

**REVIEW ARTICLE**

# Effects of home-based chronic wound care training for patients and caregivers: A systematic review

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**Abstract**

We aimed to review and synthesise the evidence of the interventions of patients' and informal caregivers' engagement in managing chronic wounds at home. The research team used a systematic review methodology based on an updated guideline for reporting systematic reviews (PRISMA) and recommendations from the Synthesis Without Meta-analysis. Cochrane Central Register of Controlled Trial of the Cochrane Library, Pubmed, Embase, CINAHL, Wanfang (Chinese), and CNKI database (Chinese) were searched from inception to May 2022. The following MESH terms were used: wound healing, pressure ulcer, leg ulcer, diabetic foot, skin ulcer, surgical wound, educational, patient education, counselling, self-care, self-management, social support, and family caregiver. Experimental studies involving participants with chronic wounds (not at risk of wounds) and their informal caregivers were screened. Data were extracted and the narrative was synthesised from the findings of included studies. By screening the above databases, 790 studies were retrieved, and 16 met the inclusion and exclusion criteria. Studies were 6 RCTs and ten non-RCTs. Outcomes of chronic wound management included patient indicators, wound indicators, and family/caregiver indicators. Home-based interventions of patients or informal caregivers' engagement in managing chronic wounds at home may effectively improve patient outcomes and change wound care behaviour. What's more, educational/behavioural interventions were the primary type of intervention. Multifactor integration of education and skills training on wound care and aetiology-based treatment was delivered to patients and caregivers. Besides, there are no studies entirely targeting elderly patients. Home-based chronic wound care training was important to patients with chronic wounds and their family caregivers, which may advance wound management outcomes. However, the findings of this systematic review were based on relatively small studies. We need more exploration of self and family-oriented interventions in the future, especially for older people affected by chronic wounds.

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**KEYWORDS**

caregiver, chronic wound, home care, systematic review, wound care training

**Key Messages**

- in the particular time, we should be noticed the fact that other equally deadly medical conditions and diseases are not taking a break. It is important for wound staff to understand the importance of patients' and informal caregivers' engagement in the management of chronic wounds at home to help professionals develop tailored interventions to better support the patients and their informal caregivers and improve patient outcomes as far as possible
- this paper reviewed and synthesised the evidence of the interventions of patients and informal caregivers' engagement in the management of chronic wounds in adults at home
- this systematic review was the first to focus on the impacts of home-based chronic wound care training for patients and caregivers and suggested that wound care training for patients and caregivers at home may be effective in changing wound care behaviour, with a consequent improvement of the quality of life of patients and family support
- this paper recommended further exploration of self and family-oriented interventions for older people affected by chronic wounds in future

## 1 | INTRODUCTION

Chronic wound refers to a major type of disease involving the injury or defect of the skin and the subcutaneous tissue, which usually lasts more than four weeks.<sup>1</sup> With social development and the gradually aged population, the prevalence of chronic wounds, especially pressure injuries, diabetic foot ulcers, and venous leg ulcers, is increasing. Chronic wounds can negatively impact the lives of patients physically, psychologically, and financially.<sup>2,3</sup>

Chronic wound prevalence has evolved into a significant public health concern and has been described as a silent epidemic that affects a significant fraction of the world's population.<sup>1,4</sup> In terms of the treatment process of the disease, chronic wounds are mainly managed at home or community because of the long treatment cycle.<sup>5</sup> Although various regions have been exploring the establishment of wound healing centres with different operation modes, from the belief and experience of patients, especially the elderly patients, they prefer to look forward to the home wound service.<sup>6-8</sup>

The European Wound Management Association defines home wound care as wound care implemented at homes by health care professionals or family caregivers, excluding that in long-term care sites such as nursing homes.<sup>9</sup> Patients with chronic wounds are reluctant to frequently travel a long distance to receive medical service because of wound pain, physical immobility, or age factors while minimising their exposure risk.<sup>10-12</sup> Home

wound care is an important link in the whole management of chronic wound patients.<sup>13,14</sup> In special periods, such as the outbreak of the COVID-19 pandemic, the implementation of home wound care is also one of the main management strategies for chronic wound patients.<sup>15</sup> Up to 61% of wound patients in Australia receive family caregivers' care or self-care.<sup>16</sup> A survey conducted by the AARP Public Policy Research Institute indicated that approximately 35% of informal caregivers performed home-based wound care.<sup>17</sup> For cognition (dementia) or older patients, chronic wound care is, to a large extent, provided at home by family members.

Home wound services from caregivers may include checking patients' feet in daily life, providing skin and toenail care, performing wound dressing and applying compression bandages, assisting with physical exercise, and also managing patients with limited mobility to reduce the risk of pressure injury.<sup>18</sup> Wound management behaviours of family caregivers will affect the patient's disease progression and quality of life.<sup>19</sup> They also play a key role in the clinical decision-making of patient-centred treatment.<sup>20</sup> But on the other hand, for lay caregivers, implementing home wound care may be a stressful experience.<sup>14,21</sup> Out of these family caregivers, nearly half (47%) identified wound care are challenging.<sup>17</sup> If the caregivers do not have adequate knowledge and skills, they may unintentionally harm the patient or affect the wound outcome, and the risk is directly related to the lack of wound care knowledge and skills.<sup>22,23</sup>

Home care is very important to chronic wound patients, but patients and nonprofessional caregivers require education or training to implement home-based wound care.<sup>14</sup> Although there are different trainings or interventions for patients and family members, we still do not have a clear answer to the characteristics of effective intervention measures. Therefore, the purpose of this review is to review and synthesise the evidence of the interventions of patients and informal caregivers' engagement in the management of chronic wounds in adults at home, including the two following objectives:

1. Determine how patients' and informal caregivers' engagement in interventions can aid in the management of chronic wounds in adults at home.
2. Understand the types of interventions participated in by patients and informal caregivers to manage chronic wounds in adults at home.

## 2 | MATERIALS AND METHODS

An updated guideline guided this review for reporting systematic reviews (PRISMA) together with recommendations from the Synthesis Without Meta-analysis (SWiM) in systematic review guidelines.<sup>24,25</sup> The protocol was registered with the International Prospective Register of Systematic Reviews, PROSPERO, with registration number: CRD42022328271.

### 2.1 | Eligibility criteria

Predefined criteria considered the review for inclusion and exclusion of studies as described in Table 1. The interventions include training or education programs to initiate wound care for patients or caregivers and re-training or re-education programs for existing wound care patients or caregivers. Training can occur in a clinical setting, in the patient's home, community, or special education centre. Training providers may involve nurses, health, or doctors. Training can be one-on-one or in small groups. Studies reporting only a certain type of dressing or treatment or exercise training without any other wound care training intervention will be excluded.

### 2.2 | Searching and selection of studies

The search for studies was conducted in six databases. Using both subject headings and keywords, a search strategy (see Data S1) was developed and optimised for

each of the following databases: Cochrane Central Register of Controlled Trial of the Cochrane Library, Pubmed, Embase (Ovid), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Wanfang database (Chinese) and CNKI database (Chinese). Searches were limited to studies published in English and Chinese language. The Year of publication was searched up to May 2022. Additionally, the references of included studies and relevant systematic reviews were screened for studies that the search strategy might have missed. All searched outcomes were imported into Endnote X7, and duplicates were automatically detected and removed. Titles and abstracts of the studies were then screened, and studies not relevant to the aim of this review were excluded. The full text of potentially eligible studies was read in full by two authors, and disagreements were discussed to reach a consensus.

