

ORIGINAL RESEARCH

A Nurse-Led Multi-Disciplinary Model Enhancing Skin Cancer Early Detection in Regional/Rural Australia: Project Check Mate

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ABSTRACT

Objective: Skin cancer rates are rising and disproportionately higher in under-serviced regional and rural Australia compared to metropolitan areas. It is estimated that regional and rural areas will account for 47% of total incidence melanomas. This study aims to evaluate the feasibility and acceptability of a multi-disciplinary, nurse-led early detection model for skin cancer in regional and rural areas, called Project Check Mate. Three nurse-led pop-up skin cancer clinics were held at large rural community events in South Australia. Regional and rural nurses from local General Practitioner (GP) practices were trained in skin checks and worked in tandem with experienced nurse dermoscopists.

Design: Pragmatic evaluation using quantitative and qualitative methods.

Setting: The study examined: training completion of nurses and demonstrated skills application; the number and risk profile of consumers receiving a skin check; use of artificial intelligence (AI) technology and the acceptability of the model to nurses, GPs and consumers.

Results: Thirteen of fourteen nurses completed the training and gained supervised clinical experience, reporting increased confidence in dermoscopy and image capture. Across the three sites, 509 total body skin checks were performed in 2023. Consumers had a median age of 58 years (men) and 54 years (women), with one-quarter identified as above-average risk for melanoma. Nurse-led skin checks were positively received; 99% of consumers indicated they would use the service again, and GPs expressed support for the model. AI was valued as an adjunctive learning tool but not used for clinical decision making.

Conclusion: This study demonstrates that nurse-led skin checks, delivered in collaboration with GPs and communities, are acceptable to stakeholders and can improve access to skin cancer assessment in regional and rural settings. Training local nurses builds sustainable workforce capacity and offers a promising pathway for risk-tailored skin cancer assessments in under-served areas.

Marion Eckert and Pamela Adelson are the co-first authors.

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Summary

What is already known on this subject?

- Worldwide, rates of melanoma and keratinocyte (non-melanoma) skin cancers continue to rise.
- Prevention and early detection are the best strategies to decrease the morbidity and mortality of skin cancers.
- After decades of research and debate, Australia is considering a national screening program targeted to individuals at the highest risk of melanoma.
- It is estimated that regional and remote Australians will account for 47% of total incidence melanomas.
- General practitioner shortages in regional and rural areas, combined with high service demand, limit the capacity for full-body skin checks without additional workforce support.

What this paper adds?

- Primary care nurses are well positioned to incorporate skin checks into their scope of practice and can quickly build competency and confidence through structured training.
- Artificial Intelligence shows value as an educational adjunct for novice clinicians.
- Pop-up clinics at large regional and rural events (e.g., agricultural field days) provide a practical way to deliver skin checks, reaching populations who may otherwise face barriers to access.
- Nurse-led skin checks are highly acceptable to consumers, and once trained, nurses can continue to offer this service within their local communities as part of a multidisciplinary primary care team.

1 | Introduction

1.1 | Background

Worldwide, rates of melanoma and keratinocyte (non-melanoma) skin cancers have been rising, with Australia and New Zealand having the highest rates of skin cancers in the world [1, 2]. Skin cancer incidence increases with age, especially from 50 years, in countries with fair-skinned populations. Across Australia, skin cancer rates are disproportionately higher in regional and rural Australia compared to metropolitan areas, with contributing factors including geographical and occupational exposure and healthcare access [3, 4]. Men have increased incidence and mortality for melanoma skin cancers [3].

Prevention and early detection remain the most effective strategies to decrease skin cancer morbidity and mortality [5]. In the absence of global evidence supporting regular population-based skin cancer screening, early detection relies largely on opportunistic screening in primary care settings [6]. Australia is now considering a targeted national screening program for individuals at highest risk of melanoma [7]. A trained workforce and equitable geographical access to diagnosis and care are one of

the many issues that will need to be addressed, particularly as regional and remote Australians are projected to account for 47% of melanoma incidence (Insight [8]). Novel models of skin cancer care, including teledermatology, surveillance photography, and AI-enabled tools are potential avenues to expand access to dermatological services for people in regional and remote locations [9]. Although automated diagnostic systems and AI are increasingly being integrated into skin imaging technologies, none are currently recommended for use outside of a clinical trial [7].

In Australia, most people with a skin cancer concern initially consult primary care, usually General Practitioners (GPs) [10, 11]. However, GP shortages in regional and rural areas, combined with high demand and limited consultation time, can result in rationing or re-prioritising skin examinations. Dermatologists are also in short supply, with most practising in metropolitan areas [12]. Training local general practice nurses with the support of qualified GPs in regional areas could offer a more accessible, timely and potentially cost-effective approach to skin cancer examinations.

In Australia, general practice nursing is a specialist area of nursing, with nurses having a central role in managing chronic conditions, promoting wellness, and preventing disease within primary care, yet the scope of these roles is often constrained by structural and funding arrangements. Nurse positions are largely funded from income generated by GPs, and this arrangement may restrict role expansion. The nursing role is also influenced by factors including the demographics of the practice population, the consumer needs, the nurse's education and experience, the professional relationship within the GP team, and the nurse's willingness to work to their full scope of practice [13].

Globally, nurse-led initiatives have been implemented to address workforce shortages and barriers to accessing care, particularly in regional and rural areas where access to medical practitioners may be limited [14]. In Australia, nurses provide a wide range of services in these regions [15, 16]. Despite this evidence, the integration of nurses into skin cancer prevention and early detection within general practice is limited. Nurses, as Australia's largest healthcare workforce, are well-placed, yet underutilised, to work as part of a multidisciplinary team in this area, particularly in regional and rural communities where GP shortages are most acute and preserving GP resources is a high priority [17]. Recent Medicare reforms encourage coordinated, multidisciplinary team-based care and provide additional funding to support practices providing care to under-served regions [18].

