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2021 Guideline for Management of Patients With Lower-Extremity Wounds Due to Diabetes Mellitus and/or Neuropathic Disease

An Executive Summary

Phyllis A. Bonham ◆ Glenda Brunette ◆ Lea Crestodina ◆ Linda R. Droste ◆ Arturo González ◆ Teresa J. Kelechi ◆ Catherine R. Ratliff ◆ Myra F. Varnado

ABSTRACT

This article provides an executive summary of the Wound, Ostomy, and Continence Nurses Society's (WOCN) "2021 Guideline for Management of Patients With Lower-Extremity wounds Due to Diabetes Mellitus and/or Neuropathic Disease." This executive summary presents an overview of the systematic process used to update and develop the guideline and recommendations from the guideline for screening and diagnosis, assessment, and management and education of patients with lower-extremity wounds due to diabetes mellitus and/or neuropathic disease. In addition, the executive summary provides suggestions for implementing recommendations from the guideline. The guideline is a resource for WOC nurse specialists and other nurses and health care professionals who work with adults who have/or are at risk for lower-extremity wounds due to diabetes mellitus/neuropathic disease. The complete guideline includes the evidence and references supporting the recommendations, and it is available in print and electronically from the Wound, Ostomy, and Continence Nurses Society, 1120 Rt 73, Suite 200, Mount Laurel, New Jersey, 08054; Web site: www.wocn.org.

KEY WORDS: Charcot foot, Charcot neuropathy, Clinical practice guideline, Diabetes mellitus, Diabetic foot ulcer, Lower-extremity wound, Peripheral neuropathy.

Phyllis A. Bonham, PhD, MSN, RN, CWOCN, DPNAP, FAAN, *Professor Emerita, College of Nursing, Medical University of South Carolina, Charleston, South Carolina.*

Glenda Brunette, MSN, RN, CWON, *Wound and Ostomy Care Nurse, Medical University of South Carolina, Charleston, South Carolina.*

Lea Crestodina, MSN, APRN, CWOCN-AP, CDE, *Wound Nurse Specialist, Joe DiMaggio Children's Hospital, Hollywood, Florida.*

Linda R. Droste, MSN, RN, CWOCN, CBIS, *WOC Nurse, Spinal Cord Injury and Disorder (SCI & D) Units, Hunter Holmes McGuire VA Medical Center, Richmond, Virginia.*

Arturo González, DNP, APRN, ANP-BC, CWCN-AP, *Clinical Assistant Professor, Graduate Nursing Department, Florida International University, Miami, Florida.*

Teresa J. Kelechi, PhD, RN, CWCN, FAAN, *Professor and Associate Dean for Research and PhD Studies, College of Nursing, The Medical University of South Carolina, Charleston, South Carolina.*

Catherine R. Ratliff, PhD, GNP-BC, CWOCN, CFCN, FAAN, *Associate Professor/Nurse Practitioner, University of Virginia Health System, Charlottesville, Virginia.*

Myra F. Varnado, BS, RN, CWON, CFCN, *Director of Clinical Services, Corstrata, Metairie, Louisiana.*

No conflicts have been identified in the development of the guideline or the executive summary.

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Correspondence: *Phyllis A. Bonham, PhD, MSN, RN, CWOCN, DPNAP, FAAN, Professor Emerita, College of Nursing, Medical University of South Carolina, 3247 Seaborn Dr, Mount Pleasant, SC 29466 (pbonham1@comcast.net).*

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INTRODUCTION

Diabetes mellitus (DM) is prevalent in the United States and across the globe.[1,2] It is often complicated by peripheral neuropathy (PN) and other comorbid conditions such as nephropathy, retinopathy, and polyneuropathies (neuropathic disease, ND). Ischemia due to lower-extremity arterial disease (LEAD) is linked to impaired renal function and cardiovascular disease; it can also lead to foot ulceration and limb loss at great cost to the individual and the health care system.[1-3] Each year, more than 1 million people with DM suffer limb loss, and approximately 80% of DM-related lower-extremity amputations (LEAs) are preceded by a foot ulcer.[3,4] Patients develop wounds due to neuropathy, LEAD, or both neuropathy and LEAD.[3,5] To effectively manage these patients and their complex needs, it is necessary to provide evidence-based, specialized, and multidisciplinary care.[3] However, the availability of high-level, specialized wound care is often inconsistent and remains an area of great need.[3]

The primary purpose of this executive summary is to provide a synopsis of the updated "2021 Guideline for Management of Patients With Lower-Extremity Wounds Due to Diabetes Mellitus and/or Neuropathic Disease" from the Wound, Ostomy, and Continence Nurses Society (WOCN).[3] This article lists recommendations from the guideline for screening and diagnosis, assessment, management, and education of patients with lower-extremity (LE) wounds due to DM/ND. It also describes the systematic review process used in developing the evidence-based guideline and provides suggestions for implementing recommendations from the clinical practice guideline (CPG).

The DM/ND guideline is a resource for WOC nurse specialists and other health care professionals who work with adults who have/or are at risk for LE wounds due to DM/ND. The complete guideline, which includes a summary of the evidence and a complete reference list that supports the recommendations, is available in print and electronically from the WOCN Society's Bookstore (www.wocn.org). Refer to Supplemental Digital Content 1, available at: http://links.lww.com/JWOCN/A67, associated with this article for a complete reference list for the guideline.

GUIDELINE DEVELOPMENT

The WOCN Society established a task force of 8 certified WOC nurse members who represented a wide range of experience and clinical practice backgrounds; 6 served as primary authors (P.B., L.C., A.G., C.R., L.D., M.V.) of the guideline. Each member of the task force submitted a disclosure form, which was reviewed by the WOCN Society's chief operations officer who determined that no conflict of interest existed with any individual task force member in regard to the topic or development of the guideline.

For the 2021 update, the previous 2012 guideline was reviewed, and a revised topical outline was developed.[6] Twenty questions were developed to guide the literature search for evidence regarding screening and diagnosis, assessment, infection, topical treatments, and management of patients with LE wounds due to DM and/or ND (Table 1).[3]

METHODS

Three primary authors of the guideline (P.B., L.C., M.V.) conducted systematic searches of MEDLINE, Scopus, CINAHL, and Cochrane Library databases with the assistance of a medical reference librarian, and identified relevant articles published in English from January 2014 through May 2018. Medical Subject Headings (MeSH) and additional key terms used to search for each specific question related to LE wounds due to DM/ND are listed as Supplemental Digital Content 2, available at: http://links.lww.com/JWOCN/A68.

The search targeted meta-analyses, randomized controlled trials, prospective clinical trials, retrospective studies, qualitative studies, and systematic reviews. The review included studies that reported primary data about specific therapies or diagnostic modalities that were relevant to LE wounds due to DM/ND. If accessible and relevant, national and international guidelines and published expert opinion were included to support recommendations in areas that were clinically important.

Titles of references and abstracts were retrieved from the electronic searches and screened for relevance to LE wounds due to DM/ND, the search questions, and inclusion criteria (Table 2).[3] After the initial screening, full-text articles were obtained for review that met the specific inclusion criteria and were relevant to the topic and search questions. In addition, reference lists of selected publications were reviewed, and during the task force's review and consensus discussions of the document in 2020 and 2021, additional relevant articles were

TABLE 1.
Questions Used to Guide the Literature Review[a]

Topic	Question
Screening and diagnosis	1. What are the risk factors for developing LE wounds due to DM/ND? 2. What is/are the most reliable, noninvasive method(s) of screening for and/or diagnosing ND? 3. What reliable and valid classification system(s) is/are available to assess wounds due to DM/ND? 4. What indicators should be used to determine the types and severity of neuropathy (ie, sensory, motor, autonomic)? 5. How do disease and perfusion status affect the potential to treat and heal wounds due to DM/ND?
Assessment	6. What key parameters should be included in the assessment of LE wounds in a patient with DM/ND, including the impact of the wound on the patient's quality of life? 7. What key parameters/tests should be included in the foot/lower extremity examination of a patient with a wound due to DM/ND, including clinical characteristics of Charcot foot and temperature mapping/monitoring? 8. What is the most effective noninvasive method for assessing/diagnosing lower extremity arterial disease (LEAD) in patients with DM/ND (eg, ankle-brachial index [ABI]; toe pressure [TP]; toe-brachial index [TBI]; photoplethysmography [PPG]; transcutaneous oxygen measurement [TCOM or $TcPO_2$])?
Infection	9. What is the most appropriate method of diagnosing infection in wounds due to DM/ND including osteomyelitis? 10. What are effective treatments (pharmacologic and nonpharmacologic) for infected wounds due to DM/ND (including osteomyelitis)?
Topical treatments for LE wounds due to DM/ND	11. What is the role of debridement in the management of wounds due to DM/ND? 12. What topical dressings are most effective for wounds due to DM/ND?
Management of patients with wounds due to DM/ND	13. What medications are effective for treating pain due to ND? 14. What are the most effective off-loading techniques for the management of wounds due to DM/ND? 15. What adjunctive therapies are effective (including cost-effectiveness) treatments for wounds due to DM/ND (eg, hyperbaric oxygen, spinal cord stimulation, topical negative pressure, and growth factors)? 16. What surgical interventions are most effective (including cost-effectiveness) for restoring function for the patient with wounds due to DM/ND, and when should patients be referred for surgical evaluation (eg, skin grafts, tissue-based products)? 17. What lifestyle factors influence healing of wounds due to DM/ND (eg, nutrition, smoking, exercise)? 18. What are the most effective (including cost-effectiveness) strategies to prevent occurrence/recurrence of wounds due to DM/ND? 19. What strategies are effective for teaching self-care for prevention or treatment of wounds due to DM/ND? 20. What interventions are effective for nonsurgical management of Charcot foot/fracture?