### 2.3 | Quality assessment and data extraction

The Cochrane Collaboration risk of bias for RCTs tool through Review Manager (RevMan) and ROBINS-I risk of bias for non-RCT tools was used in assessing the studies.<sup>26,27</sup> Data extraction used an optimised template in Excel which was first piloted with one study. Also, the Template for Intervention Description and Replication (TIDIER) checklist was used to guide the extraction of the necessary components of various interventions in studies.<sup>28</sup> The main information extracted from studies included study ID, objective, setting, samples, participants' characteristics, intervention description, study follow-up time, and relevant outcomes.

### 2.4 | Data synthesis

A narrative synthesis of findings was performed under the guidance of the SWiM guidelines because of high heterogeneity in included studies, such as different intervention types, methods, evaluation instruments, and follow-up time, which made meta-analysis inappropriate.<sup>25</sup> Therefore, data were synthesised based on the direction of effect. To achieve the aims of this review, the first stage of synthesis was carried out to determine how patients' and informal caregivers' engagement in interventions can aid in the management of chronic wounds in adults at home. The second stage evaluated the various types of patients' or informal caregivers' interventions used to manage chronic wounds in adults at home.

Studies were grouped based on the outcomes reported, and these outcomes were subsequently grouped into

TABLE 1 Eligibility criteria for studies.

PICOS	Inclusion	Exclusion
Participant	(i) Patients with chronic wounds and their informal caregivers; (ii) Patients are persons 18 years and above; (iii) Informal caregivers are defined as family members, friends, or any unpaid person providing or assisting patients without the background of formal medical education; (iv) Patient or caregiver implement wound care activities at home.	(i) Patients with chronic wounds but residents in a nursing care home or hospital; (ii) Patients received assisted wound care (where a community/family doctor or nurse performs wound care for the patient).
Intervention	(i) Interventions include training or education programs to initiate wound care for patients or caregivers to treat the existing wound problems, as well as re-training or re-education programs for existing wound care patients or caregivers; (ii) Interventions will include providing information, behavioural guidance, operational advice, and motivational interviews. A variety of educational instructional materials are provided through oral, written, picture guides, audio recordings, or computer-assisted means, including practical demonstrations and exercises; (iii) Interventions providers may involve nurses, health or doctors; (iv) Interventions can be one-on-one or in small groups.	(i) Studies reporting only a certain type of dressing or treatment or exercise training without any other wound care training intervention; (ii) Interventions involving only health professionals without patients or informal caregivers.
Context	(i) Interventions may take place in a hospital or clinic setting, special training centre, or patient's home.	(i) Nursing homes and care/residential homes where persons with chronic wounds are residing and cared for by carers and other employees.
Outcome	Effectiveness of patient or caregiver empowerment/education, for example, (i) Wound care behaviour/skills (ii) Wound care knowledge (iii) Wound size or wound healing (iv) Quality of life or caregiver burden outcomes (v) Anxiety/depression status level	(i) Cost-related outcome
Type of studies	(i) Randomised control trials or quasi-experimental studies or pre-post-design studies to assess the beneficial effects of the interventions.	(i) Qualitative studies (ii) Reviews (iii) Conference abstracts (iv) Noninterventional studies or tool development studies or methodological papers or case reports (v) Protocols without results

chronic wound management outcomes. The chronic wound management outcomes measured among persons with current chronic wounds included wound healing, self-care behaviour/practices, wound knowledge, quality of life, anxiety/depression status, and laboratory index (HbA1c).

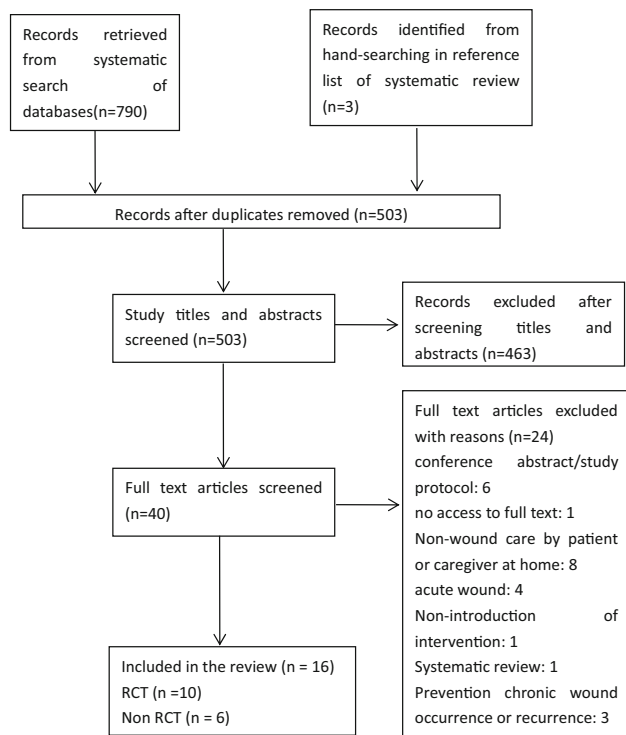
Study intervention types were classified as educational, behavioural, psychological, and mixed to optimise the description of the patients' and informal caregivers' engagement interventions. Educational interventions are intended to provide subjects with information to improve their knowledge of home-based wound care. Behavioural interventions focused on skills training and lifestyle change to improve the behaviour of home-based wound care. Moreover, psychological interventions were studies

that focused on alleviating the distressing symptoms of anxiety/depression. Finally, the intervention type was coded as mixed if there were two or more different categories of interventions.

### 3 | RESULTS OF REVIEW

#### 3.1 | Search results

The primary search of databases identified sixteen eligible studies and one relevant systematic review. The reference list of the relevant systematic review was checked, but no new eligible papers were identified. Finally, sixteen primary studies were included in this review.



**FIGURE 1** PRISMA flow diagram for study identification and selection process.

The search and selection of studies and reasons for excluding studies after full-text retrieval were shown in Figure 1, PRISMA flow diagram.

### 3.2 | Characteristics of included studies

The review included 16 studies. Thirteen of them were published in English, and the other 3 were published in Chinese. Eleven of the studies came from Asia (4 in China,<sup>29-32</sup> 3 in Indonesia,<sup>33-35</sup> 2 in Iran,<sup>36,37</sup> 1 in Singapore,<sup>38</sup> and 1 in India<sup>39</sup>), 4 from Europe (one each from Ireland,<sup>40</sup> The Netherlands,<sup>41</sup> Croatia<sup>42</sup> and Germany<sup>43</sup>) and 1 from South America (1 in Brazil<sup>44</sup>). The total number of participants with chronic wounds was 1622. Only five studies reported the characteristics of caregivers involved which was 435.<sup>30-33,35</sup> The majority of caregivers were female (66.0%), and family relationship was mostly spouse or son/daughter (41.4% and 41.1%, respectively), or other family members (17.5%). The characteristics of the studies are presented in Table 2.