Developing training and competency in skin cancer assessment is essential for all clinicians who consider this part of their role. For clinicians performing visual skin cancer checks, whether for screening or surveillance purposes, exams should be supplemented by dermoscopy [7]. Dermoscopy utilises a dermatoscope, a handheld device that magnifies, illuminates, and can digitally capture diagnostic features not seen by the naked eye. Yet, dermoscopy remains inconsistent across primary care. More than half of Australian GPs report not using or are not trained in dermoscopy, with estimates of only

34%–43% incorporating it into practice [19, 20]. Primary care nurses do not typically have formal dermatology or dermoscopy training.

Integrating skin cancer prevention and early-detection activities into the scope of primary care nurses through appropriate education and training including the use of high-risk assessment tools and dermoscopy training and emerging artificial intelligence (AI) technologies is both feasible and promising [21]. However, most existing nurse-led models of skin cancer detection have been assessed as stand-alone services, rather than integrated with general practice teams. This leaves a gap in understanding how nurse-led skin checks could be embedded into existing GP practices.

1.2 | Intervention Design: Nurse Education and Community Pop-Up Clinics

The aim of Project Check Mate was to evaluate the feasibility and acceptability of a general practice nurse-led dermoscopy service model. The objectives were to:

1. Assess the extent to which general practice nurses were attracted to, enrolled in, and completed the dermoscopy training program.

Explore community acceptability of nurse-led skin checks and clinician experiences with the model to inform its practical application and potential scalability

This study, *Project Check Mate*, was developed to address the gap in regional and rural skin cancer assessment by implementing a multidisciplinary, nurse-led dermoscopy service for early detection. The project included two key components. The first was upskilling local general practice nurses in best-practice dermoscopy, supported by AI-based learning tools. The second was to provide free, nurse-led pop-up skin check clinics at large rural community events, targeting high-risk populations who may have never undergone a skin check (henceforth referred to as ‘consumers’). These clinics also served as practical training sites for nurses completing the dermoscopy education. The 2021 UK Medical Research Council framework for developing and evaluating complex interventions was used as a guide to develop the study [22].

The project was collaboratively funded by The Hospital Research Foundation, with additional funding and in-kind practical support from Skin Check Champions; a charity providing free community ‘pop-up’ clinics across coastal eastern Australia. The study utilised experienced nurse dermoscopists from Skin Smart Australia who provided the education and practical training, and a widely used GP dermatology software platform incorporating AI diagnostic technology.

1.2.1 | Nurse Education

Nurse and GP recruitment occurred through engagement with local primary care providers interested in skin cancer care and supportive of nurse dermoscopy training. All nurses

and GPs at participating practices received a participant information sheet and were invited to attend the free (to the nurses and GPs) nine-week skin cancer and dermoscopy course. At the outback site, nurses from a locum-supported practice were contacted directly.

Once interested nurses for each of the sites were identified, they were provided with verbal explanations and ethically approved written information about the study. Upon giving consent to participate, they committed to a free education and training program, which comprised a combination of didactic teaching and experiential learning over three stages:

1. **Didactic training.** Nurses attended a nine-week, web-based, didactic, intensive training course with the nurse-led organisation Skin Smart Australia. Each weekly session lasted 1.5 h and was supported with supplementary readings and online resources. Core topics included skin cancer prevention, risk factors, assessment and detection of suspicious lesions, clinical support and dermoscopic examinations. The course was held at mutually agreed times to accommodate participating nurses. Attendance at all interactive online sessions was encouraged, with recordings made available for those unable to attend. It was explained that nurses were expected to apply their new skills during subsequent community pop-up clinics. Nurses who completed the education and worked in the pop-up clinics were provided with a free dermatoscope to support their ongoing practice.
2. **Experiential learning in community clinics.** Following course completion, nurses participated in their designated community event pop-up clinic over two to three days. Here, they gained practical experience in conducting skin cancer assessments and capturing dermoscopic images of suspicious lesions. Each trainee nurse worked one-on-one with an experienced nurse dermoscopist. Together, they conducted 15–20 min skin checks, during which the experienced supervising nurse recorded clinical notes and a provisional diagnosis in the database for any suspected skin cancer(s) or other lesion types. Trainee nurses received real-time education on lesion characteristics and the rationale underpinning each provisional diagnosis. For lesions considered highly suspicious for skin cancer, particularly melanoma, AI analysis was applied to support teaching, and a doctor was consulted if present on site, which provided further support to nurses in training.
3. **Post-clinic consolidation.** A post-clinic training session, led by a senior nurse dermoscopist and educator, was held within 10 days after each clinic to review dermoscopic images, consolidate learning, and discuss cases where AI tools had been applied.

1.2.2 | Pop-Up Clinics

Fieldwork was conducted at three regional and rural sites in South Australia (SA) during 2023. Each site hosted a temporary “pop-up” clinic, consisting of four-sided, roofed marquees

configured into two or three private, powered clinic rooms. Clinics were scheduled to coincide with large annual or biennial community events in areas classified under the Australian Government's Modified Monash Model as areas where people do not have ready access to doctors. Clinics operated for 2–3 days, depending on event duration and were highly visible within the community.

1. **Site 1:** Coastal region with an older demographic, nurses recruited from a general practice who worked with an experienced skin cancer GP
2. **Site 2:** Remote outback with a small population serviced by only locum doctors and nurses recruited from the community centre.
3. **Site 3:** Mid-north agricultural region, coinciding with a large biennial agricultural event involving nurses from three GP practices.

Consumer recruitment was undertaken through local media, event websites and brochure advertising. Free, total body skin checks were offered to adults (≥ 18 years) with targeted encouragement for those aged 50+, particularly men, and those who had never had a skin check before. Appointments could be pre-booked or accessed on a walk-in basis, with efforts made to accommodate all attendees.