Abbreviations: DM, diabetes mellitus; ND, neuropathic disease.
[a]From Wound, Ostomy, and Continence Nurses Society.[3]

TABLE 2.
Inclusion and Exclusion Criteria for Selection of Studies[a]

Inclusion Criteria	Exclusion Criteria
• Published in English; peer-reviewed literature. • Abstract available for screening. • Primary focus on LE wounds due to DM/ND, or reported specific data relevant to LE wounds due to DM/ND. • Minimum of 10 subjects included in studies/case studies of patients with LE wounds due to DM/ND, and/or in the treatment arm of comparative studies. • Human studies. • Primary research reports relevant to LE wounds due to DM/ND and the search questions. • Cochrane Library systematic reviews, or systematic reviews with meta-analysis. • Relevant clinical practice guidelines.	• Foreign language publication. • Abstract not available for screening. • Full-text article not available. • Secondary reports of research. • Conference abstracts/posters. • Description of study or outcomes lacked sufficient detail to draw conclusions. • Drug, treatment, or device not cleared/approved by the US Federal Drug Administration. • Pilot studies; phase I and II clinical trials. • Less than 10 subjects included in studies/case studies of patients with LE wounds due to DM/ND and/or in the treatment/experimental arm of comparative studies. • Non-Cochrane systematic reviews without a meta-analysis.

Abbreviations: DM, diabetes mellitus; ND, neuropathic disease.
[a]From Wound, Ostomy, and Continence Nurses Society.[3]

included. Prior to final publication of the guideline, the citations and reference list were updated to reflect the recent dates for articles and documents that were advance online publications and/or had been updated or added prior to completion of the review. To update the guideline, 1138 new full-text articles were reviewed, 706 articles were excluded, and data from 432 articles were included as evidence for the updated guideline's recommendations as cited in the text and reference list.

Data Extraction

Five primary authors (P.B., L.C., A.G., C.R., L.D.) extracted the following data from elements included in our review. These data were compiled into narrative evidence summaries relative to each of the 20 search questions: source/citation (ie, author, publication date, title, publication); type/design of study; sample (ie, size, setting/location, description of subjects); intervention(s), outcome measures, and length of follow-up; results, including statistical significance of findings (eg, *P* value, odds ratio, hazard ratio, relative risk/risk ratio, confidence interval, sensitivity/specificity); and limitations. For studies of diagnostic or screening tests, data were included if a valid reference standard was used. For systematic reviews/meta-analyses, data included the number and quality of randomized controlled trials reviewed and the results.

Based on the judgment of the primary authors, studies were assessed as acceptable or unacceptable for inclusion, and they were excluded if methodological issues were found, or data were insufficient to evaluate the results. In addition, the primary authors rated the research (levels I-VI) using criteria identified in Table 3.[3,7,8]

Synthesis of Evidence and Development of Recommendations

The 5 primary authors summarized and synthesized the data and prepared a descriptive, narrative summary of the evidence derived from the systematic search and review of the literature. The guideline was organized into a topical outline format that addressed key content areas for assessment and management of patients with/or at risk for LE wounds due to DM/ND. A synthesis of the evidence derived from the review and evaluation of literature was integrated into the appropriate content sections of the guideline, and a draft was presented to all task force members for review, discussion, clarification, and development of consensus. Conference calls were conducted from January 2021 to April 2021 during which the task force reviewed and evaluated the evidence in the draft guideline until consensus was reached.

Evidence-based recommendations were developed for specific areas where evidence was found to be sufficient to support the statement. Additional recommendations were developed based on published expert opinion or consensus of the task force in areas where evidence was insufficient or absent. The task force then appraised the strength of the evidence for recommendations in the guideline using a level-of-evidence taxonomy based on the following categories: level A, B, C, or task

TABLE 3.
Criteria for Rating Research Evidence[a]

Level of Evidence	Criteria
Level I	An RCT demonstrating a statistically significant difference in at least 1 important outcome defined by $P < .05$. Level I trials can conclude the difference is not statistically significant if the sample size is adequate to exclude a 25% difference among study arms with 80% power.
Level II	An RCT not meeting level I criteria.
Level III	A nonrandomized controlled trial with contemporaneous controls selected by some systematic method. A control might have been selected due to its perceived suitability as a treatment option for an individual patient.
Level IV	A before-and-after study or a case series of at least 10 patients using historical controls or controls drawn from other studies.
Level V	A case series of at least 10 patients with no controls.
Level VI	A case report of fewer than 10 patients.

Abbreviation: RCT, randomized controlled trial.
[a]From Wound, Ostomy, and Continence Nurses Society.[3]

TABLE 4.
Level-of-Evidence Rating for Strength of Guideline Recommendations[a]

Evidence Rating	Criteria
Level A	Two or more supporting RCTs of at least 10 humans with LE wounds due to DM/ND (at level I or II), a meta-analysis of RCTs, or a Cochrane Systematic Review of RCTs.
Level B	One or more supporting RCTs of at least 10 humans with LE wounds due to DM/ND, or 2 or more supporting nonrandomized, controlled trials of at least 10 humans with LE wounds due to DM/ND (at level III).
Level C	Other studies not meeting level B criteria, 2 or more supporting case series of at least 10 humans with LE wounds due to DM/ND, or expert opinion.
Task Force Consensus	Where a level-of-evidence rating is not included, the information or recommendation represents a consensus of the task force members.

Abbreviations: RCTs, randomized controlled trials; DM, diabetes mellitus; ND, neuropathic disease.
[a]From Wound, Ostomy, and Continence Nurses Society.[3]

force consensus (TFC) (Table 4).[3,7-11] To facilitate clinical decision making, recommendations were also reviewed and classified based on an assessment of the benefits/effectiveness versus a lack of benefit/effectiveness and based on potential adverse effects of interventions. Table 5 summarizes criteria used for classification of the recommendations according to potential benefit/effectiveness versus harm.[3,11,12]

In addition, the quality of the evidence for recommendations was rated. During the initial review of evidence, the primary authors rated the quality of evidence extracted from the individual studies. After a review and consensus of the guideline by the full task force, the overall quality of the evidence for the research-based recommendations was rated as high, moderate, or low according to the criteria in Table 6.[3,13-15] Recommendations that were based on TFC or expert opinion were designated as such in the quality-of-evidence ratings.

The completed guideline underwent peer review by an independent group of 11 certified WOC nurses and a surgeon. The reviewers assessed the guideline for relevance, clarity, accuracy, comprehensiveness, organization, consistency with current research/best practices, and usefulness to the target population. Feedback was reviewed by the task force and incorporated into the final document as appropriate.

2021 GUIDELINE FOR MANAGEMENT OF PATIENTS WITH L-E WOUNDS DUE TO DIABETES MELLITUS AND/OR NEUROPATHIC DISEASE RECOMMENDATIONS[3]

A. Comprehensive Assessment

1. Identify/assess individuals at risk for developing LE wounds due to DM/ND. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
2. Prior to treatment, assess causative and contributing factors and significant signs and symptoms to differentiate the types of LE wounds, which have different etiologies and require different management strategies in order to establish an appropriate treatment plan. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
3. Review and document the relevant health and medical history including coexisting comorbid conditions: type, onset, duration of DM; PN; obesity; cardiac disease; and LEAD. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
4. Assess the risks associated with diabetic peripheral neuropathy (DPN): DM; tobacco use; age (≥65 years); elevated hemoglobin A_{1c} (HbA_{1c}); tall stature; elevated triglycerides; toxins; vitamin B_{12} deficiency; hypothyroidism; renal disease; malignancies (eg, multiple myeloma, bronchogenic carcinoma); infections (eg, human immunodeficiency virus/HIV); chronic inflammatory demyelinating neuropathy; inherited neuropathies; vasculitis; Hansen disease (leprosy); elevated body mass index (BMI); and elevated uric acid level. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
5. Assess the risks and contributing factors associated with the development of LE wounds due to DM/ND:
   - Long duration of DM (>5 or 10 years).

   Level of evidence = B; benefit/effectiveness/harm = Class I; quality of evidence = Low
   - Age >45 years; male sex.
   - Poor glycemic control, elevated HbA_{1c}, insulin use, and use of insulin plus hypoglycemic drugs.
   - Loss of protective sensation (LOPS), LEAD, foot deformities, footwear trauma, previous history

TABLE 5.
Classification of Recommendations: Potential Benefit/Effectiveness Versus Harm[a]

Class I	Class II	Class III	Class IV
There is evidence and/or agreement of expert opinion that a procedure or treatment is beneficial and effective with greater benefit than harm. Is indicated and recommended; *should be done.*	There is limited evidence and/or agreement of expert opinion that a procedure or treatment can be beneficial and effective with greater benefit than harm. May be indicated; is *reasonable to perform*; may be considered.	Evidence and/or agreement of expert opinion about a procedure or treatment is less well established or uncertain *and/or* has conflicting evidence or divergence of opinion about the benefit and effectiveness, *and/or* there are risks/side effects that may limit benefit. May be reasonable; *may be considered* in select instances.	There is evidence and/or agreement of expert opinion that a procedure or treatment is not beneficial or effective, *and/or* can be harmful in some cases where risks/side effects outweigh the benefit. Is *not indicated* or recommended; *should not be performed.*

[a]From Wound, Ostomy, and Continence Nurses Society.[3]

TABLE 6.
Quality-of-Evidence Ratings for Recommendations[a]

