© May 2026 | IJIRT | Volume 12 Issue 12 | ISSN: 2349-6002

Smartphone-based wound assessment in home and community nursing care: a systematic review of effectiveness, accuracy, workflow and acceptability

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Abstract–
Objectives To bring together evidence on the effectiveness, accuracy, workflow impact and acceptability of smartphone-based wound assessment in adults receiving care in home or community nursing settings.
Design Systematic review with narrative synthesis following Synthesis Without Meta-analysis (SWiM) reporting and thematic synthesis of qualitative studies following Thomas and Harden.
Data sources MEDLINE, Embase, CINAHL, Cochrane CENTRAL, IEEE Xplore, Web of Science and Scopus were searched from January 2014 to May 2026. Trial registries and grey literature were also searched.
Eligibility criteria Adults with any wound receiving home or community care, assessed using smartphone photography, wound apps (including AI-assisted), or smartphone-mediated teleconsultation. All study designs except case reports and editorials.
Data extraction and synthesis Two reviewers independently screened, extracted data and assessed risk of bias using RoB 2, ROBINS-I, QUADAS-2, JBI checklists, CASP and MMAT. Certainty of evidence was rated using GRADE.
Results Of 1,842 records screened, 14 studies were included (three RCTs, two non-randomised comparative, three diagnostic accuracy, two feasibility, four qualitative/mixed-methods; approximately 1,150 patients). Smartphone-mediated specialist input was non-inferior or superior to standard care for healing in two of three trials. Wound measurement apps showed excellent intra-rater reliability for area (ICC 0.96–0.99). Patient travel and community attendance fell. Nurses reported improved confidence; patients found it broadly acceptable. Certainty of evidence was low to moderate.
Conclusions Smartphone-based wound assessment is feasible, acceptable and probably non-inferior to standard care for healing in community settings. Important gaps remain around AI-assisted apps, home-environment accuracy validation and pressure injury populations.

Keywords: wound assessment, smartphone, mHealth, community nursing, home care, telemedicine, wound measurement, district nursing

I. INTRODUCTION

Chronic wounds are a growing problem in community nursing. Pressure injuries, diabetic foot ulcers, venous leg ulcers and infected surgical wounds together account for a large share of district nursing visits, and their prevalence rises as populations age and diabetes becomes more common. In the United Kingdom alone the annual cost of wound care exceeds £8 billion, most of it outside hospital.[1] Day-to-day wound assessment in the community falls largely to generalist nurses, often working alone in patients' homes with limited access to specialist tissue viability advice.

Accurate assessment matters because dressing selection, debridement decisions, antimicrobial choices and referral timing all depend on it. Traditional methods - paper documentation, ruler-based measurement and free-text description - have well-known problems: poor inter-rater reliability for wound area, weak capture of three-dimensional features and frequent loss of information between visits. Specialist wound nurses and dermatologists are concentrated in hospitals, and community nurses consistently report that distance, travel time and waiting lists slow escalation.

Smartphones have changed this picture. Since roughly 2014, built-in cameras and mobile connectivity have been good enough for clinically useful wound photography, and a range of dedicated apps has appeared- from simple secure-capture tools through measurement platforms (Tissue Analytics, Swift Skin and Wound, imito, Minuteful for Wound) to machine-learning systems for tissue classification. Large telehealth services for chronic wounds have been built around community nurses sending smartphone images to off-site specialists, including the French Domoplaies network and the Norwegian DiaFOTo programme.

Existing reviews have looked at telemedicine for chronic wounds in general,[2] at app-store quality,[3] or at diabetic foot disease alone.[4] None has specifically asked whether smartphone-based assessment, used by nurses or patients in the home or community, changes outcomes that matter. The community context differs from hospital or clinic use: lighting and connectivity are variable, the operator is often a generalist nurse or the patient, and the comparator is the nurse's own visual assessment rather than a hospital specialist.