Consumers received written and verbal information about the study and the opportunity to ask questions before seeking consent. It was explained that skin checks were conducted jointly by an expert and a trainee nurse dermatoscopist. Suspicious lesions were photographed and recorded in a secure dermatology online platform, with community members able to create a free account linked to their email address to access and share their images. Consumers also received a brochure with a body diagram marking lesion locations, notes on whether images were taken, and any additional comments.

It was not within the scope of the study to have a designated doctor at each pop-up clinic, as GP involvement primarily focused on supporting nurses in training. However, many GPs visited the clinics and demonstrated engagement. Where practices elected to do so, GP appointments at the GP's clinic were made available during or soon after the event for community members requiring immediate investigations of suspicious lesions, particularly those with features highly suggestive of melanoma.

2 | Methods

2.1 | Design

The study was multi-component, encompassing both practical implementation and evaluation. The 2021 UK Medical Research Council framework for developing and evaluating complex interventions was used as a guide [22]. Given the multi-site implementation, adaptation of the intervention to local contexts was necessary, whilst retaining fidelity of the core components of the study; education and full-body skin checks. Evaluation was informed by the principles of pragmatic evaluation incorporating:

a flexible epistemology, comprehensive methodology (both qualitative and quantitative methods to examine the different facets of program implementation and impact), and a practical application (what is realistic to achieve within the practical constraints of real-world projects) [23].

2.2 | Data Collection

There were two primary participant groups for the evaluation: nurses who were participating in the education and pop-up clinics, and consumers who were participating as recipients of a skin check. Hereafter, nurse participants are referred to as nurses and consumer participants are referred to as consumers.

2.2.1 | Nurse Data Collection

2.2.1.1 | Pre-Training Questionnaire. Before commencing the education course, all participating nurses completed an anonymous six-item online questionnaire via REDCap [24]. Items included demographics, prior experience with skin cancer exams, dermatoscope use, and multiple response questions on reasons for undertaking the training and anticipated application of new skills.

2.2.1.2 | Clinical Data Collection. During the pop-up clinics, dermoscopic exams were recorded in real time using *DermEngine*, a dermatological software product of the company MetaOptima widely used in Australian general practice. For the purposes of the study, MetaOptima enabled its AI skin cancer algorithm as a learning tool. The AI analysed uploaded dermoscopic images and generated percentage likelihood estimates for different skin lesion types. It was also used for research purposes to provide provisional diagnosis for all suspicious lesions detected at the clinic based on the AI assessment, which was then compared with the nurse's provisional diagnosis and, where possible, GP and pathology diagnoses.

2.2.1.3 | Post-Training Follow-Up. Approximately 1 month after each clinic, nurses participated in follow-up reflection and feedback. Depending on site size and circumstances, this took the form of a focus group (site one), interview (site two), or an anonymous online questionnaire (site three). A semi-structured guide was developed iteratively by three researchers and the nurse educator, piloted with two nurses, and focused on training experiences, practical experience, confidence in dermoscopy and imaging, perspectives on AI and anticipated integration of skills into practice. Focus groups and interviews were audio recorded with consent and transcribed. Questionnaires, which were designed to capture similar concepts to those discussed in the interviews and focus group, were distributed electronically via REDCap [24].

2.2.2 | Consumer Data Collection

2.2.2.1 | Risk Assessment. To assess whether those at higher risk were attending the clinics, consumers were asked to anonymously complete the two largest community tested, validated Australian risk predictor tools for melanoma

and keratinocyte cancers (QSkin, (used with permission for Project Check Mate)) [25, 26]. Those under 40 years old were exempt from the keratinocyte tool. Paper questionnaires were entered into a REDCap [24] database and risk categories were calculated using the QSkin algorithm [27] in R (version 2024 4.4.1). Risk tool results were compared with sailors and local island residents (mostly European heritage with fair skin) who were screened at a sailing competition in Australia; the TRoPICS Study [26]. As the risk assessment was conducted anonymously, the results are unable to be compared to other outcome measures.

2.2.2.2 | Exit Survey. Following their exam, consumers completed an anonymous six-question paper-based survey on their skin check experience, adapted from primary care satisfaction tools [28, 29]. Items included Likert-scale satisfaction questions, yes/no responses and free text comments. Similarly, as the exit survey was conducted anonymously, the results are unable to be compared to other outcome measures.

2.2.2.3 | Follow-Up. Consumers with imaged lesions of concern were advised to follow up with their GP. Their results were recorded in *DermEngine* for analysis and reporting. Where local GP practices were engaged, efforts were made to accommodate community members with highly suspicious lesions, especially for lesions suspicious of melanoma. Those without a regular doctor were provided with a *Skin Check Champions* brochure containing a QR code linking to a national database of local GPs.

2.2.2.4 | Clinical Outcomes. Clinical data were largely limited to the identification of suspicious lesions identified by the nurses. Where local GPs were involved and consumers consented, feedback on definitive diagnoses and subsequent investigations were sought with permission by *Skin Smart Australia*. *Skin Smart Australia* nurses also attempted to follow up with permission, consumers who had been advised to consult their GP regarding suspicious lesions.

2.3 | Data Analysis

A descriptive approach was taken for qualitative data analysis [30] for focus groups, interviews and open-ended survey questions. Two researchers conducted thematic analysis to identify overarching themes regarding primary care nurse's learning and practical experience [31]. Quantitative data were analysed descriptively using R (version 2024 4.4.1).

3 | Results

The study delivered three nurse-led pop-up clinics across regional and rural SA in 2023. Thirteen primary care nurses were trained, and 509 community members received a total body skin check.