### 3.3 | Risk of bias assessment

The results of the risk of bias assessment of the 16 studies are respectively presented as Data S2 and S3 for RCTs

and non-randomised studies by authors with judgement reasons. Most of the RCTs had a high risk of bias for non-blinding of participants and personnel assessment because it was hard to blind these people. Except for 3 studies,<sup>40,41,44</sup> it was unclear if outcome assessors were blinded or not. Apart from 1 non-randomised study,<sup>36</sup> other non-randomised studies were all rated moderate for bias because of confounding and measurement of outcome. Most of the non-randomised studies had an overall moderate risk of bias (Figures 2–6).

### 3.4 | Outcomes and measures

Outcomes of chronic wound management included patient indicators, wound indicators, and family/caregiver indicators (Table 3). To sum up, patient indicators included physical activity measurement,<sup>41</sup> psychological indicators,<sup>29</sup> quality of life/global assessment,<sup>29,34,39,44</sup> wound care attitude/knowledge/behaviour<sup>30,40,42</sup> and HbA1c<sup>33,35</sup>; wound indicators referred to wound severity,<sup>30,33-36,44</sup> and healing/recurrence rate<sup>30-32,41</sup>; family/caregiver indicators included family support and caregiver behaviour.<sup>30-33,35</sup>

One study assessed the physical activity of patients with an international physical activity questionnaire. It showed that participants in the intervention group conducted their leg exercises 32% more often over the follow-up period.<sup>41</sup> One study reported psychological outcomes of the Hospital Anxiety Scale (HAS) and Hospital Depression Scale (HDS) and indicated that both anxiety and depression status decreased significantly in the intervention group at the 3-month follow-up.<sup>29</sup> Participants' quality of life/global assessment was reported by four studies,<sup>29,34,39,44</sup> and three of them indicated an improvement after intervention.<sup>29,34,39</sup> The measurement of participants' quality of life/global assessment differed across the four studies, including three generic tools (the SF-36 scale,<sup>34</sup> RAND-36 scale,<sup>39</sup> patient global assessment questionnaire<sup>29</sup>) and one specific wound-related tool (Freiburg Life Quality Assessment for Wounds<sup>44</sup>).

One study reported the participants' attitude toward compression therapy by self-designed questionnaire and indicated that the educational intervention increased patients' awareness of compression therapy at post-intervention follow-up.<sup>42</sup>

The study of participants' wound care knowledge was assessed by three studies,<sup>30,40,42</sup> two for venous leg ulcers (VLU),<sup>40,42</sup> and one for pressure ulcers.<sup>30</sup> The knowledge of venous leg ulcers that communicated with patients in interventions contained an explanation of the causes of VLU, method of compression therapy and wound dressing, how to exercise and position the leg, and the importance of foot hygiene by information leaflet or educational

TABLE 2 Characteristics of studies.

Author/country	Study design; Participants (I:C)	Intervention and control treatment		Intervention duration/follow up	Outcomes (I vs. C), (P value)
		Participant characteristics I	C		
Appil R (2020), Indonesia	Non-RCT; I:17, C:16	N = 33 (i) Mean DFU patient age not stated (I:56.76 ± 9.66, C:53.25 ± 8.43) Female n = 19 (I:8, C:11) (ii) Mean caregiver age not stated (I:38.59 ± 10.9, C:38.0 ± 10.2) Female n = 28 (I:15, C:13)	(i) Self and family empowerment program (ii) Skills training and education on DM management and DFU treatment through picture booklet, lecture, and practice exercises (iii) It involved discussion and evaluation meeting with family	nonstructural education provided verbally without family involvement	(i) Improved family knowledge (16.59 ± 3.92 vs. 13.38 ± 1.26) (P = 0.005) and attitude (3.65 ± 0.93 vs. 2.75 ± 0.45) (P = 0.002) and behaviour (8.65 ± 1.27 vs. 13.59 ± 3.02) (P = 0.019) (ii) Decreased HbA1c (% mean ± SD) from 10.47 ± 2.44 to 8.81 ± 1.83 compared with the CG from 10.86 ± 2.53 to 10.40 ± 2.56 (P = 0.048) (iii) Improved wound healing process (Diabetic Foot Ulcer Assessment Scale score) for the IG (4.71 ± 7.74) compared with the control group (17.25 ± 17.06) (P = 0.01)
Chen H (2020), China	RCT; I:90, C:90	N = 180 Mean DFU patient age not stated (I:59.4 ± 10.1, C:59.9 ± 11.1) Female n = 68 (I:37, C:31)	(i) Intensive patients education program (ii) Education to the patients and the family members including supervising patients' harmful habits and diets, psychological care through pamphlet, educational sessions and WeChat group	Usual care included the instructions 3 months 3 months	(i) For anxiety assessment, higher HADS-A score changes were discovered in IEP group (-1.5 ± 2.6 vs. -0.6 ± 3.3) (P = 0.046) (ii) For depression assessment, raised SDS score change in IEP group (-6.7 ± 10.6 vs. -3.3 ± 12) (P = 0.049) (iii) For patient global assessment, elevated PGA score change in IEP group (-2.4 ± 1.6 vs. -1.7 ± 1.5) (P = 0.006)
Clarke Moloney M (2005), Ireland	RCT; I: not stated	N = 20	verbal information on their condition	Not stated 4-6 weeks	An overall improvement in knowledge from (3.8 ± 2.2) (Continues)

TABLE 2 (Continued)

Author/country	Study design; Participants (I:C)	Intervention and control treatment		Intervention duration/follow up	Outcomes (I vs. C), ( <i>P</i> value)
		I	C		
Damhudi D (2021), Indonesia	Non-RCT; I:30; C:30 Median VLU patient age was 67.5 (range: 49–89), mean age not stated (I:70, C:66) The gender ratio is not stated	verbal information on their condition and an information leaflet	Not stated	8 weeks 3 months	to 7.0 ± 2.94) compared with the control group from (4.7 ± 1.49 to 7.7 ± 2.11) ( <i>P</i> = 0.083), with no statistical difference between them (i) Decreased diabetic foot ulcer degree (Wagner) change in DSMES group (1.29 ± 1.87 vs. 2.19 ± 1.5) ( <i>P</i> not stated) (ii) Improved diabetes foot self-care behaviour (DFSCBS) change in DSMES group (33.7 ± 10.3 vs. 27.4 ± 8.77) ( <i>P</i> not stated) (iii) Improved QoL (SF-36) change in DSMES group (130.5 ± 30.9 vs. 125.1 ± 37.36) ( <i>P</i> not stated)
Heinen M (2012), The Netherlands	RCT; I:92; C:92 N = 184 Mean VLU patient age was 66 ± 12.5 (I:65 ± 13, C:67 ± 12) Female n = 110 (I:55, C:55)	(i) The Lively Legs self-management program (ii) The intervention group received lifestyle counselling additionally to usual care (iii) Demonstrate and practice, education materials, discussion, and motivational interviewing were involved	Usual care according to the guidelines for leg ulcer patients and wound care	6 months 18 months	(i) Adherence rate with compression therapy in both groups has not significant difference between the groups (46% vs. 45%) ( <i>P</i> = 0.77) (ii) The IG performed significantly better on conducting leg exercises (59% vs. 40%) ( <i>P</i> < 0.01)

TABLE 2 (Continued)