We therefore aimed to synthesise quantitative evidence on healing, accuracy and workflow, together with qualitative evidence on patient and clinician experience, for smartphone-based wound assessment in home and community nursing care.

II. METHODS

Protocol and registration

The protocol was developed using the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 checklist[5]. The review is reported in accordance with the PRISMA 2020 statement[6] and the Synthesis Without Meta-analysis (SWiM) reporting guideline.[7]

Eligibility criteria

We included studies of adults (≥18 years) receiving wound care in home, community or district nursing settings, assessed using any smartphone-based modality (photography, dedicated app including AI-assisted, or smartphone-mediated teleconsultation). Comparators included standard assessment (visual inspection with ruler, paper documentation, in-person specialist review) or none. All study designs were eligible except case reports, editorials and conference abstracts without extractable data. The eligibility window was January 2014 to May 2026, English language only.

Element	Inclusion	Exclusion
Population	Adults with any chronic or acute wound in home, community or district nursing care	Children; inpatient-only or outpatient-clinic-only populations
Intervention	Smartphone photography, wound apps (including AI-assisted), smartphone-mediated teleconsultation	Tablet-only or stand-alone camera systems without smartphone arm
Comparator	Visual inspection with ruler, paper documentation, in-person specialist review, or none	—
Outcomes	Healing, accuracy, workflow, decision-making, patient and clinician experience, adverse events	—
Study design	RCT, non-randomised comparative, diagnostic accuracy, cohort, qualitative, mixed-methods, economic	Case reports, editorials, abstracts without data

Table 1. *PICOS eligibility criteria.*

Information sources and search strategy

We searched MEDLINE (via PubMed), Embase, CINAHL (EBSCO), Cochrane CENTRAL, IEEE Xplore, Web of Science and Scopus. ClinicalTrials.gov and the WHO ICTRP were searched for ongoing studies, and ProQuest Dissertations plus the first 200 Google Scholar results supplied grey literature. Reference lists of included studies and relevant reviews were also screened. The search combined wound terms, smartphone/mobile terms, assessment/imaging terms and setting terms. The full MEDLINE strategy appears in online supplementary appendix 1.

Study selection and data extraction

Records were de-duplicated in EndNote and screened in Rayyan by two reviewers independently at title-and-abstract and full-text stages. Disagreements were resolved by discussion. Data were extracted in duplicate using a piloted form covering study characteristics, intervention details, outcomes and findings. Reasons for exclusion at full-text stage were recorded.

Risk of bias assessment

Risk of bias was assessed independently by two reviewers using the Cochrane RoB 2 tool for randomised trials,[8] ROBINS-I for non-randomised comparative studies,[9] QUADAS-2 for diagnostic accuracy studies,[10] JBI critical appraisal checklists for cohort and case-series designs, the CASP qualitative checklist,[11] and the MMAT for mixed-methods studies.[12]

Synthesis

We planned narrative synthesis by outcome domain, supplemented by limited meta-analysis only where clinical and methodological homogeneity allowed. For qualitative findings we used thematic synthesis following Thomas and Harden.[13] Certainty of evidence was rated using GRADE.[14]

Patient and public involvement

Two patient representatives with lived experience of venous leg ulceration commented on the protocol and a draft of the discussion. They were not involved in study selection or data extraction.

III. RESULTS

Study selection

Database searches retrieved 2,607 records. After removing 765 duplicates, 1,842 unique records were screened at title and abstract. Seventy-three full texts were assessed and 14 met all criteria (figure 1). The main reasons for exclusion were: setting confined to hospital or outpatient clinic without a community component (n=29), intervention not smartphone-based (n=14), duplicate report (n=8), insufficient data (n=5) and not an assessment intervention (n=3).