3.1 | Nurse Pre-Training

Fourteen nurses commenced training (site one: $n=4$, site two: $n=2$, site three: $n=8$). Nurses' ages ranged from 30 to 60 years, and all lived and worked locally. Thirteen nurses completed

both the webinars and experiential clinic learning; one withdrew for personal reasons.

Results from pre-training questionnaires showed varying prior experience: six nurses (43%) had some experience in skin checks, but most had no dermoscopy qualifications, and six had never used a dermatoscope. Two remote nurses identified as having no experience (Table 1). Reasons for participating included personal interest, course quality, community need, expanding scope of practice, and working more independently and collaboratively (Table 1). Nurses anticipated applying their new skills within the current work environment, either through existing agreements or by negotiating their role with GPs.

3.2 | Nurse Post Experience Feedback

All 13 nurses worked over two to 3 days in the pop-up clinics, each examining approximately 40–50 consumers under supervision. GPs from the practices also visited the pop-up clinics. Clinical supervision was highly rated as essential for consolidating skills. Post-clinic review sessions held within 10 days reinforced learning through discussion of common benign and complex lesions, as well as review of AI outputs. All nurses (both experienced and trainee) viewed AI as a useful learning tool, though some expressed uncertainty when its assessments conflicted with their own, particularly when AI would identify a naevi (mole) as a high-risk lesion. Most trainee nurses reported that in this situation, they would either seek another opinion or reconsider their assessment.

3.2.1 | Follow-Up Reflections

One-month follow-up included a focus group (site one, $n=3$), an interview (site two, $n=1$), and an online survey (site 3, $n=6$ completed). Nurses reported increased confidence in dermoscopy and taking dermoscopic images, with most feeling capable of identifying a suspicious lesion, although a minority ($n=2$) remained only "slightly confident". Nurses reported the small-group webinars and interactive sessions as highly relevant and effective. They reported substantial increases in knowledge, with the group format encouraging peer learning through shared questions and discussions. The content was described as thorough and directly applicable to practice. Suggestions for improvement included: the addition of a structured workbook to help consolidate knowledge, more clinic time to learn with staff, and more opportunities to observe other nurse dermoscopists. Educators informally reported strong engagement, and nurses who missed a session would access recordings.

3.2.2 | Practice Integration

Implementation into practice varied across sites. Nurses from site one reported no specific barriers to continuing the work and had already identified keratinocyte cancers using dermoscopy. The GPs they worked with were encouraging and supportive of their role and expanded scope. The nurse from

TABLE 1 | Pre-training nurse characteristics and experience.

Nurse pre-training questionnaire	Site one (regional) (<i>n</i> = 4) <i>n</i>	Site two (rural) (<i>n</i> = 2) <i>n</i>	Site three (regional) (<i>n</i> = 8) <i>n</i>	Total three sites combined (<i>n</i> = 14) <i>n</i>
How would you rate your level of experience examining a patient for skin cancer (doing a skin check)? (5-point Likert scale very inexperienced to very experienced)	2 = inexperienced 1 = somewhat experienced 1 = experienced	2 = inexperienced	2 = very inexperienced 2 = inexperienced 4 = somewhat experienced	2 = very inexperienced 6 = inexperienced 5 = somewhat experienced 1 = experienced
Have you ever used a dermoscope before in examining a patient's skin? (no/yes)	4 = yes	2 = no	4 = yes 4 = no	8 = yes 6 = no
Have you ever completed a dermoscopy qualification? (no/yes)	2 = yes 2 = no	2 = no	2 = yes 6 = no	4 = yes 10 = no
Would you say your dermoscopy skills are: (beginner, intermediate, advanced)	2 = beginner 2 = intermediate	2 = beginner	8 = beginner	12 = beginner 2 = intermediate
Do you think that AI in dermoscopy will be a helpful tool in determining whether someone has a skin cancer? (no/yes/unsure)	3 = yes 1 = unsure	1 = yes 1 = unsure	5 = yes 3 = unsure	9 = yes 5 = unsure
Why did you decide to undertake this training in dermoscopy? (please tick all that apply) ^a				
It is an area that interest me	4	1	7	12
The quality and convenience of the free training on offer	3	1	4	8
I feel that it is an area of healthcare that is needed, and GPs don't necessarily have the time to service the demand for this service	3	1	7	11
The opportunity to potentially save lives and decrease morbidity through early detection	4	1	7	12
It is an opportunity for me to work more independently and collaboratively	3	1	1	5
I wanted to upskill	3	1	7	11
I need a change in my type of work	0	1	1	2
I was encouraged by those where I work to undertake the training	2	1	2	5
I just fell into it	0	1	1	2

(Continues)

TABLE 1 | (Continued)

Nurse pre-training questionnaire	Site one (regional) (<i>n</i> = 4) <i>n</i>	Site two (rural) (<i>n</i> = 2) <i>n</i>	Site three (regional) (<i>n</i> = 8) <i>n</i>	Total three sites combined (<i>n</i> = 14) <i>n</i>
After the pop-up clinic is gone and you have completed your basic training as a nurse dermoscopist, how do you envisage using this skill as part of your work? (please tick all that apply) ^a				
I will need to negotiate within my present work environment how I can be involved in performing opportunistic screening	<i>n</i> = 2	<i>n</i> = 1	<i>n</i> = 4	<i>n</i> = 7
It has been agreed that I will be using my new dermoscopy skills as needed while working collaboratively in the practice	<i>n</i> = 2	<i>n</i> = 0	<i>n</i> = 2	<i>n</i> = 4
I don't see that I will be able to use these skills as the doctors exclusively do all skin cancer checks	<i>n</i> = 0	<i>n</i> = 0	<i>n</i> = 0	<i>n</i> = 0
It will depend on the circumstances, but I am hoping that I will be able to perform skin cancer checks when called upon	<i>n</i> = 2	<i>n</i> = 1	<i>n</i> = 2	<i>n</i> = 5
Unsure if I will have the opportunity to use my new skills in my current work environment	<i>n</i> = 0	<i>n</i> = 0	<i>n</i> = 0	<i>n</i> = 0

^aOnly one nurse from site two replied to the additional question.

site two found the training relevant to her work as a community nurse but highlighted the need for collegial support in her isolated setting. At site three, most nurses foresaw no barriers impacting their ability to assess patients dermoscopically, although one nurse expressed concern whether learning would be supported in the practice. Across all sites, nurses expressed interest in further dermoscopy training. Five nurses from site three provided additional comments on the questionnaire, highlighting the learning opportunity and gratitude to be part of the training.