Type of Evidence	Quality Rating
• Well-designed and well-conducted, RCTs, or meta-analyses of such trials, which addressed the population of interest and directly assessed effects on health outcomes. • Studies directly addressed the question; used adequate randomization, blinding, and allocation concealment; were adequately powered; used intention-to-treat analyses; and had high follow-up rates. • High level of certainty about the estimate of effect.	High
• RCTs with minor limitations, which affected confidence in/or applicability of the results. • Well-designed, well-conducted controlled or observational studies. • Meta-analyses of such studies. • Moderate certainty about the estimate of effect.	Moderate
• RCTs, nonrandomized controlled/quasi-experimental studies, or observational studies (eg, prospective, retrospective cohort, case-control, cross-sectional studies) with major limitations affecting confidence in/or applicability of the results; or meta-analyses of such studies. • Limitations included: inadequate randomization; lack of blinding of participants or outcome assessors; inadequate power; outcomes of interest are not prespecified for the primary outcomes; low follow-up rates; and findings were based on subgroup analyses. Whether the limitations are considered minor or major depends on the number and severity of the flaws in design or conduct of the study. • Uncontrolled clinical observations without an appropriate comparison group (eg, case series or reports). • Low certainty about the estimate of effect.	Low

Abbreviation: RCTs, randomized controlled trials.
[a]From Wound, Ostomy, and Continence Nurses Society.[3]

of diabetic foot ulcer (DFU), and improper foot care and callus management.
- Underlying infection; onychomycosis.
- Limited range of motion of the metatarsophalangeal joint and ankle, altered gait, amputation of the contralateral leg, and transtibial amputation/wearing a below knee prosthesis.
- Hypertension, cardiovascular autonomic dysfunction, prior stroke, nephropathy, retinopathy, elevated BMI, tobacco use, and depression.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
- Increased plantar pressure. Level of evidence = B; benefit/effectiveness/harm = Class I; quality of evidence = Moderate

6. Assess the risks/comorbid factors associated with recurrence/reoccurrence of DFUs: PN with loss of ankle reflexes; LEAD; previous DFUs; long duration of DM; tobacco use; poor glycemic control; HbA_{1c} greater than 10%; poor foot care; inappropriate footwear; physical impairment; comorbidities; and multiple complications. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
7. Assess the risks associated with increased mortality: infection, oncologic disease, heart failure, previous LEA, previous LE wound, and older age. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
8. Assess for biomarkers associated with an increased risk of ND and/or DFUs as appropriate:
   - Biomarker associated with the risk of ND: Elevated adiponectin.
   - Biomarkers associated with the risk of DFUs: elevated cystatin and osteoprotegerin.
   - Biomarkers associated with increased wound severity and risk of amputation: elevated levels of fibrinogen, C-reactive protein (CRP), white blood cells (WBCs) count, and neutrophils; decreased bilirubin levels.

   Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
9. Assess the history of the wound: previous wound and/or wound recurrence; atypical presentation or atypical appearance of any previous wound; onset, course, and duration of past/present wounds; previous treatments and effectiveness; surgical interventions/biopsies; and adherence to prevention and treatment programs (eg, off-loading, footwear, and regular foot care). Level of evidence = TFC, benefit/effectiveness/harm = Class I; quality of evidence = TFC
10. Assess the pain history: presence/absence of pain; description of pain and type of pain; response to analgesia; alleviating or aggravating factors; and the severity of pain using an established pain scale. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
11. Assess the pharmacologic history (eg, use of prescribed and self-prescribed medications and supplements). Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
12. Assess quality of life and psychosocial factors, which are often significantly and negatively related to severity of DFUs and risk of LEAs. Level of evidence = B; benefit/effectiveness/harm = Class I; quality of evidence = Low

B. Comprehensive Examination of the LEs

13. Perform a physical examination of the legs, ankles, feet, and nails (including the footwear) at least annually to identify risk factors for wounds and LEAs.
    - Assess feet and nails for deformities, observe foot hygiene, and assess self-care of feet (eg, cleansing, moisturizing, foot exam, footwear practices indoors and outdoors) and ability to see and reach feet and nails.

- Inspect the dermatological status of the skin of the LEs and feet:
  - Skin appearance: color, quality, texture, and turgor.
  - Callus: location, degree of firmness, and evidence of hemorrhage into the callus, which indicates an ulcer underneath the callus.

Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC

- Examine the legs and feet/toes for the following:
  - Hair growth, skin moisture (ie, anhidrosis, xerosis, maceration), fissures, nail appearance (ie, atrophy/hypertrophy, paronychia). Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
  - Fungal infection: onychomycosis and tinea pedis, which are common dermatophyte infections in patients with DM, particularly in the presence of hyperglycemia, LEAD, and/or DFUs. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
- Determine the presence and characteristics of LE edema:
  - Location, localized, dependent, pitting, or nonpitting.
  - Obtain serial measurements of the ankle and calf if edema is circumferential.
  - Unilateral edema of a foot may be a heralding sign of Charcot deformity.

Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC

- Examine for the presence of inflammation (ie, erythema, edema):
  - Measure skin temperature with a noncontact, infrared dermal thermometer to provide an objective temperature measurement; routine clinical indicators of inflammation may not be reliable in the neuropathic foot.
  - An increase in skin temperature of more than 2°C compared to an unaffected site on the contralateral limb has been considered significant for inflammation.
  - Use skin temperature measurement along with other clinical variables when assessing for inflammation.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low

- Determine the presence of LE cutaneous manifestations associated with DM such as diabetic dermopathy, necrobiosis lipoidica, and bullosis diabeticorum.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

- Examine for the presence of clinical signs/symptoms of Charcot foot:
  - Unilateral swelling (may be profound), erythema, warmth.
  - Increased local skin temperature (≥2°C) compared to an unaffected area/contralateral limb.
  - Pain may or may not be present.
  - In the absence of LEAD, pulses are present and may be bounding.
  - Foot deformity: The classic deformity associated with Charcot foot is a "rocker bottom deformity," which is a collapse of midfoot structures, and unusual bony prominences may be present. Although less common, the forefoot, ankle, and heel can also be involved in Charcot foot/fracture.
  - Differentiate signs/symptoms of acute Charcot foot from other conditions: infection (eg, abscess, cellulitis, osteomyelitis, septic arthritis), gout, ankle sprain, deep vein thrombosis (DVT), and inflammatory conditions such as rheumatoid arthritis or psoriatic arthritis infection. *Note:* Charcot foot is often misdiagnosed as infection and may or may not be associated with an open wound.
  - Chronic Charcot foot may not present with signs of inflammation.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low

- Determine the perfusion status of each LE to determine the presence or absence of LEAD:
  - Examine the skin and limb for changes characteristic of decreased perfusion: skin color (ie, cyanotic, mottled); skin and limb color changes with activity (ie, elevational pallor and dependent rubor); minimal or no hair; skin atrophy (ie, thin, smooth, loss of subcutaneous tissue); skin tenting (wrinkling); skin feels cool to touch compared to the contralateral limb or to an unaffected site on the same limb if there is only 1 limb present.
  - Determine if the patient has a history of intermittent claudication.
  - Determine the presence or absence of LE peripheral pulses by palpating the pedal pulses (ie, dorsalis pedis and posterior tibial pulses), the common femoral pulses, and the popliteal pulses. The presence of palpable pulses does not rule out LEAD, nor does the absence of palpable pulses indicate LEAD; especially if edema is present, which makes palpation difficult and often inaccurate.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

C. Vascular Assessment/Tests

14. Perform appropriate noninvasive vascular tests to rule out LEAD in patients with DM who have DFUs that fail to heal within 4 to 6 weeks despite proper care, or have signs/symptoms of LEAD.
    - For patients with/or at risk for DFUs, assess pedal perfusion by ankle systolic pressures, an ankle-brachial index (ABI), ankle and pedal Doppler arterial waveforms, and either systolic toe pressures (TP)/toe-brachial index (TBI) or transcutaneous oxygen pressure ($TcPO_2$) measurement.
      - Obtain annual ABI exams for patients with a prior history of DFUs or LEAD and other known risk factors.

- ABI values: Normal (ABI ≥ 1.00); LEAD (ABI ≤ 0.90); borderline perfusion (ABI ≤ 0.60-0.80); severe ischemia (ABI ≤ 0.50); critical ischemia-limb threatened (ABI ≤ 0.40); noncompressible arteries (unable to obliterate the pulse signal at cuff pressure of >250 mmHg); elevated (ABI > 1.30).
- Assess the ABI every 3 months for patients with nonhealing wounds; ABI can decrease over time.

- Measure TP/TBI with photoplethysmography if the ABI is elevated (>1.30) or unmeasurable due to noncompressible arteries.
- TP < 30 mmHg is considered to indicate severe/critical limb ischemia (CLI) and is associated with lack of wound healing.
- TBI cutoff values indicating LEAD vary from less than 0.60 to less than 0.70.