Author/country	Study design; Participants (I:C)	Intervention and control treatment		Intervention duration/follow up	Outcomes (I vs. C), (P value)
		Participant characteristics I	C		
Hemmati Maslakpak M (2018), Iran	Non-RCT; I:24; C:26	N = 50 Mean DFU patient age not stated (I:53.70 ± 9.25, C:54.57 ± 6.04) Female n = 27 (I:13, C:14)	usual care	3 weeks 4 months	(iii) The IG had less wound healing month (1.2 ± 2.5 vs. 2.5 ± 3.6) (P < 0.01)  (i) Higher self-care means scores was observed in the intervention group (94.25 ± 9.45 vs. 67.26 ± 9.62) (P = 0.001)  (ii) A significant difference was found between the two groups regarding topographic aspects, ischemia, infection, and wound healing phase
Heng ML (2020), Singapore	RCT; I:33; C:19	N = 52 Mean DFU patient age was 56.9 (I:55.2 ± 10.7, C:60.1 ± 10.6) Female n = 16 (I:14, C:2)	(i) A collaborative approach in patient education counselling  (ii) Drawing out patients' intrinsic self-motivation and know-how to work toward cocreating the next steps in the treatment plan	Traditional didactic education 20 to 30 min 12 weeks	(i) Participants in the IG experienced a significant improvement in knowledge and self-care behaviour score from 32.8 ± 6.9 to 38.8 ± 8.5 compared with the CG from 35.5 ± 7.6 to 39.1 ± 6.6 (P < 0.001)
Domingues EAR (2018), Brazil	RCT I:36; C:35	N = 71 Mean VLU patient age was 66.5 ± 12.8 (I:64.83 ± 12.86, C:68.1 ± 12.63) Female n = 41 (I:21, C:20)	Lifestyle guidelines on the physiopathology of a venous ulcer, the importance of compression therapy, physical exercises, and rest by informative brochures, face-to-face meetings, and phone calls	Usual care according to routine guidelines of the health services 12 weeks 12 weeks	The IG had significant improvement in the wound healing on 30, 60, and 90 days of follow-up when compared with the CG (P = 0.0197; P = 0.0472; P = 0.0116) (mean wound area not stated)
Protz K (2019), Germany and Austria	Non-RCT I:68; C:68	N = 136 Mean VLU patient age was 71 (I:70.9 ± 12.2, C:71.6 ± 12.6) Female n = 100 (I:54, C:46)	Reading a brochure about venous disease and compression therapy at home  Without reading the brochure	Not stated Next appointment	Patients in the IG had significantly more knowledge than patients in the CG in most items. For example, with 98.5%, most of them knew that compression therapy

(Continues)



TABLE 2 (Continued)

Author/country	Study design; Participants (I:C)	Intervention and control treatment		Intervention duration/follow up	Outcomes (I vs. C), (P value)
		Participant characteristics I	C		
Satehi SB (2021), Iran	RCT I-1:30; I-2:30; C:30	N = 90 Mean DFU patient age not stated (I-1:55.56 ± 11.23, I-2: 56.33 ± 16.68, C:55.80 ± 11.73) The gender ratio is not stated	(i) In the teach-back group, the researcher provided training in a single one-on-one, face-to-face session (ii) In the multimedia group, patients received educational videos via CD, DVD, and mobile device files with the same content	Orally educational recommendations 45 min 2 weeks	Improved diabetes Management Self-Efficacy Scale score in the teach-back group (58.43 ± 11.38) and multimedia group (60.26 ± 6.70) vs. control group (41.60 ± 9.18) ( $P < 0.001$ ) Improves wound healing, and 56.9% of the control group did not know this ( $P = 0.000$ )
Sonal Sekhar M (2019), India	RCT I:70; C:65	N = 136 Mean DFU patient age was not stated (I:58.6 ± 7.9, C:60.3 ± 8.4) Female n = 32 (I:15, C:17)	Education on various foot care measures and the importance of medication compliance, the need for off-loading, wound dressing, and the use of properly fitting footwear by using information leaflets and telephonic interview	Not stated 6 months 6 months	Both summary scores of physical health and mental health of RAND-36 increased from (25.6 ± 7.3 to 42.9 ± 9.7) and (28.8 ± 7.1 to 48.8 ± 8.4) in the intervention group than in control group (24.1 ± 6.6 to 26.5 ± 5.1) and (30.1 ± 7.4 to 48.8 ± 8.4) ( $P < 0.05$ )
Subrata SA (2020), Indonesia	RCT I:27; C:29	N = 56 (i) Mean DFU patient age was not stated (I:51 ± 5.27, C:51.2 ± 5.41) Female n = 20 (I:8, C:12) (ii) Mean caregiver age not stated The gender ratio is not stated	(i) Self and family-management support programs (ii) Intensive health education was delivered through skill training on wound care and motivational interviewing	Usual care refers to diabetes health education (not including skill training and MI) 3 months 3 months	(i) Improved HbA1c: Mean square = 10.92, df = 1, $F = 6.65$ , $P = 0.013$ (values for I vs. C not stated) (ii) Improved in wound size: Mean square = 21 799.41, df = 1, $F = 38.11$ , $P = 0.000$ (values for I vs. C not stated) (iii) Improved in self-management: Mean square = 237.93, df = 1, $F = 5.38$ , $P = 0.024$ (values for I vs. C not stated)

TABLE 2 (Continued)

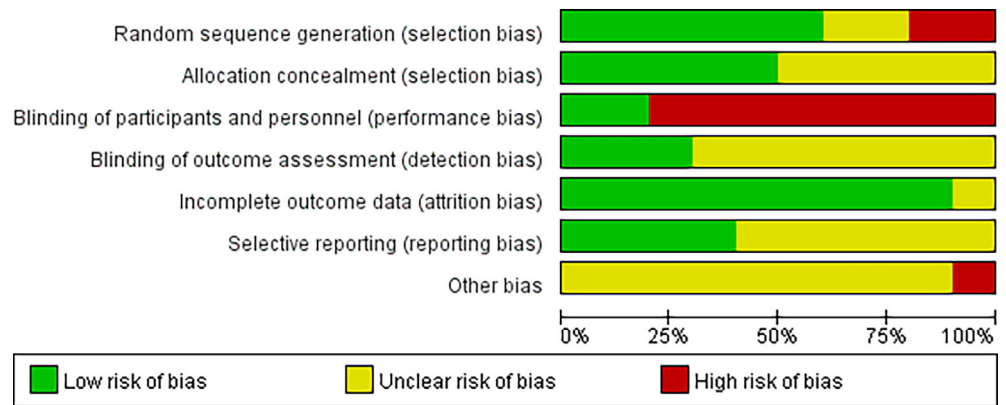
Author/country	Study design; Participants (I:C)	Intervention and control treatment		Intervention duration/follow up	Outcomes (I vs. C), (P value)
		Participant characteristics I	C		
Žulec M (2022), Croatia	RCT I:112; C:96	N = 208 Mean VLU patient age not stated Female n = 112 (I:61, C:51)	Without the educational brochure  (i) Educational Intervention on Self-Care through the educational brochure and a short presentation of it (ii) The central part of the brochure explained wound dressing in a step-by-step manner, with photos of real patients	Not stated 3 months	(iv) Improved in family support: Mean square = 36.55, df = 1, F = 6.88, P = 0.011 (values for I vs. C not stated)  The educational intervention increased awareness of compression therapy, knowledge of recurrence prevention, appropriate lifestyle habits, and warning signs related to venous leg ulcers
Cheng H (2019), China	Non-RCT I:50; C:50	N = 100 (i) Mean PI patient age was not stated (I:78.12 ± 12.65, C:73.35 ± 12.65) Female n = 51 (I:24, C:27) (ii) Mean caregiver age not stated (X <sup>2</sup> = 1.512, P = 0.619) Female n = 70 (I:32, C:38)	(i) Family-based tel-nursing mode (ii) Wound therapists establish a WeChat group and send notification information to patients and caregivers on PI home care and prevention education	Routine follow-ups  Not stated 2 months	(i) Lower the severity of pressure sores in IG, X <sup>2</sup> = 7.028, P = 0.03 (ii) Lower Waterlow score in IG, X <sup>2</sup> = 13.3, P < 0.001 (iii) Lower recurrence rate of PI in IG, X <sup>2</sup> = 6.618, P = 0.01 (iv) Better caregiver's knowledge of PI in IG, for example, nutrition (X <sup>2</sup> = 9.653, P = 0.002) (v) Better total scores of the family nursing evaluation in IG, (40.24 ± 6.72 vs. 27.81 ± 7.49, P < 0.001)
Liu X (2016), China	Non-RCT I:100; C:100	N = 200 (i) Mean PI patient age was 75.15 ± 12.8 (I:74.82 ± 13.67, C:75.48 ± 11.66) Female n = 93 (I:46, C:47) (ii) Mean caregiver age was 62.31 ± 9.34	(i) Wound therapist made an individualised pressure ulcer home care plan (ii) Nursing plan information leaflet and phone call were involved	Routine discharge guidance with only telephone follow-up  Not stated 2 months	(i) Improvement healing rate of PI: IG (59%) versus CG (32%) (X <sup>2</sup> = 14.690, P = 0.000) (ii) Lower recurrence of PI: IG (24%) versus CG (39%) (X <sup>2</sup> = 5.214, P = 0.022)