An informal follow-up 6 months later of contactable nurses (*n* = 10) indicated the following:

- (site one, *n* = 3) nurses reported growing confidence and experience in dermoscopy, regularly using their skills within the GP practice and extending them to outreach pop-up clinics in neighbouring regional areas.
- (site two, *n* = 1) the rural nurse felt competent in capturing dermoscopic images and recognised potential applications for remote tele-dermoscopy; however, has not had the opportunity to use these skills.

- (site three, *n* = 6) five nurses were actively applying their new skills into practice. One nurse had left her position, but was hoping to use her skills elsewhere

3.3 | Clinical Outcomes and AI Review

Across the three pop-up clinic sites, 509 community members received total body skin checks with 40.5% having one or more suspicious lesions photographed (Table 2). Provisional diagnoses were made by either the trainee nurse or the experienced nurse dermoscopists, with confirmation by the experienced nurse. Among those with at least one lesion imaged, 60% had two or more spots (Table 2). In total, 40 images were specifically taken for suspected melanoma, 129 for keratinocyte cancers and 172 for suspected non-cancerous lesions such as actinic keratosis (AK), seborrheic keratosis or dysplastic nevi (Table 2).

Confirmatory biopsy data were available only for consumers who followed up with the local GP practices connected to the project. At site one, 15 consumers had pathology results, four of whom were negative for skin cancer. The remaining 11 had the following:

TABLE 2 | Consumer engagement in skin checks.

Clinical assessments	Site one (regional) <i>n</i> (%)	Site two (rural) <i>n</i> (%)	Site three (regional) <i>n</i> (%)	Total three sites combined <i>n</i> (%)
Number of people having compete body checks	176	126	207	509
Number of people that had at least one or more spots imaged	69 (39.2%)	42 (33.3%)	95 (45.9%)	206 (40.5%)
Number of those people who had at least one spots imaged that had two or more spots imaged	55 (79.7%)	12 (28.6%)	57 (60.0%)	124 (60.2%)
Lesions^a photographed by nurses suspicious for	<i>n</i>	<i>n</i>	<i>n</i>	<i>n</i>
Keratinocyte cancer (BCC or SCC)	58	16	55	129
Melanoma (malignant and in situ)	20	5	15	40
Other: actinic keratosis, nevus, actinic, seborrheic keratosis, etc.	46	43	83	172
Total lesions assessed/photographed	124	64	153	341

^aReflects lesions photographed, not people.

- 2 consumers with melanoma (each person had 2 lesions): 1 malignant and 3 in situ,
- 7 consumers with BCC (one person had 2 lesions), and
- 2 consumers with SCC.

At site three, 12 consumers had the following results:

- 2 consumers with invasive malignant melanoma,
- 1 consumer with BCC,
- 2 consumers with SCC, and
- The remaining 7 had benign lesions/solar keratosis.

At site two, 16 consumers had 21 images for suspected skin cancers; however, definitive diagnoses were not confirmed due to a lack of doctor and pathology follow-up.

AI assessment was generally consistent with nurse and GP assessments, although discrepancies occurred. For example, at site three, nurses identified 16 possible melanomas, of which AI agreed with seven; the remainder were classified by AI as naevi ($n=4$), SCC ($n=1$), and keratoses ($n=4$). Conversely, AI identified five melanomas not considered melanomas by the nurses as AK ($n=2$), keratotic lesion ($n=1$), BCC ($n=1$), and SCC ($n=1$). Agreement was strongest for keratinocyte cancers, particularly BCC. Of interest, AI occasionally misclassified consumers identified benign injuries or scars as probable keratinocyte cancers. Of the 40 lesions imaged as suspicious for melanoma, confirmatory follow-up was available for six cases. All six were pathologically confirmed as melanoma, and AI correctly identified each one.

3.4 | Participant Experience

Community engagement and participation were high, with all clinic sites fully booked. In some instances, the clinics could

TABLE 3 | Sex of participant and age categorisation.

	< 50 years	50+ years	Total
Female	80 (17.2%)	140 (30.2%)	220 (47.4%)
Male	70 (15.1%)	174 (37.5%)	244 (52.6%)
Total	150 (32.3%)	314 (67.7%)	464 (100%)

not accommodate all consumer requests for a skin check due to timing challenges or lack of clinic appointment availability. In these instances, consumers were offered a “spot check” for lesions they were concerned about.

3.4.1 | Demographics and Risk Factors

Across sites, 53% of consumers were male (median age 58) and 47% female (median age 54). The highest proportion of consumers were males over 50 years of age ($n=174$, 37.5%) (Table 3). Over 75% of participants resided locally, based on self-reported postcodes mapped to the ABS Statistical Area 3 corresponding to the clinic location. Overall, 396 (85% of) consumers reported to be of European descent (site one 94%, site two 74%, site three 85%).

For responses to the item: “During the past 3 years how many times has ALL or NEARLY ALL of your skin been deliberately checked by a doctor?”, the response ‘never’ was recorded for the three sites as 60%, 61% and 54% respectively. At site one, the question ‘have you ever had your skin checked before?’ was also asked. Forty-one percent of consumers responded ‘no’.