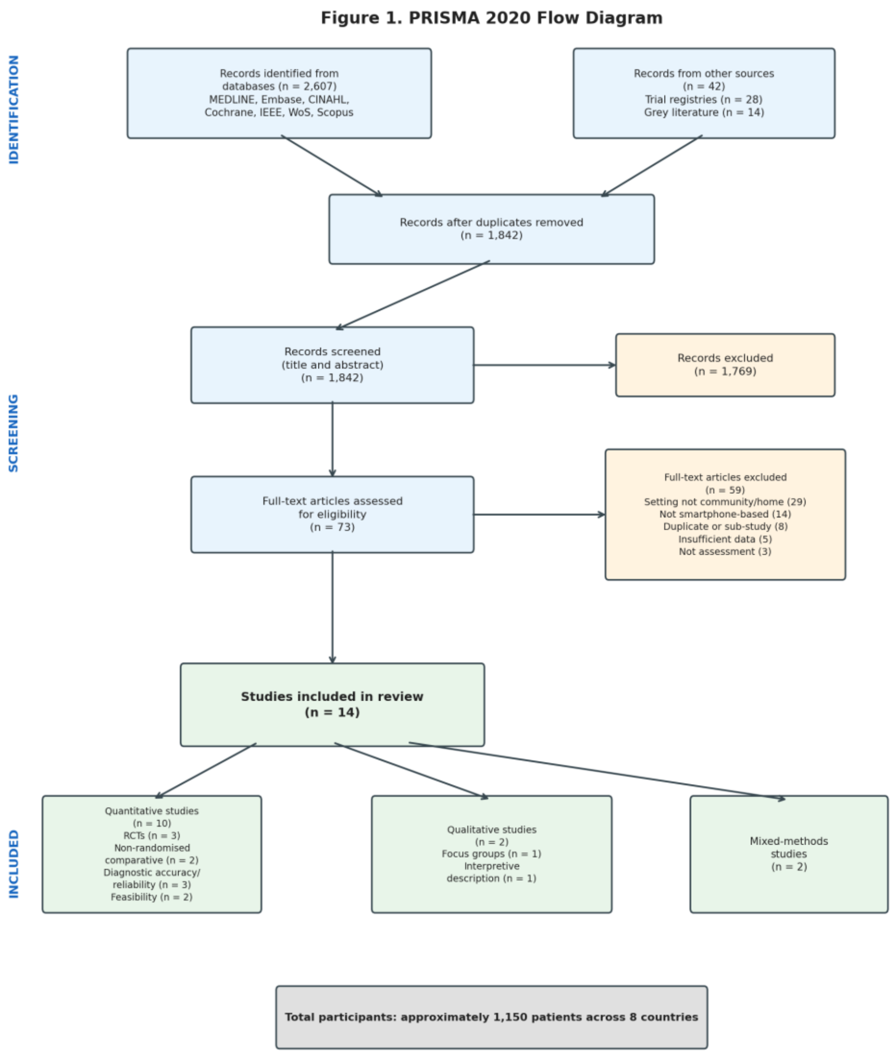

Figure 1. *PRISMA 2020 flow diagram.*

Study characteristics

The 14 studies comprised three RCTs, two non-randomised comparative cohorts, three diagnostic accuracy or reliability studies, two single-arm feasibility studies and four qualitative or mixed-methods studies, enrolling approximately 1,150 patients across Denmark, Norway, France, the United Kingdom, the United States, Singapore, Ireland and the Netherlands. Wound types included diabetic foot ulcers (seven studies), mixed chronic wounds (four), venous leg ulcers (two) and surgical site infection (one). In nine studies the smartphone was operated by a community or primary-care nurse; in four by the patient or carer; in one by both.