(Continues)

TABLE 2 (Continued)

Author/country	Study design; Participants (I:C)	Participant characteristics	Intervention and control treatment	Intervention duration/follow up	Outcomes (I vs. C), (P value)
		(I:65.73 ± 6.5, C:61.17 ± 9.2) Female n = 119 (I:65, C:54)	I C		(iii) Improved caregiver's behaviour scores, IG from 43.89 ± 7.89 to 46.18 ± 4.44, CG from 42.21 ± 6.32 to 43.33 ± 5.67, $F_{\text{group}} = 5.512$ , $P = 0.017$
Zhou DM (2014), China	RCT I:23; C:23	N = 46 (i) Mean PI patient age was not stated (I:79.83 ± 13.54, C:78.65 ± 14.42) Female n = 26 (I:13, C:13) (ii) Mean caregiver age was not stated (I:57.04 ± 9.14, C:60.17 ± 11.33) Female n = 37 (I:19, C:18)	(i) Individualised education programs on PI prevention and management at home (ii) Individual manual and CD guidance, family visit, and telephone follow-up and consultation were involved Routine nursing education in the outpatient department and being followed up once in 1 or 3 months after the first visit, respectively	3 months 3 months	(i) Improved caregiver's behaviour scores, IG from 41.1 ± 5.92 to 46.67 ± 3.88, CG from 41.3 ± 6.88 to 40.25 ± 6.28, $F_{\text{group}} = 8.703$ , $P < 0.01$ (ii) No differences both in healing rate (IG: 52.4%, CG: 45%, $X^2 = 0.223$ , $P = 0.636$ ) and the recurrence rate (IG: 14.3%, CG: 25%, $X^2 = 0.749$ , $P = 0.387$ ) of PI between two groups

FIGURE 2 Risk of bias graph.



	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Chen H 2020	+	+	-	?	+	?	?
Clarke MM 2005	+	+	-	+	+	?	?
Heinen M 2012	?	?	-	+	+	?	?
Heng ML 2020	+	+	+	?	+	+	?
Otten M 2018	+	+	-	+	+	+	-
Satehi 2021	?	?	+	?	+	+	?
Sonal SM 2019	+	?	-	?	+	?	?
Subrata 2020	+	+	-	?	+	+	?
Zhou DM 2014	-	?	-	?	?	?	?
Žulec 2022	-	?	-	?	+	?	?

FIGURE 3 Risk of bias summary.

brochure. Wound therapists provide remote pressure ulcer guidance to patients and caregivers through the WeChat platform, including the importance of pressure ulcer home care, position and pressure-relieved device application guidance, wound dressing and skin care method, and other nursing guidance. All of them showed improvement in knowledge in the post-intervention phase. However, one of the three studies indicated that the difference was insignificant compared with the control group.<sup>40</sup>

Besides, six studies assessed participants' wound care behaviour or self-management practice.<sup>34-38,41</sup> Five out of the six studies were concerned with diabetic foot ulcers (DFU),<sup>34-38</sup> and the other was for VLU.<sup>41</sup> Meanwhile, different assessment tools were used for each study, and among them included three specific DFU care behaviour tools (Diabetes Foot Self-Care Behaviour Scale,<sup>34</sup> Self-care status Scale,<sup>36</sup> and Brief Self-administered Questionnaire),<sup>38</sup> two generic diabetes self-management tools (Diabetes Mellitus Self-Management Questionnaire<sup>35</sup> and Diabetes Management Self-Efficacy Scale<sup>37</sup>), and one of adherence with compression therapy questionnaire for VLU.<sup>41</sup> All of them recorded an improvement in wound self-care behaviour or practice of participants after the intervention; however, one study for VLU indicated the difference was not significant when compared with the control group.<sup>41</sup>

Finally, regarding the outcome of patient indicators, two studies measured HbA1c for DFU patients.<sup>33,35</sup> Both studies indicated an improvement in the level of HbA1c at the 3-month follow-up, and the difference with the control group was significant. Patients and family members were provided with basic knowledge about Diabetes Mellitus, diet/meal planning, medication, blood sugar control, physical exercise, and stress management and treatment of DFU through a picture booklet/lecture or skill training/motivational interviewing.

Wound-related outcomes were investigated by nine studies with different tools.<sup>30-36,41,44</sup> Patients and family

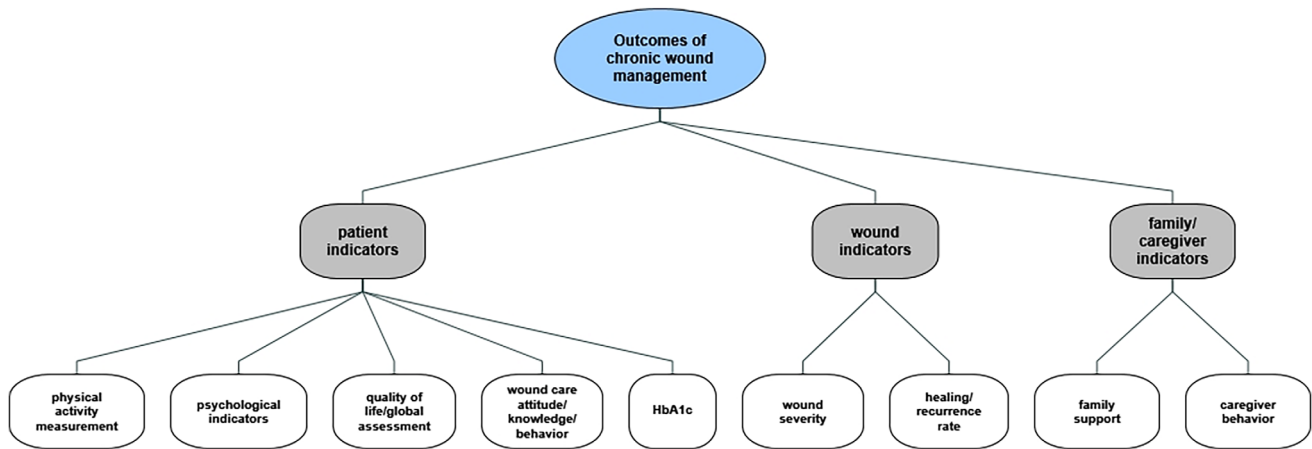


FIGURE 4 Outcomes of chronic wound management.