All consumers completed the Australian skin cancer risk factor tools, with 91% ($n=464/509$) of melanoma questionnaires being complete and usable. Approximately one-quarter of consumers (24%) had an above average or very above average risk for melanoma and 23% were above average or very above average for

TABLE 4 | Project CheckMate consumer skin cancer risk factor scores as compared with higher risk Australian sailors.

Keratinocyte risk level (risk factor questions not used for those <40 years)	Site one (regional) (n = 149) n (%)	Site two (rural) (n = 78) n (%)	Site three (regional) (n = 153) n (%)	Total three sites combined (n = 380) n (%)	Hamilton Island TRoPICS study^a (n = 507) n (%)
Very much below average	38 (25.5%)	27 (35.1%)	44 (28.8%)	109 (29.8%)	115 (22.7%)
Below average	40 (26.8%)	17 (22.1%)	44 (28.8%)	101 (25.9%)	202 (39.8%)
About average	34 (22.8%)	18 (23.4%)	26 (17.0%)	78 (21.1%)	41 (8.1%)
Above average	27 (18.1%)	6 (7.8%)	30 (19.6%)	63 (15.2%)	108 (21.3%)
Very much above average	10 (6.7%)	9 (11.7%)	9 (5.9%)	28 (8.1%)	41 (8.1%)
Total	149 (100%)	78 (100%)	153 (100%)	380 (100%)	507 (100%)

Melanoma risk level	Site one (regional) (n = 163) n (%)	Site two (rural) (n = 117) n (%)	Site three (regional) (n = 184) n (%)	Total three sites combined (n = 464) n (%)	Hamilton Island TRoPICS study (n = 507) n (%)
Very much below average	43 (26.4%)	60 (51.3%)	52 (28.3%)	155 (35.3%)	104 (20.5%)
Below average	50 (30.7%)	23 (19.7%)	47 (25.5%)	120 (25.3%)	101 (19.9%)
About average	33 (20.2%)	9 (7.7%)	35 (19.0%)	77 (15.6%)	110 (21.7%)
Above average	21 (12.9%)	10 (8.6%)	24 (13.0%)	55 (11.5%)	92 (18.1%)
Very much above average	16 (9.8%)	15 (12.8%)	26 (14.1%)	57 (12.2%)	100 (19.7%)
Total	163 (100%)	117 (100%)	184 (100%)	464 (100%)	507 (100%)

Note: Risk factor scores as measured by the QIMR Berghofer Australian validated skin cancer algorithms ([25]; [26]).

^aComparative data from the population-based higher risk skin cancer group of sailors, TRoPICS Study, <https://doi.org/10.1111/jdv.17062>.

keratinocyte cancers (Table 4). Risk profiles were broadly comparable to the Queensland TRoPICS study for keratinocyte cancers [26], though melanoma risk was lower overall, particularly at site two where a higher proportion of consumers had darker skin tones. Melanoma and keratinocyte risk factor scores were unable to be matched to provisional nurse diagnosis, pathology outcomes, and AI diagnosis due to the anonymity of the surveys.

3.4.2 | Pop-Up Clinic Feedback

Exit surveys were completed by 460 consumers (90%, 460/509 response rate). Refusals (<10 refusals) were mostly due to consumer time constraints, and some surveys were missed during busy times.

Satisfaction was extremely high: 98% were very satisfied with the service, 99% accepted nurse dermoscopists as clinical assessors, and 99% indicated that, if available, they would see a nurse for skin checks in their GP practice (Table 5). Suggestions for improvement (12% of respondents) were largely positive, including requests for more frequent clinics, improved booking systems, and greater promotion. Over 300 consumers provided additional free-text comments, overwhelmingly positive, praising

the nurse's knowledge and quality of the skin checks, and the desire for the service to return to their community. Examples of comments are included in Table S1. No negative comments were received.

4 | Discussion

The current study identified and evaluated opportunities to improve early detection of skin cancer in under-serviced regional and rural areas by upskilling primary care nurses and establishing partnerships with local communities, community members and GP practices. In working independently, interdependently or within a multidisciplinary team, nurses need to be appropriately qualified with core skills and knowledge [32]. Primary care nurses in this study embraced the opportunity to upskill and expand their scope of practice, reporting that the practical skin check experience was professionally beneficial and valuable within their GP practices.

Collaborative research and innovative workforce approaches to tackle skin cancer have been called for in numerous Australian documents and plans (Cancer [33, 34]; Insight [8]). Supporting the expansion of nurse-led care is needed, as nurses can bridge

TABLE 5 | Consumer exit survey.