- Measure $TcPO_2$ to assess tissue perfusion when an LE wound is not healing, if an ABI cannot be measured due to noncompressible arteries at the ankle, or if TPs cannot be measured due to toe amputations.
  - $TcPO_2$ less than 40 mmHg is considered hypoxic and has been associated with impaired wound healing.
  - $TcPO_2$ less than 30 mmHg indicates severe/CLI.
- Assess pulse volume recordings, which are useful to establish the diagnosis of LEAD. Normal signals are triphasic, and abnormal signals indicative of LEAD are biphasic, monophasic, nonpulsatile, or absent.
- Obtain additional diagnostic evaluations if tests are inconclusive and/or not compatible with the patient's clinical presentation.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

15. Consider vascular imaging for the following patients:
    - Patients with a DFU and LEAD if the DFU is not healing within 4 to 6 weeks of optimal treatment.
    - Refer for urgent vascular imaging and an evaluation of the need for revascularization for patients with a DFU and an ABI less than 0.50; ankle pressure less than 50 mmHg, TP less than 30 mmHg, or a $TcPO_2$ less than 25 mmHg.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
16. When considering revascularization, use tests to obtain anatomical information such as a color duplex ultrasonography, computed tomography angiography (CTA), magnetic resonance angiography, and/or intra-arterial digital subtraction angiography. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

D. Examination of the LEs/Feet for PN and LOPS

17. Examine the feet for distal PN and LOPS to identify feet at risk for ulceration and/or amputation.
    - Observe for signs of PN (eg, decreased sensation, weakness of ankles or feet, gait abnormalities, foot drop/drag, foot deformities, abnormal sweating, loss of position sense/proprioception).
    - Screen patients for distal symmetric polyneuropathy at diagnosis of type 2 DM (T2DM), 5 years after the diagnosis of type 1 DM, and at least annually, thereafter.
    - Screen patients with PN semiannually; quarterly for patients with PN and deformity and/or LEAD; and monthly or quarterly for those with previous LE wounds or amputation.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
18. Determine if the patient has LOPS.
    - Test for LOPS of the feet using a 10-g monofilament, plus at least one other assessment such as testing for the ability to sense/perceive vibration, or testing the ankle reflexes. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
    - Test for the ability to sense/perceive vibration (large fiber function) using a 128-Hz tuning fork or other available devices such as electromechanical instruments. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
19. Assess for motor neuropathy: musculoskeletal/biomechanical status.
    - Gait pattern.
    - Muscle group strength (ie, active/passive resistance, weight-bearing status, flexibility, and ankle joint equinus).
    - Assess the feet for abnormalities/deformities.
      - Examine for deformities (eg, hammer or claw toes, prominent metatarsal heads, Charcot deformity), muscle atrophy, and pressure points (eg, bunions, callus formation).
      - If Charcot foot is suspected (ie, foot is warm, swollen, erythematous, and/or has a rocker-bottom appearance, which is often misdiagnosed as cellulitis or other conditions such as gout, DVT, etc), rule out infection and perform radiography or magnetic resonance imaging (MRI) if radiography is inconclusive.
    - Test for absence of deep tendon reflexes of the ankles with a reflex/percussion hammer.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Low
20. Assess for signs/symptoms of autonomic neuropathy: altered vasomotor activity with reduced or absent sweating (ie, anhidrosis) or increased sweating of the feet; vasodilation, arteriovenous shunting and/or edema; dizziness and/or orthostatic hypotension/fainting; heart palpitations; gastrointestinal disturbances; urinary incontinence or difficultly urinating; sexual dysfunction; and sensation of pain in the head, neck, and trapezius region related to orthostatic hypotension. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
21. Conduct or refer patients for electrophysiological tests and/or imaging tests for screening and

diagnosis of PN if clinical features are atypical, or if the diagnosis is unclear:

- Nerve conduction studies. Level of evidence = C; benefit/effectiveness/Harm = Class II; quality of evidence = Low
- Point-of-care, portable and handheld devices are available that can serve as adjunctive tools for diagnosing DPN in the clinical setting. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
- Ultrasonography. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
- Magnetic resonance neurography. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
- MRI. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
- Laser-evoked-potential to diagnose small fiber neuropathy. Level of evidence = C; benefit/effectiveness/harm = Class III; quality of evidence = Low

22. Examine the patient's shoes/footwear: condition and wear patterns; use of socks, insoles, or orthoses; and the fit, design, and shape of the shoes/footwear in relation to the patient's feet. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

E. Identification and Stratification of Foot Risk

23. Identify and stratify foot risk for ulceration and to guide prevention and management strategies:
    - Category 0: Very low risk; no LOPS and no LEAD; screen annually.
    - Category 1: Low risk; LOPS or LEAD; screen every 6 to 12 months.
    - Category 2: Moderate risk; LOPS plus LEAD, or LOPS plus foot deformity, or LEAD plus foot deformity; screen every 3 to 6 months.
    - Category 3: High risk; LOPS or LEAD and 1 or more of the following: history of a foot ulcer, minor or major LEA, or end-stage renal disease; screen every 1 to 3 months.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

F. Comprehensive Wound Assessment

24. Determine and document the clinical characteristics of the wound (s) and periwound skin at each dressing change: location; onset/duration; shape; type of tissue in the wound base; wound edges; exudate; periwound (ie, callus, maceration, presence/absence of erythema, inflammation); and complications (ie, infection, cellulitis, gangrene, osteomyelitis, Charcot foot). Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
25. Identify factors that are associated with impaired wound healing or poor outcomes.
    - Factors associated with impaired healing:
        - Duration of wound greater than 2 months; large wound size and depth; wound location on the heel; recurrent and multiple DFUs; history of foot problems; wound severity; infection (ie, bioburden, osteomyelitis, fungal infection); and long use of antibiotics.
        - Long duration of DM; poor glycemic control; older age; LEAD; nonpalpable popliteal pulse; PN; Charcot neuropathy; ischemia plus neuropathy; nonambulatory status; hospitalization and long stays; tobacco use; DVT; altered lipids; elevated BMI; edema; anemia; low serum albumin; high levels of matrix metalloproteinases; abnormal liver enzymes; heart failure; and delayed referral to a specialist.

      Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
        - Renal disease/renal failure; elevated cystatin C. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
    - Factors associated with increased mortality: cardiac disease, elevated WBCs count, LEAD, and kidney failure. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
    - Factors associated with increased risk of LEA:
        - Multiple complications and comorbidities, previous LE wound/DFU; long duration of DFU; ulcer location on the heel and large size of ulcers; wound severity (Wagner grades 3-5); prior antibiotic therapy; infection severity (ie, gram-negative rods, polymicrobial infection, osteomyelitis, necrotizing infection); previous LEA; delayed referral to a specialist.
        - Nonpalpable popliteal artery; LEAD; CLI; PN; CLI plus neuropathy; Charcot foot.
        - T2DM; insulin use; duration of DM more than 10 years; elevated HbA_{1c} and fasting blood sugar; malnutrition; age more than 45 to 50 years; rural residence; elevated erythrocyte sedimentation rate (ESR) greater than 70 mm/h; elevated WBC count; elevated CRP; male sex; tobacco use; low hemoglobin; dyslipidemia; coronary heart disease; retinopathy; gastrointestinal disorders; walking disability.
        - Factors associated with major LEA versus minor LEA: long duration of DM and DFU; Wagner grade of 4 and greater; hindfoot ulcers versus forefoot ulcers; CLI; older age; longer length of hospital stay; elevated CRP (> 10.94 mg/L); elevated WBC count at admission; cardiac disease.

      Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
26. Identify factors that are associated with faster healing of LE wounds/DFUs and/or improved outcomes:
    - Factors associated with faster healing: medication treatment of T2DM versus diet control; insulin treatment of T2DM versus medication treatment; stable HbA_{1c} within normal limits;

total contact cast (TTC) treatment; creatinine levels less than 91 μmol/L; triphasic wave forms; TP greater than 30 mmHg. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

- Medications associated with improved outcomes:
  - Metformin: Associated with less calcifications below the knee in patients with T2DM. *Note*: Metformin is contraindicated in patients with severe chronic kidney disease (estimated glomerular filtration rate < 30 mL/min). Level of evidence = C; benefit/effectiveness/harm = Class III; quality of evidence = Low
  - Antiplatelet (cilostazol): Shown to increase 1-year amputation-free survival rate, improve $TcPO_2$, and decrease intermittent claudication. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
  - Statin therapy: Associated with a reduction in the rate of LEAs and cardiovascular mortality. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Moderate

G. Wound Classification

27. Classify the wound according to its clinical characteristics using an established/validated classification system in accordance with the clinical situation and specific purpose of the classification system. Externally validated classification systems for various clinical outcomes and/or the risk of LEA include the following:
    - Wagner classification.
    - Site, Ischemia, Neuropathy, Bacterial Infection, and Depth (SINBAD) classification.
    - University of Texas Diabetic Wound classification.
    - Perfusion, Extent, Depth, Infection, Sensation (PEDIS) classification.
    - Society for Vascular Surgery (SVS): Wound, Ischemia, and foot Infection (WIfI) classification.
    - Infectious Diseases Society of America/International Working Group on the Diabetic Foot (IDSA/IWGDF) classification for assessment of infection.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

H. Wound Management

28. Provide evidence-based, specialized, multidisciplinary care. Level of evidence = C; benefit/effectiveness/Harm = Class I; quality of evidence = Low

Wound Treatment

29. Cleanse the wound and periwound at each dressing change using a neutral nonirritating, nontoxic solution to minimize trauma to the wound; sterile saline or potable tap water may be used. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
30. Debride avascular tissue in the wound after adequate perfusion has been established.
    - Maintain dry, stable eschar on noninfected, ischemic wounds.
    - Debride callus around the wound every 1 to 4 weeks, as needed.
    - Select the method for debridement as determined by the condition of the wound, presence or absence of infection or biofilms, amount of necrotic tissue, vascularity of the wound, use of anticoagulants, pain tolerance, health-care setting, cost-effectiveness, availability and access to debridement methods, capability of the health care provider, and professional licensing restrictions.
    - Options for debridement include surgical, conservative sharp, mechanical high-pressure fluid irrigation, ultrasonic mist, autolysis, enzymatic (chemical, surfactant), and larval therapy (biosurgery, biodebridement).
    - If the patient has intact sensation, provide appropriate pain management for debridement as indicated.

    Level of evidence = C; benefit/effectiveness/harm = Class I;quality of evidence = Expert opinion
31. Select appropriate dressings according to accepted wound care principles and the characteristics of the wound and periwound skin that protect the wound, maintain a moist wound bed, control exudate, avoid maceration of the surrounding skin, and promote comfort and odor control. Also, consider cost, availability, and ease of application of the dressings.
    - Assess the wound at every dressing change to determine whether modifications in the dressings/topical therapy are needed; the type of dressing needed may change over time as the wound heals or deteriorates.

    Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC
    - Consider dressing options that might promote healing:
      - Collagen dressings (bovine derived). Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low
      - Hyaluronic acid dressings. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low

I. Off-Loading and Wound Protection

32. Off-load and protect the diabetic and/or neuropathic foot with an ulcer with an appropriate modality according to the location of the wound and the presence of any contraindicating factors.
    - Preferred options for a plantar ulcer include a nonremovable, knee-high off-loading TCC or an instant TTC (ITCC). The ITCC is a removable cast walker that is rendered nonremovable by wrapping it with cast material or a bandage.
    - If a nonremovable, knee-high off-loading device (eg, TCC) is contraindicated or not tolerated by the patient, consider using a removable knee-high or ankle-high off-loading device.

- Options for nonplantar ulcers include footwear that relieves pressure off the ulcer (ie, surgical sandal, heel-relief shoe, removable ankle-high off-loading device, footwear modifications, toe spacers, orthoses) depending on the type and location of the foot ulcer.

Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate

- Educate the patient on the benefits of adherence to wearing any of the removable devices.

Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

- Avoid nonremovable, off-loading devices, or use them with caution along with close monitoring of the patient in the following circumstances: severe LEAD (ABI < 0.50, $TcPO_2 < 20$ mmHg, or a history of revascularization); active wound infection or sinus tract with deep extension into the foot, which requires daily access for topical wound care; elderly or those at risk for falls; individuals with unstable gait; cast claustrophobia; history of nonadherence to treatment plans; fluctuating leg edema or active skin disease; and inadequately trained/experienced staff for application of the device. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

J. Identification and Diagnosis of Infection

33. Identify/diagnose infection.
    - Differentiate between contamination, colonization, and infection.
    - Diagnose soft tissue diabetic foot infection (DFI) based on the presence of local or systemic signs and symptoms of infection.
    - Classify the severity of the DFI using the grading criteria established by the IWGDF to guide treatment.
    - Suspect the presence of biofilm if the wound fails to heal despite appropriate diagnostic and therapeutic interventions and determine the presence of clinical signs and symptoms that may serve as surrogate markers of biofilm formation.
        - Biofilms are not visible to the naked eye. Tissue specimens are the optimal technique for identifying biofilms using microscopy (ie, scanning electron, confocal, transmission, or light microscopy). In the absence/unavailability of definitive diagnostic options, clinicians may have to rely on an assessment of clinical signs and symptoms to identify biofilm infections.
        - Identify if the following clinical signs/symptoms of a chronic biofilm infection are present: slough or necrotic tissue; prolonged signs of inflammation or local infection including secondary or covert signs of infection such as friable granulation tissue or wound undermining; negative culture results despite optimal sampling technique and a high suspicion of infection by the clinician; medical history of a biofilm-predisposing condition (eg, implanted medical device); and the wound is not responding to topical or systemic antimicrobial therapy.
    - Refer patients with a severe DFI (eg, fever and systemic symptoms of infection; purulent secretions) for an evaluation by an experienced health care specialist (eg, surgical consult, infectious disease specialist) within 24 hours.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

    - Collect an appropriate tissue specimen for culture (curettage or biopsy) for clinically infected wounds or if biofilm is suspected to determine the causative pathogens and their sensitivity to antibiotics to guide antibiotic therapy.
        - If tissue samples are not available, quantitative swab cultures obtained by the Levine technique are a reasonable alternative in clinical practice for diagnosing a wound infection and guiding antibiotic therapy.
        - Perform cultures to identify both anaerobic and aerobic bacteria.
        - Avoid performing cultures indiscriminately in the absence of clinical indications.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

    - Assess for the presence of elevated serum levels of inflammatory biomarkers (ie, CRP, ESR, WBC count, tumor necrosis factor α, neutrophils, neutrophil-to-leukocyte ratio, fibrinogen) if the clinical examination is equivocal or uninterpretable as an adjunctive measure along with the clinical signs/symptoms of DFI to establish a diagnosis. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
34. Obtain serial plain radiographs for patients with a new DFI to examine the foot for bone abnormalities (eg, deformity, destruction), soft tissue gas, and foreign bodies.
    - Obtain an MRI for patients who require more specific imaging if a soft tissue abscess is suspected, or if the diagnosis of osteomyelitis is uncertain.
    - If an MRI is contraindicated or unavailable, a leukocyte scan combined with a bone scan is an appropriate alternative.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
35. Identify/diagnose diabetic foot osteomyelitis.
    - Assess for the presence of elevated serum levels of inflammatory biomarkers (ie, WBC count, CRP, ESR, neutrophil-to-lymphocyte ratio, and serum type 1N propeptide) along with an assessment of clinical factors. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
    - Use a combination of the probe-to-bone test, plain radiography, and laboratory findings as initial studies to diagnose osteomyelitis. However, note that radiography has low sensitivity and specificity to confirm or exclude osteomyelitis, but it can be beneficial in ruling out fractures or foreign bodies. Level of evidence = C; benefit/

effectiveness/harm = Class II; quality of evidence = Low
- Perform an advanced imaging study if the diagnosis is in doubt:
  - MRI. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Moderate
  - 18F-FDG-positron emission tomography/computed tomography or leukocyte scintigraphy with/or without computed tomographic scintigraphy. Level of evidence = C; benefit/effectiveness/harm = Class III; quality of evidence = Low
- Collect a sample of bone, percutaneously or surgically if possible, to culture for microorganisms and for histopathology for a person with DM and suspected osteomyelitis of the foot for whom making a definitive diagnosis or determining the causative pathogen is necessary for selecting treatment. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

36. Refer patients for further evaluation and treatment if infection is suspected, if there is a positive probe-to-bone test, and/or if radiographic changes demonstrate the presence of Charcot neuropathy. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC

K. Treatment of Infection/Osteomyelitis

37. Treat wound infection with appropriate antibiotic/antimicrobial therapy.
    - Avoid prophylactic or routine use of systemic or topical antimicrobials and antiseptics.
    - Consider hospitalization for patients with DM and a severe DFI and also for those with a moderate infection who have other complex or significant morbidities.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

Topical antimicrobial/antibiotic therapy

38. Consider a short course of a topical antimicrobial agent to decrease bacterial levels for ulcers with levels of bacteria greater than 10^5 colony-forming units per gram (CFU/g) of tissue following adequate debridement and discontinue the antimicrobial agent after the bacterial load is decreased to minimize cytotoxic effects and the emergence of resistant organisms. Level of evidence = A; benefit/effectiveness/harm = Class III; quality of evidence = Low
    - In high-risk patients with DM undergoing reconstructive surgery of the foot/ankle, consider a topical application of vancomycin into the surgical site prior to closure to reduce the risk of a deep surgical site infection. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
    - For patients with clinical signs/symptoms of a localized wound infection, consider a short course of treatment with silver-based dressings. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low

Systemic antibiotic therapy

39. Select an antibiotic for treating a DFI based on the likely or proven causative pathogen(s) and their antibiotic susceptibilities; the clinical severity of the infection; published evidence of efficacy of the agent for DFIs; risk of adverse events, including collateral damage to the commensal flora; likelihood of drug interactions; drug availability; and financial costs.
    - Consider the following antibiotics: penicillin, cephalosporin, carbapenem, metronidazole (in combination with other antibiotics), clindamycin, linezolid, daptomycin, fluoroquinolones, or vancomycin.

    Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low
    - Prior to empirical therapy, obtain a wound specimen for culture and sensitivity to guide antibiotic therapy; start treatment targeted at the most common infecting organisms for DFUs, and modify treatment according to the culture results if there is no response to the antibiotics being used.
      - Check resistance and antibiotic sensitivity of organisms in DFUs because susceptibilities can vary in different areas of the same country and among different countries, and multidrug resistant organisms are common in DFUs.
      - Select antibiotics that cover both gram-negative and gram-positive aerobes due to the increase in gram-negative organisms in DFIs.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
40. Treat patients with a mild or moderate DFI with oral antibiotic therapy at presentation, or when they are clearly improving after initial intravenous therapy. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
41. Use systemic antibiotics for acute DFIs not confined to the wound, such as with deep tissue infections or cellulitis.
    - Administer antibiotic therapy initially by the parenteral route to any patient with a severe DFI. Switch to oral therapy if the patient is clinically improving, has no contraindications to oral therapy, and if there is an appropriate oral agent available. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
    - Intravenous options include ceftaroline fosamil. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
42. Administer antibiotic therapy to patients with a mild/moderate skin or soft tissue DFIs for a duration of 1 to 2 weeks.
    - Consider continuing treatment up to 3 to 4 weeks if the infection is improving but extensive, is resolving slower than expected, or if the patient has severe LEAD.
    - If evidence of infection has not resolved after 4 weeks of appropriate therapy, reevaluate the patient and reconsider the need for further diagnostic studies or alternative treatments.

Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

43. Consider continuing antibiotics for 1 to 2 weeks after symptoms have resolved in patients with a DFI and LEAD, which might reduce recurrence of infection. Level of evidence = B; benefit/effectiveness/harm = Class III; quality of evidence = High
44. Consider daily probiotic and/or magnesium oral supplements along with antibiotic therapy to support wound healing and improve glycemic control in patients treated for DFIs:
    - Probiotics: *Lactobacillus acidophilus, Lactobacillus casei, Lactobacillus fermentum,* and *Bifidobacterium bifidum*. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = High
    - Magnesium oxide (250 mg). Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
45. Consult with a surgical specialist in addition to providing antibiotic therapy in cases of severe infection or moderate infection complicated by extensive gangrene, necrotizing infection, signs suggesting deep (below the fascia) abscess or compartment syndrome, or severe lower limb ischemia. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

Biofilm management

46. Provide biofilm-based wound care.
    - Initiate treatment with a combination of aggressive debridement of biofilms and topical antibiofilm treatments that have been shown in laboratory or clinical studies to be effective at killing biofilm bacteria.
        - Surgical or conservative sharp debridement is preferred for biofilm removal.
        - Other types of debridement may offer some level of disruption or removal of biofilms: autolytic, mechanical (eg, therapeutic irrigation, monofilament fiber pads, low-frequency ultrasonography, hydrosurgery), enzymatic/chemical/surfactant, and biosurgical/larval therapy.
        - Commercially available products with some reported antibiofilm activity include polyhexamethylene biguanide; BlastX (NextScience; 3 M, St Paul, Minnesota); Plurogel (MEDLINE, Mundelein, Illinois); silver; hypochlorous acid; Dispersin B wound spray (Kane Biotech, Winnipeg, Manitoba, Canada); Microlyte AG GA (Imbed Biosciences; Madison, Wisconsin); cadexomer iodine; and lasers/photodynamic therapy.
    - As the bioburden of biofilm bacteria is reduced and the wound moves out of a chronic inflammatory phase into an active healing phase, topical treatment can then "step down" to less frequent and aggressive debridement combined with antimicrobial dressings that can effectively kill planktonic bacteria and prevent reformation of biofilm communities in the wound.
    - When the DFU wound bed has been adequately prepared, "step up" to advanced wound treatments (eg, human placental-derived dressings, growth factors, skin grafts/flaps) to stimulate healing.
    - Throughout the process, monitor and assess the healing status of the wound, manage the host factors (eg, off-loading, DM, nutrition), and individualize therapy according to the healing status.
    - If needed, consider controlled use of systemic antimicrobials to help manage planktonic bacteria, an acute infection, and to prevent associated systemic infection.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

Osteomyelitis treatment

47. Consider treating patients with DM and uncomplicated forefoot osteomyelitis for whom there is no other indication for surgical treatment, with antibiotic therapy without surgical resection of the bone. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
    - Treat patients with antibiotics that have demonstrated efficacy for osteomyelitis in clinical studies and treat for no longer than 6 weeks. If the infection does not clinically improve within the first 2 to 4 weeks, reconsider the need for collecting a bone specimen for culture, undertaking surgical resection, or selecting an alternative antibiotic regimen.
    - For cases that initially require parenteral antibiotic therapy, consider switching to an oral regimen after 5 to 7 days if the likely or proven pathogens are susceptible to an available/appropriate oral agent.

    Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low
48. Treat patients with osteomyelitis that is unresponsive to antibiotic therapy or complicated by ischemia and/or necrotizing soft tissue with surgical intervention and removal of the infected bone, followed by antibiotic therapy. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
49. Treat fungal infection of the feet.
    - Treat dermatophyte infection with oral terbinafine. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
    - Educate patients to wash their feet and toes daily with soap; wash well between each toe 4 to 5 times, and dry the feet and toes completely. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

L. Neuropathic Pain Management

50. Manage neuropathic pain.
    - Monitor patients for pain and depression, social dysfunction and isolation, and limited mobility due to pain.
    - Utilize a multidisciplinary team to manage neuropathic pain.

Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC

- Determine the effectiveness of medications/supplements for pain management:
  - Consider initial treatment with medications such as the antidepressant duloxetine, anticonvulsants (ie, pregabalin, gabapentin), or topical anesthetics (eg, lidocaine creams, patches). *Note*: The US FDA warns that serious breathing difficulties may occur when gabapentin or pregabalin is taken with other medicines that depress the central nervous system (such as opioids) in patients who have underlying respiratory problems and/or in the elderly. Therefore, caution is advised when using those medications. Level of evidence = C; benefit/effectiveness/harm = Class III; quality of evidence = Expert opinion
  - For acute severe pain, consider short-term treatment with a combination of oral nortriptyline-morphine. Level of evidence = B; benefit/effectiveness/harm = Class III; quality of evidence = High
  - Avoid the use of opioid drugs to manage chronic neuropathic pain. Level of evidence = C; benefit/effectiveness/harm = Class IV; quality of evidence = Expert opinion
  - Consider use of acetyl-L-carnitine as a supplement to help alleviate neuropathic pain. Level of evidence = B; benefit/effectiveness/harm = Class III; quality of evidence = Moderate
- Refer patients with intractable/severe neuropathic pain for an evaluation by pain specialists and a surgical consult to determine if they would benefit from nerve decompression surgery. Level of evidence = C; benefit/effectiveness/harm = Class III; quality of evidence = Low
- Consider spinal cord stimulation for patients with chronic neuropathic pain that persists despite conventional medical therapy. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate

M. Lifestyle Measures to Influence Wound Healing

51. Optimize nutritional status.
    - Monitor patient's nutritional status (ie, glycemic control [HbA_{1c}, glucose level], weight, vitamin B_{12}, vitamin D, zinc, prealbumin, serum albumin, high-density lipoprotein, triglycerides) for deficits.
    - Refer individuals who have nutritional deficits to a registered dietitian for assessment and appropriate intervention.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
52. Consider educating patients with DFUs and ischemia to perform Buerger's exercises to improve peripheral circulation and promote healing. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

N. Nonsurgical Management of Charcot Foot

53. Treat acute Charcot foot (stages 0-1) by off-loading, preferably with a nonremovable TCC or an ITCC, and with non–weight-bearing status until bone consolidation has occurred.
    - Monitor progression of healing with serial radiography every 4 to 6 weeks and routine temperature surveillance with an infrared dermal thermometer with every office visit.
    - After consolidation is achieved, a removable off-loading device may be considered such as accommodative footwear with a modified ankle foot orthosis or a Charcot restraint orthotic walker.
    - Educate post–acute patients and their caregivers regarding the serious nature of Charcot neuropathy and the need for daily inspection of the feet, dermal temperature monitoring, professional foot care, proper footwear, and prompt reporting of any problems to their health care provider.
    - Refer patients with the following complications for surgical evaluation to determine the need for surgical reconstruction: chronic recurrent ulcerations, unbraceable deformity, acute fracture, dislocation, infection, and poor quality of life.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
54. Provide lifelong professional foot care and surveillance for individuals with DM and Charcot neuropathy. Level of evidence = TFC; benefit/effectiveness/harm = Class I; quality of evidence = TFC

O. Adjunctive Therapies

55. Consider adjunctive therapy for wounds that do not demonstrate improvement (ie, >50% wound area reduction) after 4 weeks of standard therapy. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
56. Reevaluate vascular status, infection control, need for debridement, and off-loading to ensure patient/wound optimization prior to initiation of adjunctive wound therapy. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
57. Select adjunctive treatment based on clinical findings, availability, and clinical and cost-effectiveness:
    - Platelet-derived growth factor. Level of evidence = A; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
    - Skin and tissue substitutes/replacements:
      - Human amniotic and/or chorionic membrane dressings. Level of evidence = A; benefit/effectiveness/harm = Class I; quality of evidence = High
      - Dehydrated amniotic membrane allograft. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
      - Human acellular dermal matrix. Level of evidence = A; benefit/effectiveness/harm = Class II; quality of evidence = High
      - Acellular dermal regeneration template (bovine collagen and glycosaminoglycan). Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = High

  - Cell-based bioengineered, human epidermal/dermal or human fibroblast-derived dermal skin substitutes. Level of evidence = B; benefit/effectiveness/harm = Class II; quality of evidence = Low
  - Porcine-derived extracellular matrix. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
- Hyperbaric oxygen therapy. Level of evidence = B; benefit/effectiveness/harm = Class III; quality of evidence = Low
- Negative pressure wound therapy. Level of evidence = A; benefit/effectiveness/harm = Class II; quality of evidence = Low
- Electrical stimulation. Level of evidence = B; benefit/effectiveness/harm = Class III; quality of evidence = Low

P. Surgical Interventions

58. Refer patients with nonhealing wounds and ischemia or Charcot deformities for surgical evaluation and intervention when other treatment measures have failed in order to achieve 1 or more of the following goals:
    - Prevent or correct foot/ankle deformities; promote optimal functionality of the LE; improve quality of life.
    - Prevent ulceration/reulceration, or promote wound healing.
    - Restore tissue perfusion; eliminate osteomyelitis; achieve limb salvage.
    - Provide tissue coverage of chronic, nonhealing wounds.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
59. Consider revascularization (angioplasty or bypass) for the following patients:
    - Patients with a DFU and LEAD if the DFU is not healing within 4 to 6 weeks of optimal care.
    - Consider an urgent revascularization for a patient with TP less than 30 mmHg, ankle pressure less than 50 mmHg, ABI less than 0.50, or $TcPO_2$ less than 25 mmHg.
    - Carefully assess the risks versus short-term and long-term benefits of surgery when considering revascularization.
    - Use of the Society for Vascular Surgery (SVS) WIfI classification for LE threatened limbs can assist surgeons in determining which patients are most likely to require and benefit from revascularization.
    - Prophylactic revascularization to prevent wounds is not recommended.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
60. Consider use of skin grafts for superficial wounds or flaps for full-thickness wounds on weight-bearing surfaces with exposed tendons, bones, vessels, or joints to provide coverage and promote healing of chronic, nonhealing wounds with tissue defects. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
61. Debride the wound to remove necrotic or devitalized tissue and control infection (ie, $\leq 10^5$ CFU/g of tissue with no beta hemolytic streptococci) prior to attempted surgical closure by a skin graft or flap. Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
62. Identify surgical patients with perioperative hyperglycemia (>200 mg/dL) or elevated HbA_{1C} (>7.5 mg/dL) who are at an increased risk for a surgical site infection and implement appropriate therapy. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