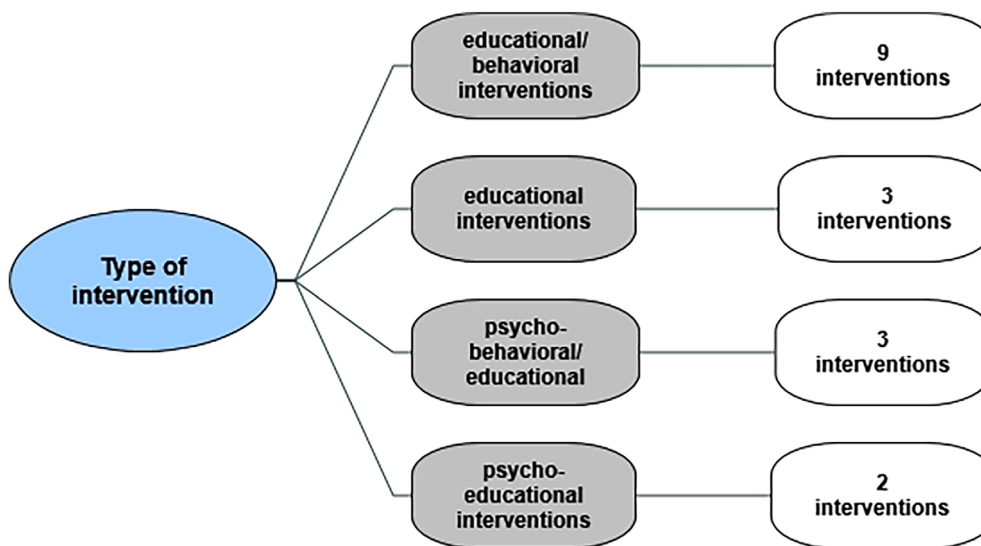


FIGURE 5 Type of intervention.

members were encouraged to participate in self and family support plan activities and to be deeply involved in wound care at home. Among them, wound severity (Diabetic Foot Ulcer Assessment Scale,<sup>33</sup> Wagner grade,<sup>34</sup> Saint Elian Wound Score System,<sup>36</sup> PUSH tool,<sup>44</sup> pressure ulcer stage,<sup>30</sup> and wound size<sup>35,44</sup>) were objectively measured in six studies, and most were for DFU patients. Besides, all six studies reported improvement in wound grade/stage or reduction in wound size in the intervention groups; Moreover, three studies reported on the wound healing rate/time,<sup>31,32,41</sup> and three reported on the wound recurrence rate.<sup>30-32</sup> Two out of the three studies recorded a significant improvement in healing rate/time,<sup>31,41</sup> and two studies recorded a reduction in the recurrence rate of participants after intervention.<sup>30,31</sup>

Regarding family-related outcomes, five studies contributed data to this outcome with different tools.<sup>30-33,35</sup> All five studies indicated that there was an improvement in the level of family support or caregiver behaviour post-

intervention, and the difference with the control group was significant. The family empowerment scale<sup>33</sup> and Diabetes family behaviour checklist<sup>35</sup> were generic family behaviour questionnaires for DFU patients, Home Management Activities Questionnaire,<sup>30</sup> the caregiver behaviour scale,<sup>31</sup> and the caring behaviour questionnaire<sup>32</sup> were specific caregiver behaviour questionnaire for pressure ulcer patients. Family caregivers were empowered to change wound dressing, diet care, position care, skin care, and stress management.

### 3.5 | Intervention description

It is noteworthy that 16 studies included 17 intervention groups; thereinto, one study included two intervention groups.<sup>37</sup> Except for three studies that did not state the number of intervention sessions,<sup>30,31,38</sup> other interventions were delivered over several sessions with a media of