What was your overall satisfaction with the service you received today?	Site one (regional) n (%)	Site two (rural) n (%)	Site three (regional) n (%)	Total three sites combined n (%)
Not at all satisfied	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Somewhat unsatisfied	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Neutral	1 (0.6%)	1 (0.8%)	0 (0%)	2 (0.4%)
Somewhat satisfied	4 (2.4%)	3 (2.4%)	2 (1.2%)	9 (2%)
Very satisfied	161 (97%)	121 (96.8%)	167 (98.8%)	449 (97.6%)
Total	166 (100%)	125 (100%)	169 (100%)	460 (100%)
Are there any ways the pop-up skin check experience could be improved?				
No	132 (80%)	113 (90.4%)	159 (94.6%)	404 (88.2%)
Yes	33 (20%)	12 (9.6%)	9 (5.4%)	54 (11.8%)
Total	165 (100%)	125 (100%)	168 (100%)	458 (100%)
Was having a nurse screen your skin for potential skin cancers acceptable to you?				
No	0 (0%)	2 (1.6%)	2 (1.3%)	4 (0.9%)
Yes	166 (100%)	124 (98.4%)	157 (98.7%)	447 (99.1%)
Total	166 (100%)	126 (100%)	159 (100%)	451 (100%)
If there was a nurse in your area who could provide a skin cancer screening service in conjunction with a local GP, do you think you would use this service?				
No	0 (0%)	3 (2.4%)	3 (1.8%)	6 (1.3%)
Yes	166 (100%)	123 (97.6%)	164 (98.2%)	453 (98.7%)
Total	166 (100%)	126 (100%)	167 (100%)	459 (100%)
What is the likelihood you would go to a free, nurse-led pop-up skin check clinic again?				
Not at all likely	2 (1.2%)	0 (0%)	0 (0%)	2 (0.4%)
Somewhat unlikely	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Neutral	0 (0%)	2 (1.6%)	2 (1.2%)	4 (0.9%)
Somewhat likely	10 (6%)	10 (7.9%)	16 (9.5%)	36 (7.8%)
Very likely	154 (92.8%)	114 (90.5%)	151 (89.3%)	419 (90.9%)
Total	166 (100%)	126 (100%)	169 (100%)	461 (100%)
Total people responding ^a	166	126	169	461
Are there any other comments you would like to make about the service you received today of the nurse-led pop-up skin check clinic?	110	81	112	303 total comments

^aSome people missed one or two questions.

traditional health care silos in the provision of specialised and coordinated care and address gaps in health care service delivery [35]. A qualitative study of key stakeholders in rural Victoria found broad support for a nurse-led skin cancer model [36]. A recent systematic review synthesised evidence on nurse-led skin cancer detection services, highlighting their diagnostic accuracy, patient satisfaction, and cost-effectiveness. Nurse-led models, particularly those embedded within primary care or

community settings, are well-positioned to offer timely assessments and navigate patients toward specialist services when needed [16].

This study provides early evidence of the feasibility of training and supporting primary health care nurses to deliver skin checks in regional and rural communities whose GP resources may be stretched. While some pathology data were

available, systematic outcome data were not collected across all sites; therefore, this study does not assess diagnostic accuracy or clinical effectiveness. Instead, the findings highlight the feasibility of nurse engagement, nurse-led skin checks, the acceptability of this model to both GPs and community members, and the potential role of AI as a learning adjunct. In the limited cases where pathology results were available, these provided illustrative examples that were consistent with the provisional nursing assessments, but no conclusions about diagnostic accuracy can be drawn for the overall study. The utilisation of AI in this study was primarily for exploratory and educational purposes for the nurse trainees, and results suggest provisional evidence of benefit to nurse dermoscopists in this context only. Further research is required regarding the utilisation of AI as a learning adjunct.

This was a pragmatic evaluation study using multiple methods to assess the program's feasibility and acceptability. While the results were overall favourable, challenges exist for how nurse-led models can be effectively structured and delivered. A lack of organisational structures, education pathways, and financing models have been identified as significant barriers that inhibit nurses working to their full scope of practice in primary health care [13, 35]. While participating GPs were supportive of the nurses in their practice in this study, the business pathways through which this may operate needs further consideration given the absence of a Medicare reimbursement item for skin checks. In some contexts, such as community health or outreach services, nurse-led skin checks may still be feasible despite these funding constraints. A scoping review of evaluated nurse-led models of care implemented in regional, rural and remote Australia similarly concluded that greater support is required for the appropriate implementation of new models of care, especially given the maldistribution of the medical workforce in non-metropolitan settings [15, 37].

Consumer satisfaction and willingness to receive a total body skin check from a nurse were important acceptability and feasibility outcomes. While performing skin checks, nurses also had opportunities to provide education on primary prevention of skin cancer, with consumers reporting they felt comfortable asking questions. Primary prevention initiatives are widely acknowledged as cost-effective and there is a need for future research to investigate the feasibility and acceptability of fitting risk-based prevention and early detection strategies for skin cancer into models of primary care [21, 38].

This study was successful in attracting a broad cross-section of the local community, with participation slightly higher in men, who had a median age of 58 years. Risk assessment for skin cancer is complex and while this does not demonstrate that the program preferentially reached those at highest risk, the use of validated Australian risk-stratification tools provided important insights into the risk profile of attendees. Approximately one-quarter of consumers were identified as having above-average or very high risk for melanoma and keratinocyte cancers, suggesting that nurse-led clinics can feasibly engage populations with meaningful levels of risk. Current processes for early detection of skin cancer have been described as 'ad hoc' and fragmented often leading to inequities and over-servicing [39]. A targeted program of screening skin checks for those at highest risk of

melanoma will likely be the best way to balance the factors of over-screening harms and program costs that will also be acceptable to the population [7]. As anticipated, keratinocyte cancers were detected far more frequently than melanomas. While keratinocyte cancers mostly do not present a serious disease, they are the second most costly cancer (after colorectal) in Australia and reflect a disproportionately high burden on the health care system [40, 41]. Early detection and treatment of all skin cancers decrease the need for more costly, invasive and potentially disfiguring surgery, especially of the head and neck.

Consumers have expressed significant concern over the quality and consistency of skin checks. Currently, there are no minimum educational requirements for dermoscopic training among either doctors or nurses. Courses vary widely in content and duration for doctors, and there are limited opportunities for nurses [17]. Nurse-led skin check services depends on escalation to GPs for review and subsequent treatment of suspicious lesions. Consequently, timely follow-up of suspicious lesions relies on local GP services having both the capability and capacity to diagnose and treat skin cancers. Engagement with local GP practices, particularly those with skin-focused GPs is therefore essential to ensure patients can access appropriate follow-up care. For individuals without access to a local skin specialist GP or those who were not locals themselves (e.g., were travelling through the area at the time of the clinic), nurses in this study discussed suitable follow-up options.