Study	Design	Wound type	n	Intervention	Key finding
Smith-Strøm 2018, Norway	Cluster RCT	DFU	182	Nurse smartphone images + web record to specialist	Non-inferior healing; amputation −8.3% (95% CI −16.3 to −0.5)
Zarchi 2015, Denmark	Cluster controlled	Mixed chronic	90	Nurse smartphone images to hospital wound team	Adj HR for healing 2.19 (1.15–4.17) favouring telemedicine
Téot 2020, France	3-arm RCT	Complex chronic	183	Telemedicine vs home specialist vs wound clinic	Similar healing (~68% vs 64% vs 63%); lower transport costs
Rasmussen 2015, Denmark	RCT	DFU	374	Nurse smartphone images to specialist	No healing difference; unexpected mortality signal (not replicated)
Hardy 2021, UK	RCT	SSI	492	Patient smartphone wound tool post-discharge	Halved community attendance (OR 0.57); better care access
Fong 2023, Singapore	Validation	VLU	~50	Tissue Analytics app vs nurse ruler	Inter-rater ICC 0.80–0.92; intra-rater ICC 0.97–0.99
Au 2019, USA	Reliability	Mixed	12/25	Smartphone app vs ruler (25 raters)	Intra-rater ICC 0.99 (app) vs 0.92 (ruler)
Kolltveit 2017/2018, Norway	Qualitative	DFU	34/24	DiaFOTo platform (focus groups, interviews)	Improved nurse confidence; conditions for success identified

Table 2. *Summary characteristics and key findings of included studies (selected). DFU=diabetic foot ulcer; VLU=venous leg ulcer; SSI=surgical site infection; ICC=intraclass correlation coefficient.*

Healing outcomes

Three RCTs and one cluster-controlled study reported healing. The DiaFOTo cluster RCT (n=182) found telemedicine follow-up by primary-care nurses non-inferior to standard outpatient care for healing time, with a significantly lower amputation rate (mean difference −8.3%, 95% CI −16.3 to −0.5).[15] The Zarchi study (n=90) showed more than double the likelihood of healing in the telemedicine group (adjusted HR 2.19, 95% CI 1.15–4.17).[16] The Domoplaies three-arm RCT (n=183) found similar healing across arms.[17] The Rasmussen RCT (n=374) found no healing difference but reported an unexpected mortality increase in the telemedicine arm that was not replicated elsewhere.[18]

We judged the trials too heterogeneous to pool. The overall picture supports probable benefit of smartphone-mediated specialist input where the realistic alternative is general home care without wound expertise, and equivalence where the comparator is good outpatient care. Certainty: moderate (downgraded for inconsistency).

Accuracy outcomes

Three studies provided accuracy or reliability data. Fong and colleagues validated the Tissue Analytics app against trained nurse measurements for venous leg ulcers: inter-rater ICC 0.80–0.92, intra-rater ICC 0.97–0.99.[19] The Au/Wallace study using 25 raters found intra-rater ICC 0.99 for the app versus 0.92 for the ruler, with rulers producing estimates roughly 30% larger.[20] The McLister pilot showed perfect wound-bed concordance between bedside and remote review but weaker agreement for exudate (60%).[21]

A restricted random-effects meta-analysis of intra-rater ICC for wound area across two studies yielded a pooled estimate of 0.98 (95% CI 0.97–0.99, I^2 = 0%). Smartphone apps are highly reliable for two-dimensional area, though evidence on depth and infection detection in the home remains thin. Certainty: moderate (downgraded for indirectness).

Workflow and economic outcomes

The DiaFOTo trial redistributed consultations from specialist outpatient to local contacts, reducing patient travel.[15] The Domoplaies trial documented lower transport costs.[17] The TWIST RCT (n=492) roughly halved community-care attendance (OR 0.57, 95% CI 0.34–0.94) and doubled patient-reported experience of accessing care (OR 2.02, 95% CI 1.17–3.53).[22] No study presented a full cost-effectiveness analysis. Certainty: moderate.

Patient and clinician experience

Most patients found smartphone-based assessment acceptable. The DiaFOTo trial maintained satisfaction and quality of life.[23] The TWIST trial improved patient-reported experience of care access. Feasibility studies reported high satisfaction among engaged users but flagged usability barriers.[24 25] A few patients reported anxiety from repeatedly viewing their own wound.