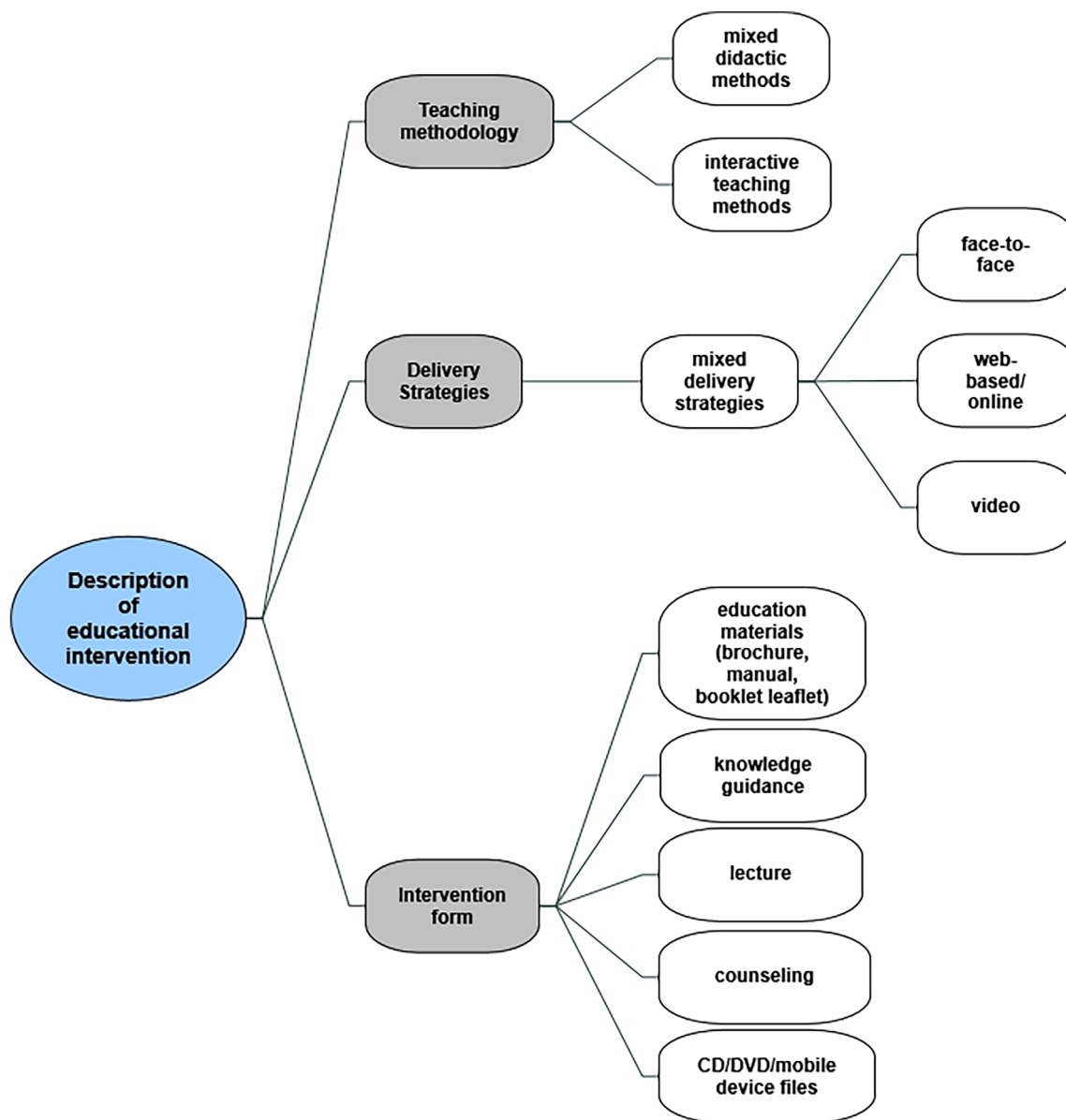


FIGURE 6 Description of educational intervention.

4 (range 1 to 24) over a median duration of 8 weeks (range 30mins to 24 weeks). According to the predefined classification of intervention type, there were nine educational/behavioural interventions,<sup>30-33,36,37,41,44</sup> three each of educational<sup>40,42,43</sup> and psycho-behavioural/educational<sup>29,34,35</sup> and two psycho-educational interventions<sup>38,39</sup> (see Data S4 and S5 for a description of interventions and coded intervention types, respectively).

All intervention types involved educational intervention in increasing wound care knowledge through educational materials (brochure, manual, booklet leaflet), knowledge guidance, lecture, counselling, CD/DVD, and mobile device files. These different educational interventions were implemented by mixed didactic and interactive teaching methods, through mixed delivery strategies (face-

to-face, web-based, video, etc.). The second-ranked type was behavioural intervention including skill training, skill demonstration, and practice exercise through mixed delivery strategies (face-to-face, video). Patients and caregivers were encouraged to learn wound-related care skills, to identify barriers and facilitators, and finally, to promote self-management/family support. The psychological intervention was used as a part of the whole intervention in these studies to improve treatment compliance and negative emotions, mainly through motivational interviews. It is worth mentioning that 14 out of all intervention groups were a combination of at least two intervention types, consistent with the characteristics of the complex interventions.<sup>28,45</sup> However, none of the above interventions were reported according to the TIDIER checklist and guide.

TABLE 3 Chronic wound management outcomes.

Outcomes	Assessment tools	Results	Study IDs
Physical activity	(i) IPAQ (Heinen et al.)	One study reported data on this outcome and showed that patients in the intervention group conducted 32% more often their leg exercises over the follow-up period. The difference at 18 months was 59% of the patients in the intervention group compared with 40% of the control group	(i) Heinen et al. (2012)
Psychological indicators	(i) HAS/ZSAS (Chen et al.) (ii) HDS/ZSDS (Chen et al.)	One study had data on this outcome and indicated that both anxiety and depression status decreased significantly in the intervention group at the 3-month follow-up	(i) Chen et al. (2020)
Quality of life/global assessment	(i) The SF-36 (Damhudi et al.) (ii) FLAQW (Domingues et al.) (iii) RAND-36 (Sonal et al.) (iv) PGA scale (Chen et al.)	Three studies reported on the health-related quality of life of patients with different tools and one study reported on the patient global assessment. Three out of the four studies recorded an improvement in quality of life or global health assessment after intervention and the difference with the control group was significant	(i) Damhudi et al. (2021) (ii) Domingues et al. (2018) (iii) Sonal et al. (2019) (iv) Chen et al. (2020)
Wound care attitude	(i) Attitude toward compression therapy (Žulec et al.)	One study had data on this outcome and indicated that the educational intervention increased patient's awareness of compression therapy at the 3-month follow-up	(i) Žulec et al. (2022)
Wound care knowledge	(i) SKQ (Clarke et al.) (ii) Knowledge of wound management and wound care (Žulec et al.) (iii) PU cognition questionnaire (Cheng et al.)	Three studies reported data on this outcome. All three studies indicated that there was an improvement in wound care knowledge post-intervention. However, one out of the three studies indicated that although there was an improvement in the intervention group, the difference was not significant when compared with the control group	(i) Clarke et al. (2015) (ii) Žulec et al. (2022) (iii) Cheng et al. (2019)
wound care behaviour/self-management	(i) DFSCBS (Damhudi et al.) (ii) Self-care status (Hemmati et al.) (iii) BSAQ (Heng et al.) (iv) DMSMQ (Subrata et al.) (v) DMSES (Satehi et al.) (vi) Adherence with compression therapy (Heinen et al.)	Five studies reported on the wound self-care behaviour of patients and one study reported on the self-management of patient's family. Five out of the six studies recorded an improvement in wound self-care behaviours or practices of participants after intervention and the difference with control group in each study was significant	(i) Damhudi et al. (2021) (ii) Hemmati et al. (2018) (iii) Heng et al. (2020) (iv) Subrata et al. (2020) (v) Satehi et al. (2021) (vi) Heinen et al. (2012)

TABLE 3 (Continued)

Outcomes	Assessment tools	Results	Study IDs
HbA1c	(i) Laboratory values (Appil et al.; Subrata et al.)	Two studies had data on this outcome. Both studies indicated that there was an improvement in the level of HbA1c at the 3-month follow-up, and the difference with the control group was significant	(i) Appil et al. (2020) (ii) Subrata et al. (2020)
Wound severity (grade/ stage/size)	(i) DFUAS (Appil et al.) (ii) Wagner grade (Damhudi et al.) (iii) SEWSS (Hemmati et al.) (iv) PUSH tool (Domingues et al.) (v) PU stage (Cheng et al.) (vi) Wound size (Domingues et al.; Subrata et al.)	Six studies measured the wound severity with different tools. All of the six studies reported improvement in wound grade/stage or reduction in wound size in the intervention groups, but in one study, regarding wound area on the baseline, the mean difference between the two groups was significantly different	(i) Appil et al. (2020) (ii) Damhudi et al. (2021) (iii) Hemmati et al. (2018) (iv) Domingues et al. (2018) (v) Cheng et al. (2019) (vi) Subrata et al. (2020)
Healing rate/ healing time/ recurrence rate	(i) Healing rate/time (Heinen et al.; Liu et al.; Zhou et al.) (ii) Recurrence rate (Cheng et al.; Liu et al.; Zhou et al.)	Three studies reported on the wound healing rate/time and Three studies reported on the recurrence rate. Two out of the three studies recorded a significant improvement in healing rate/time and two studies recorded a reduction in recurrence rate after intervention	(i) Heinen et al. (2012) (ii) Liu et al. (2016) (iii) Zhou et al. (2014) (iv) Cheng et al. (2019)
Family support/ caregiver behaviour	(i) FES (Appil et al.) (ii) DFBC (Subrata et al.) (iii) HMAQ (Cheng et al.) (iv) CBS (Liu et al.) (v) CBQ (Zhou et al.)	Five studies contributed data to this outcome with different tools. All five studies indicated that there was an improvement in the level of family support or caregiver behaviour at post-intervention, and the difference with control group was significant	(i) Appil et al. (2020) (ii) Subrata et al. (2020) (iii) Cheng et al. (2019) (iv) Liu et al. (2016) (v) Zhou et al. (2014)