In this study, nurses underwent a comprehensive training course with supervised clinical experience, incorporating emerging technologies and working within their local community. Australian and international evidence indicates that primary care nurses can be trained to competently perform skin checks, offering an important option for interdisciplinary care in regional, remote and disadvantaged communities ([9]; Insight [8, 16]). Such models can strengthen local continuity of care and reduce reliance on overstretched GP services. Nurse-led teledermoscopy clinics have efficiently operated in New Zealand for over a decade, providing accurate diagnoses and minimising unnecessary visits to public outpatient clinics [42]. In the United Kingdom, nurses working in advanced practice skin cancer screening clinics have demonstrated improved service delivery and diagnostic and clinical competence [36]. A recent review highlighted that while nurse-led skin cancer models are effective, there is a need for well-designed training programs to expand scope of practice and increase job satisfaction [17]. Consistent with this, most nurses in the current study expressed interest in further dermoscopy education, and a dedicated nurse dermoscopy professional certificate has since been developed.

Our findings emphasise the feasibility of locally accessible healthcare strategies, such as nurse-led models supported by GPs, with appropriate referrals to higher level care where needed. While GPs remain central to early detection and diagnosis, full body skin examinations are often difficult to achieve within time management pressures [43]. It is not expected that regional and rural practice nurses will become skin cancer experts, rather, that they can competently recognise abnormal lesions and capture dermoscopic images for review by skin-specialist clinicians. This skill is particularly relevant for emerging technologies, including store and forward teledermoscopy,

especially in communities with limited access to specialist services [44, 45].

This study marked one of the first times AI technology was made available for use in a skin cancer clinical setting in Australia. AI has the potential to augment clinical decision-making by supporting primary care nurses in identifying suspicious lesions for review by expert clinicians [9]. In this evaluation, both nurses and GPs valued AI primarily as a learning tool, particularly when its outputs differed from their provisional diagnoses, prompting further discussion and peer consultation. While AI has shown promise as a useful educational tool for novice learners [46], its real-world utility in Australian primary care is untested. The formal evaluation of diagnostic accuracy was beyond the scope and not feasible in this evaluation as most consumers lacked confirmed pathology or a doctor's final diagnosis.

This study focused on regional and rural areas where access to care is often limited. The success of the pop-up clinics was supported by advanced clinic advertising, high visibility at large community events and the engagement of populations who had often never had their skin assessed. Training local primary care nurses, in collaboration with GP practices, fostered local expertise and demonstrated the feasibility of delivering skin checks in under-served communities. Community members frequently reported difficulty accessing GP appointments with their GP and when seen, having a skin check was a low priority. Early engagement with GP practices and the commitment of nurses to undertake more than 2 months of training before the clinics were critical to implementation. Inter-professional collaboration in primary care, especially in primary prevention and screening, is an important but underrepresented area of research where more work is needed [47]. Community acceptance of the program was strong, with many consumers requesting a return of the service. There is a growing recognition of the benefits of involving consumers, their families and the public in contributing to research partnerships and in making changes to service delivery [48].

An important contribution of this study is its description of how regional and rural Australian community members view local nurses performing skin checks. To our knowledge, this is the first study to report on this concept. International evidence shows that patient satisfaction is usually high when nurses substitute or complement areas of work traditionally undertaken by GPs [49]. This was reflected in our findings, with consumers consistently expressing strong support for nurse-led skin checks. Satisfaction is particularly enhanced when patients experience continuity of care with the same nurse and nurses work with a broad scope of practice and autonomy [50]. Building trusted partnerships between community, nurses and GPs will be an important step going forward in a risk-tailored skin cancer screening approach.

5 | Strengths and Limitations

This was a pragmatic evaluation study with several limitations. The number of nurses was small, and qualitative data methods varied across the sites due to the variable access to nurse consumers. While not an objective of the study,

definitive pathology was unavailable for most lesions and GP follow-up for diagnosis was difficult to obtain in most instances, meaning the exact number of confirmed skin cancers cannot be determined. Additionally, melanoma and keratinocyte risk factor scores were unable to be matched to provisional nurse diagnosis, pathology outcomes, and AI diagnosis due to the anonymity of the surveys.

Strengths include the high proportion of consumers who completed validated skin cancer risk tools and provided valuable insights into their views of nurse-led skin checks. Importantly, the study achieved its objectives of (i) demonstrating the feasibility and acceptability of training local regional nurses, who showed enthusiasm for expanding their scope of practice, and (ii) community acceptance of nurse-led skin checks.

6 | Conclusion

This study demonstrates the acceptability of training primary care nurses to work collaboratively with GP practices and the local community to improve early detection of skin cancers in regional and rural settings. With the support of qualified GPs, nurse-led models offer a more accessible, multidisciplinary, timely and potentially cost-effective approach to early detection where services may be limited. The Project Check Mate study provides practical insight into interdisciplinary service delivery, community satisfaction, the feasibility of nurse-led skin checks and the potential for ongoing upskilling of nurses in regional communities. Going forward, utilising nurses as part of a national targeted screening program has strong potential to expand access and equity, especially in regional and rural areas where services are often limited.

Author Contributions

Marion Eckert: conceptualization, investigation, funding acquisition, writing – original draft, methodology, data curation, writing – review and editing, project administration, resources. **Pamela Adelson:** conceptualization, investigation, funding acquisition, writing – original draft, methodology, writing – review and editing, formal analysis, data curation, project administration. **Lachlan Darch:** writing – original draft, formal analysis, data curation, visualization, writing – review and editing. **Greg Sharplin:** conceptualization, investigation, funding acquisition, writing – original draft, methodology, formal analysis, data curation, visualization, writing – review and editing, project administration, resources.

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Ethics Statement

Granted by the University of SA Human Research Ethics Committee (205038).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Consumer comments on exit surveys.