Q. Strategies Including Patient Education to Prevent Wounds and/or Adverse Outcomes

63. Implement measures to prevent LE wounds and amputations in patients with at-risk feet.
    - Perform routine neuropathic foot screening based on level of risk and screen at least annually.
    - Inspect patient's feet for problems at every health care visit.
    - Prescribe appropriate prevention measures and treatments stratified by risk category.
    - Ensure selection and use of appropriate footwear and management of foot problems.
    - Provide patient/caregiver education regarding risks and self-care management.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
64. Educate patients and caregivers about risk reduction strategies.
    - Include the following in patient/caregiver education:
      - Risk factors and management of risks.
      - Implications of foot deformities, LOPS, and LEAD.
      - Importance of routine, daily self-inspection of the feet.
      - Proper foot, skin, and nail care.
      - Need to obtain professional callus care.
      - Importance of early recognition and prompt reporting of all injuries to the health care provider.
      - Need for routine foot surveillance by health care providers.
      - Selection of appropriate footwear and use of appropriate footwear at all times including at home.
      - The necessity of surveillance for foot problems and continued off-loading throughout the life span of an individual with/or at risk for developing a new or recurrent foot wound.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
    - Instruct patients and caregivers in self-care practices for foot and skin care:
      - Check feet daily and note any areas of concern (eg, marks, redness, blisters, cuts, swelling, corns, calluses).
      - Report injuries or areas of redness to a health care provider and schedule an appointment to have those areas checked.

- Use a mirror or have a family member or friend check the feet daily if unable to see the bottoms of the feet.
- Wash feet and between the toes daily in warm, soapy water; dry the feet and between the toes thoroughly.
- Use skin lotion over the tops and bottoms of the feet—but not between the toes to reduce the risk of a fungal infection.
- Trim toenails straight across, gently file rough edges with a nail file, and seek care from a qualified health care provider if unable to see or reach the feet.
- Never walk barefoot.
- Wear socks and well-fitting shoes at all times.
- Test water temperature before immersing feet.
- Do not use hot water bottles or heating pads because they can burn the feet.
- Do not self-remove corns and calluses or use over-the-counter products; seek care from a qualified health care provider for care of corns and calluses.
- Promote blood flow by wiggling the toes and rotating the ankles up and down 2 to 3 times a day.
- Stop tobacco use.
- Have feet checked by health care providers at every visit.

• Instruct patients who are at moderate or high risk of foot ulceration to self-monitor skin temperature of their feet once daily to identify early signs of inflammation. If the temperature difference is greater than 2°C between similar regions on the 2 feet on 2 consecutive days, instruct the patients to reduce their ambulation, off-load the affected foot, and notify their health care provider for further diagnosis and treatment.

• Instruct patients to assess for LOPS using a 10-g monofilament and test at least 4 sites (ie, first, third, and fifth metatarsal heads and plantar surface of the distal hallux) on each foot.

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

• If monofilaments are not available, instruct caregivers/relatives to assess the patients' feet for LOPS using the Ipswich Touch Test to determine if the patient can feel 1 to 2 seconds of light touch from a caregiver's index finger on the tips of the first, third, and fifth toes of each foot. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low

65. Develop educational strategies to increase knowledge, self-efficacy, and self-care practices for prevention and/or management of wounds.
    • Utilize varied educational approaches to teach patients self-management including intensive and focused education (eg, lectures, slides, videos), individualized counseling, interactive education with demonstration and return demonstrations, and print materials.

    Level of evidence = A; benefit/effectiveness/harm = Class II; quality of evidence = Low

    • Provide reinforcement and follow-up education:
        - Integrate follow-up education and reinforcement of learning during all health care visits including primary care and clinic visits (eg, check patients' feet and footwear each visit; repeat audio-visual programs). Level of evidence = B; benefit/effectiveness/harm = Class I; quality of evidence = Moderate
        - Consider sending follow-up phone text messages to patients with reminders of key learning points. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
66. Identify barriers to education and self-care (ie, lack of knowledge and self-awareness; low self-efficacy; depression; attitudes and beliefs about health; religious beliefs; cognitive dysfunction). Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
67. Ensure the use of proper footwear.
    • Educate patients with DM and/or ND and their caregivers regarding the necessity to wear proper footwear to prevent ulcerations or callus:
        - Wear footwear that fits, protects, and accommodates the shape of the feet. There should be at least one-half inch between the longest toes and the end of the shoe.
        - Always wear socks with footwear to prevent friction and shear.
        - Check footwear, each time before wearing to ensure that there are no foreign objects in/or penetrating the footwear.
        - Check feet each time footwear is removed to ensure that there are no signs of abnormal pressure, trauma, or ulceration.
        - Do not wear: shoes/boots with narrow toes; thong sandals/flip-flops; open-heel shoes; open-toe shoes; shoes/boots that are too tight or too loose; or shoes with vinyl tops.
    • Use therapeutic footwear in high-risk patients with DM, Charcot neuropathy, foot deformities, previous ulcer, previous amputation, callus/preulcerative callus, and poor circulation; and use custom-molded shoes for patients with bony deformities, including Charcot foot, that cannot be accommodated with commercially available therapeutic footwear.
        - Instruct patients with PN to seek professional assistance in fitting shoes properly, because LOPS might preclude patients from recognizing proper fit.
        - Review prescribed footwear every 3 months to ensure that the footwear still fits adequately and protects and supports the feet.
    • Prescribe appropriate off-loading devices for patients who have DM/ND and a plantar foot ulcer in order to heal the ulcer, because therapeutic footwear is not specifically recommended for treatment of plantar ulcers.

Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion

68. Provide ongoing patient-oriented, multidisciplinary assessment, management and monitoring (eg, health and medical care and examinations, DM care, eye examinations and eye care, professional foot care and foot checks), DM and foot care education, and assessment of adherence to recommendations for self-care. Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Low
69. Use telemedicine technology (if available) to supplement usual wound care for follow-up assessment, monitoring, and consultation. Level of evidence = A; benefit/effectiveness/harm = Class II; quality of evidence = Moderate
70. Ensure disease management.
    - Establish and review HbA_{1c} goals:
        - Monitor/test HbA_{1c} twice per year for patients with stable glycemic control.
        - Provide quarterly monitoring for patients whose therapy has changed, or for those who are not meeting their glycemic goals.
        - HbA_{1c} goals:
            - An HbA_{1c} less than 7% is appropriate for most nonpregnant adults.
            - A lower HbA_{1c} level such as less than 6.5% may be acceptable if it can be achieved safely without significant hypoglycemia or an adverse event and if a lower level is agreeable to the health care provider and the patient.
            - A less stringent HbA_{1c} goal (ie, < 8%) may be appropriate for patients with a history of severe hypoglycemia, short life expectancy, advanced microvascular or macrovascular complications or other comorbidities, or for individuals with long-standing DM who cannot achieve more stringent goals, despite best practice efforts in education, monitoring, and use of multiple glucose-lowering agents.
            - Lower HbA_{1c} goals (ie, <7.5%) may be appropriate for older adults who are otherwise healthy, while those with multiple coexisting chronic illnesses, cognitive impairment, or functional dependence should have less-stringent HbA_{1c} goals (ie, 8.0%-8.5%).
            - Avoid hypoglycemia in older adults with DM: Monitor patients regularly and adjust glycemic targets and pharmacologic regimens as indicated.

    Level of evidence = C; benefit/effectiveness/harm = Class II; quality of evidence = Expert opinion
    - Educate patients to promote a healthy lifestyle:
        - Avoid use of tobacco or e-cigarettes.
        - Maintain adequate nutrition and a healthy diet:
            - Maintain weight or if overweight or obese, reduce weight.
            - Cholesterol goal: non–high-density lipoprotein (non-HDL) less than 130 mg/dL; consider statin use if indicated.
        - Optimize blood pressure control for patients with DM and hypertension:
            - Blood pressure goals: less than 130/80 for individuals at high risk for cardiovascular

TABLE 7.
Barriers to Implementation of Evidence-Based Clinical Practice Guidelines[a]

Common Barriers to CPG Implementation	Examples of Barriers
Personal/individual factors	• Lack of knowledge about the CPG, the recommendations, and the evidence supporting the recommendations. • Beliefs and attitudes: lack of interest or agreement with the recommendations; lack of self-efficacy, skills, and motivation; habits; low expectations for improved outcomes; resistance to change; low morale; passivity and lack of engagement/commitment/ownership.
External factors: environmental, organizational, system level, and cultural	• Organizational constraints (eg, inadequate processes, procedures; unstable work environment; high level of staff turnover). • Lack of administrative/management support. • Lack of resources (eg, time restrictions; heavy workload; lack of financial resources for personnel, equipment, and supplies; lack of infrastructure/systems; reimbursement issues). • Lack of facilitation, characteristics of the facilitator, or disconnect between the facilitator and other staff. • Lack of collaboration and cooperation: poor team functioning; "turf" issues/conflicts; competing agendas/priorities. • Societal and clinical norms: poor learning culture. • Lack of evaluation, follow-up, accountability, and sustainability.
Guideline-related factors	• Access to guideline. • Layout of guideline: clarity, wording, and quality. • Evidence for guideline. • Plausibility, complexity, applicability, and trialability of recommendations. • Lack of clear goals and measurable outcomes for intervention(s).
Patient-related factors	• Competing claims and advice from health care providers. • Fear of interventions and adverse effects. • Psychosocial issues. • Lack of trust; inconsistent interpersonal relationships with health care providers.