Abbreviations: BSAQ, brief self-administered questionnaire; CBS, caregiver behaviour scale; CBQ, caring behaviour questionnaire; DFBC, diabetes family behaviour checklist; DFSCBS, diabetes foot self-care behaviour scale; DFUAS, diabetic foot ulcer assessment scale; DMSES, diabetes management self-efficacy scale; DMSMQ, diabetes mellitus self-management questionnaire; FES, family empowerment scale; FLAQW, freiburg life quality assessment for wounds; HAS, hospital anxiety scale; HDS, hospital depression scale; HMAQ, home management activities questionnaire; IPAQ, international physical activity questionnaire; PGA, patient global assessment; PU, pressure ulcer; SEWSS, Saint Elian wound score system; SKQ, structured knowledge questionnaire; ZSAS, zung self-rating anxiety scale; ZSDS, zung self-rating depression scale.

None of the studies included a wide variety of chronic wound types. Wound types of 11 studies from Asia were 8 for DFU<sup>29,33-39</sup> and 3 for PU,<sup>30-32</sup> and the PU studies were all from China. In these mixed interventions, participants were taught to change wound dressing, implement skin and nutrition care, control blood sugar, change position/relieve pressure, identify risk factors, etc. The wound types of 4 studies from Europe were all VLU.<sup>40-43</sup> Participants were provided with knowledge and skill training on wound dressing change, compression therapy, leg position and exercise, skin protection, etc. Behavioural-educational or psycho-educational interventions resulted in improved DFU/PU/VLU care practices and lowered DFU/PU severity and healing time.

## 4 | DISCUSSION

As far as we know, this systematic review was the first to focus on the impacts of home-based chronic wound care training for patients and caregivers. The results helped draw out the interventions (mainly behavioural-educational type) that improved chronic wound management outcomes, including a variety of patient indicators, wound indicators, and family/caregiver indicators.

The effects of interventions for home-based wound care identified in this review were consistent with the findings of other relevant systematic reviews indicating that the involvement of patients or informal caregivers in interventions improved clinical outcomes and quality of



life for DFU and older patients.<sup>46,47</sup> Positive outcomes were also found in patients with acute wounds through patient education or self-care training.<sup>48-50</sup> This explained that participants were more confident, skilled, and prepared to participate in home-based wound care after the interventions.<sup>17,51</sup>

In the part of intervention characteristics, very interestingly, 11 of the whole 16 studies were from Asia. The possible reasons may relate to the traditional oriental family culture and limited community-based health care resources.<sup>19,52</sup> Many patients with chronic wounds suffer from advanced age or little movement or complication; home care provides accessible wound care services. Patients and caregivers were considered a surrogate for the wound care provider at home.<sup>53</sup> Therefore, interventions tailored to individuals' needs made patients and caregivers more prepared to engage in their challenging roles.<sup>54</sup> Besides, patients are the actual owner of the wound; they understand their wounds better than medical staff. Patients and caregivers can be conscious of the change of wound timely with the support of professionals. We should respect their thoughts and provide tailored interventions to inhibit the factors inducing burden and enhance those that improve quality of life.<sup>55</sup>

Besides, results showed that interventions were usually delivered over several sessions. It was challenging to change patients' or caregivers' home care behaviour simply through one-time education sessions. Patients and caregivers actively involved in the management of chronic wounds at home with the long-term support of intervention could learn to change wound dressing, carry out compression therapy and leg exercise, do skin care, relieve pressure and change position, and so on. Improving self-care ability and implementing aetiology-based wound management is very important.<sup>56</sup> What's more, the interventions of the wound care training for patients and caregivers, combined with mixed teaching methodology (both didactic and interactive) and mixed delivery strategies (face-to-face/written documents/phone calls/online), resulted in improved wound-related care behaviours and wound severity/healing and quality of life of participants.

However, it was found that only less than one-third of the total studies included family caregivers in our systematic review. Traditionally, caregivers relied, to a large extent, on their own in learning how to perform nursing tasks with which they believe difficult to deal. About half of the caregivers who performed complex nursing tasks were worried about making mistakes.<sup>17</sup> There is no doubt that wound care at home is a complex care problem for untrained caregivers. Informal caregivers showed low quality of life and significant burden when providing informal home care for pressure ulcer patients, especially those with less experience.<sup>55</sup> Caregiver-oriented interventions as

support for caregivers have been investigated in these studies. A self and family empowerment program including 33 pairs of patients and caregivers improved family knowledge, attitude, and behaviour and improved the wound healing process of patients with DFU.<sup>33</sup> Other self and family management support programs showed similar positive results on family support and wound size through skill training on wound care and motivational interviewing.<sup>30,35</sup> As the population is aging worldwide and the COVID-19 pandemic continues to impact, caregivers will play a more and more key role in the home-based wound care of elderly patients.<sup>57</sup> We need to explore further the effects of interventions with caregiver/family empowerment.

Limitations of this review were that results were based on relatively small studies, and eligible studies were identified from only ten countries of three continents in the world, despite using a systematic search strategy in six popular and influential databases. Besides, further meta-analytic analyses were not possible considering the high heterogeneity of intervention approaches. However, a narrative synthesis without Meta-analysis can also provide the current intervention situation and guide future research trends in the field of home-based training.<sup>46</sup> We found many interventions that included education on chronic wound management, usually combined with other intervention elements such as skill training, family support, and resource facilitation. The use of "pure" education, that is, delivery of information about wound treatment, was found in the studies on venous leg ulcers. A disadvantage in this area, which affects home-based wound care research as a whole, is the inadequate definition of interventions as recommended by the TIDIER checklist. Last but not least, most RCTs had a high risk of bias for non-blinding of participants and personnel assessment, and most non-randomised studies had an overall moderate risk of bias because of confounding and measurement of outcome. Future researchers should adapt a carefully planned approach for RCTs and quasi-experimental studies to clarify the effects and mechanisms of home-based wound care training for patients and caregivers.

In conclusion, the findings of this systematic review, based on relatively small studies, suggest that wound care training for patients and caregivers at home may be effective in changing wound care behaviour, with a consequent improvement in the quality of life of patients and family support. We recommend further exploration of self and family-oriented interventions for older people affected by chronic wounds in the future.

## AUTHOR CONTRIBUTIONS

Yao Huang, Jiale Hu, and Ting Xie contributed equally to the study. Yao Huang and Wenjing Ding were responsible for the development of the search strategy. Yao Huang, Jiale Hu, and Zhaoqi Jiang administered the data

collection and quality assessment of studies. Yao Huang, Jiale Hu, and BeiQian Mao performed data synthesis. Yao Huang and Ting Xie were responsible for the drafting of the manuscript. Lili Hou and Ting Xie made critical modifications to the paper. Lili Hou and BeiQian Mao supervised the study.

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## CONFLICT OF INTEREST STATEMENT

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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