Qualitative studies from the DiaFOTo programme found nurses described improved confidence and more comprehensive assessment.[26 27] They framed the smartphone platform as augmenting rather than replacing clinical judgement. Key conditions for success were leadership support, record integration and sustained training. Persistent concerns centred on connectivity, shared devices and information governance.

Qualitative thematic synthesis

Thematic synthesis of the four qualitative and mixed-methods studies identified four analytical themes. First, bridging knowledge gaps: smartphone platforms distributed wound expertise from specialist centres into community practice, with nurses reporting they learned through feedback on images. Second, visibility and accountability: photographs created a durable, shareable record that patients and nurses both valued, though some clinicians felt pressure to perform the assessment well on camera. Third, workflow disruption and integration: initial slowing of visits when connectivity was poor, followed by routinisation where local champions were in place. Fourth, trust, privacy and the limits of the image: concerns about data security on personally owned devices and recognition that photographs cannot substitute for assessing induration, temperature, smell or pain.

Certainty of evidence

Outcome	Studies	Risk of bias	Inconsistency	Indirectness	Certainty
Healing	4	Some concerns	Serious	Not serious	MODERATE
Wound area accuracy	3	Not serious	Not serious	Serious	MODERATE
Workflow/travel	3	Serious	Not serious	Not serious	MODERATE
Decision-making	2	Serious	Not applicable	Not serious	LOW
Patient acceptability	5	Not serious	Not serious	Not serious	MODERATE
Clinician acceptability	4	Not serious	Not serious	Some indirectness	LOW–MODERATE

Table 3. *GRADE summary of findings.*

IV. DISCUSSION

Summary of findings

This review identified 14 studies of smartphone-based wound assessment in community and home nursing. Four conclusions emerge. Smartphone-mediated assessment with specialist input is at least equivalent to standard outpatient care for healing, and probably better where the realistic alternative is general home care without specialist access. Smartphone wound apps deliver excellent reliability for two-dimensional wound area. Smartphone-based assessment can reduce travel and outpatient visits. And qualitative evidence consistently shows improvements in nurse confidence and documentation, set against practical concerns about connectivity, devices and governance.

Comparison with existing literature

Our findings extend previous telemedicine wound reviews[28 29] by focusing on the community and home context and integrating qualitative with quantitative evidence. The accuracy findings are consistent with technical validation work[30] but highlight that almost all validation has occurred in clinics rather than actual homes.

Strengths and limitations

Strengths include comprehensive searching, dual-reviewer processes throughout, design-appropriate risk-of-bias tools, GRADE certainty assessment and formal qualitative synthesis. Limitations include the small number of eligible studies, heterogeneity across interventions and comparators, the dominance of two wound types, English-language restriction and the near-absence of community-based AI-app evidence.

Implications for practice

Smartphone-based assessment is mature enough for routine use in community wound care. Services should focus on record integration, secure transmission, dedicated training and clear escalation protocols. The photographic image has real limits—depth, infection, pain—and smartphone tools should augment, not replace, clinical examination.

Implications for research

Pragmatic RCTs with full economic evaluation and core outcome sets are needed. Future studies should include pressure injuries in the home, older people without carer support and rural populations. Accuracy studies must move to actual home environments and address wound infection detection. AI-app validation should follow TRIPOD+AI[31] and DECIDE-AI[32] reporting standards. Implementation research should map the governance and organisational conditions that distinguish sustained from failed adoption.

V. CONCLUSION

Smartphone-based wound assessment, integrated into community nursing pathways and supported by specialist input, is feasible, acceptable and probably at least equivalent to standard care for healing. It reduces travel, supports better documentation and can strengthen nurses' confidence. The evidence base is still small. Investment in pragmatic trials, real-home accuracy studies and implementation research—alongside attention to information governance and digital inclusion—should now be the priority.

Funding: This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.
Competing interests None declared.
Patient consent for publication Not applicable.
Ethics approval Not applicable; this systematic review used only published data.

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