Abbreviation: CPG, clinical practice guideline.
[a]From Wound, Ostomy, and Continence Nurses Society.[3,16] Adapted from Fischer et al[20] (open access article permitting unrestricted use and reproduction of content under the Creative Commons Attributive License; https://creativecommons.org/licenses/by/4.0/legalcode). Data were derived from Dogherty et al[18]; Fischer et al[20]; Munce et al[23]; Franks et al[26]; and Graham et al.[27]

disease and less than 140/90 for individuals with low to moderate risk for cardiovascular disease.
- Monitor patients' blood pressure at every clinical visit and educate patients to self-monitor their blood pressure at home.
  - Engage in regular activity and exercise to maintain strength, flexibility, and balance (eg, 150 minutes of moderate intensive exercise per week such as walking).
  - Limit alcohol use to moderate consumption: For women, no more than 1 drink per day,

TABLE 8.
Applying Evidence-Based Knowledge to Clinical Practice: A Brief Guide[a]

Knowledge creation: knowledge inquiry and synthesis	
Phase 1. Identify the created knowledge—the evidence-based CPG.	• Assess the currency and quality of the CPG. • Establish an implementation task force. • Choose the key facilitator/leader for implementation who is credible, trustworthy, passionate, a good communicator, flexible, open-minded, and tenacious; a clinical and process expert; has good interpersonal skills and a sense of humor; understands and uses principles of group process and change theory; and acts as a resource rather than an "authority."
Action cycle: knowledge application	
Phase 2. Identify the problem.	• Review the recommendations in the CPG. • Identify the gaps between the CPG's recommendations and clinical practice (audit current practice). • Identify high priority need(s) for change in a clinically important area rather than attempting to implement the entire guideline at one time.
Phase 3. Adapt knowledge to the local context.	• Determine the target users. • Identify who will be impacted. • Identify stakeholders who should be involved in the implementation process. • Identify or develop infrastructure/systems to implement the best practices.
Phase 4. Identify barriers to EBP.	• Determine the personal/individual, external, guideline-related, and patient-related barriers to implementation. • Use focus groups, small groups, brainstorming sessions, etc. • Conduct surveys, questionnaires, interviews, needs assessments, etc.
Phase 5. Identify facilitators for EBP.	• Support of key opinion leaders and leadership (management/administration). • Multidisciplinary support. • Stakeholder engagement and support. • Readiness for change. • No conflicts of interest. • Shared decision making and control.
Phase 6. Select, tailor, and implement interventions depending on the local context.	• Establish a time frame and target date; identify the "who, what, where, when, and how" of implementation. • Establish role/responsibilities/accountability for implementation. • Determine goals/outcome measures for interventions and evaluation of success. • Determine costs and resources needed and ensure that adequate resources are available for implementation (eg, finances, staffing levels; equipment/supplies). • Obtain management/administrative support. • Use multiple strategies to address the negative barriers and enhance the facilitating factors (eg, education, marketing, consensus building). • Use group process and interdisciplinary collaboration to develop partnerships and relationships; engage multidisciplinary staff, stakeholders, and patients who are impacted by the change; utilize champions; avoid conflicts of interests. • Develop dissemination and implementation tools tailored to key stakeholders: education/training (eg, videos, webcasts, lectures/slide presentations, case examples/discussions); decision support tools/point-of-care tools in varied print, digital, and online formats (eg, standardized protocols and procedures, algorithms, checklists, pocket guides, mobile device applications, fact sheets, wall posters, standing orders); train-the-trainer classes; skill-building exercises, etc. • Integrate tools and/or interventions with the electronic medical record, or develop alternative approaches. • Pilot test new interventions.
Phase 7. Monitor and evaluate the use of evidence-based knowledge in clinical practice and the outcomes.	• Determine data to collect based on outcome measures. • Conduct audits, surveys, pre/-posttests, before/after questionnaires, etc. • Perform quality improvement projects. • Conduct research studies.
Phase 8. Sustain use of knowledge for EBP.	• Provide reminders, cues. • Conduct follow-up audits, surveys; provide feedback of results. • Update changes to the CPG as they become available. • Role model EBP; engage mentors for support and follow-up. • Use feedback to reinforce positive behaviors and/or modify action plans as needed.

Abbreviations: CPG, clinical practice guideline; EBP, evidence-based practice.
[a]From Wound, Ostomy, and Continence Nurses Society.[3,16] Data were derived from Taylor et al[17]; Dogherty et al[18]; Field et al[19]; Fischer et al[20]; Gagliardi et al[22]; Munce et al[23]; Franks et al[26]; and Graham et al.[27]

and for men, no more than 2 drinks per day (ie, 1 drink is equal to a 12-oz beer, a 5-oz glass of wine, or 1.5 oz of distilled spirits).

Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

71. Refer the following individuals to appropriate specialists/health care providers for further evaluation and management:
    - Patients who use tobacco or e-cigarettes for cessation counseling or therapy.
    - Patients who have LOPS, structural foot abnormalities, a history of LE complications, and/or LEAD who need ongoing preventive care and lifelong surveillance.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion
72. Identify and refer patients with the following complications to appropriate specialists/health care providers for further evaluation and management:
    - Cellulitis.
    - Osteomyelitis.
    - Nonhealing ulcers or recurrent ulcers.
    - Atypical ulcers.
    - New onset of Charcot foot.
    - LEAD or CLI.
    - Persistent, uncontrolled pain.
    - Anxiety, depression, or mental/psychological issues.

    Level of evidence = C; benefit/effectiveness/harm = Class I; quality of evidence = Expert opinion

GUIDELINE IMPLEMENTATION

Evidence-based practice is necessary for safe, quality patient care and outcomes.[3,16] Although CPGs are available with recommendations to improve the quality and outcomes of patient care, evidence indicates that the adoption and implementation of CPG recommendations are limited and inconsistent.[3,16-24] In addition to providing access to CPGs, purposeful strategies are necessary to identify gaps between evidence-based practice recommendations and practice and promote knowledge, acceptance, adoption, and adherence to the recommendations.[3,16,22]

There is no specific optimal method for implementing a particular CPG that meets all contextual situations.[3,16,21,22,25] Appropriate individuals and stakeholders from the organization or clinical setting will need to determine if a CPG will be adapted or adopted in whole or in part. The CPG should be reviewed to select recommendations to improve patient care and outcomes that are supported by the best evidence and determine if they are appropriate and feasible to implement in a specific setting, given the needed resources (eg, finances, personnel, equipment, supplies, etc).

Effective use of a CPG requires measures to overcome barriers.[3,16,26] Multiple personal/individual, external, guideline-related, and patient-related factors are common barriers to CPG implementation (Table 7).[3,16,18,20,23,26,27]

Essential steps to successful implementation of recommendations from a CPG include ensuring access to the guideline; developing strategies to identify and overcome barriers to implementation; developing strategies, tools, defined roles and responsibilities, and time frames for implementation; and determining outcome measures.[3,16,22] The Knowledge to Action (KTA) Framework proposed by Graham and colleagues[27] has been used to guide the design, delivery, and evaluation of implementation strategies to apply knowledge to practice.[19,23] The KTA Framework comprises 2 components: the knowledge creation cycle in which the evidence-based CPG is developed, and the action cycle in which the knowledge is applied or implemented in practice in several phases.[3,16,27] The phases can occur sequentially or simultaneously and may overlap and influence each other. The action cycle includes the following 7 phases: (*a*) identify the problem, review, and select the knowledge; (*b*) adapt the knowledge to the local context; (*c*) assess barriers to the use of the knowledge; (*d*) select, tailor, and implement interventions; (*e*) monitor knowledge use; (*f*) evaluate outcomes; and (*g*) sustain knowledge use.[3,16,23,27]

The evidence-based recommendations in the DM/ND guideline were developed to be adopted and implemented by WOC nurses or other health care providers in various care settings at the point of care. To facilitate that process, a brief guide for implementation of CPG recommendations was adapted from the KTA framework.[3,16,27] The guide includes an overview of strategies/activities for implementing/applying evidence-based knowledge from CPGs to clinical practice (see Table 8).[3,16-20,22,23,26,27] Recommendations from CPGs are not recipes that fit every clinical situation; instead, they should be integrated into practice based on individualized patient assessment, critical analysis of patient needs, and clinical judgment in order to achieve the most effective outcomes in accordance with the patient's preference, values, and goals.[28]

CONCLUSION

The updated guideline serves as a resource for WOC nurses and other health care providers and contributes to evidence-based management of persons with/or at risk for LE wounds due to DM/ND. It is essential that individuals with DM/ND and their families are educated about the risks for developing LE wounds, appropriate preventive and management strategies, their role in self-management to prevent the occurrence and recurrence/reoccurrence of LE wounds, and the importance of seeing a wound specialist for the management of any wounds that develop.

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KEY POINTS

- Screening for LOPS and early signs of Charcot neuropathy, patient education about foot care/footwear and the importance of lifelong surveillance and protection of at-risk feet, and specialized, multidisciplinary care are paramount to reducing morbidity and mortality for patients with DM/ND with/and without LE wounds.

- Off-loading is the cornerstone of effective management of LE wounds due to DM/ND and the primary treatment for acute Charcot neuropathy/Charcot foot.
- Patients with nonhealing wounds despite proper care for 4 to 6 weeks should be assessed for infection and biofilm formation and screened with an ABI, ankle/pedal Doppler arterial waveforms, and either TP/TBI or $TcPO_2$ to rule out LEAD.
- Health care providers should inspect the feet of patients with DM/ND for problems at every health care visit.
- Adoption and integration of evidence-based recommendations into clinical practice require a strategic implementation plan that addresses barriers in the clinical setting and not just the dissemination of a CPG.

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