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Abbreviations used in this issue

ACL = anterior cruciate ligament
DFU = diabetes-related foot ulcer
HbA1c = haemoglobin A1c
NHS = UK National Health Service

Welcome to Issue 69 of Foot and Ankle Research Review.

This issue brings together ten studies spanning biomechanics, diabetes-related foot disease, dermatology, and patient experience. Footwear and gait are explored through research on ACL reconstruction biomechanics and a novel 3D-printed shoe sole for knee osteoarthritis, while diabetes-related foot health features studies on hospitalisation risk factors, micronutrient intake, and the real-world psychology behind footwear adherence. Diagnostic vigilance is a key theme, with two papers addressing melanoma misdiagnosis and recognition in the diabetic and general foot. Rounding out the issue are studies on menopause and plantar heel pain, as well as the outcomes of custom foot orthoses in progressive collapsing foot deformity. As always, I would encourage you to dip into the full-text articles for the finer methodological details before drawing your own conclusions.

I hope you enjoy the issue.

Noho ora mai

Professor Matthew Carroll

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Research Review thanks Foot Science International for their sponsorship of this publication and their support for ongoing education for healthcare professionals.

Menopause and plantar heel pain: Findings from a series of focus groups exploring lived experience

Authors: Douglas-Harris M et al.

Summary: This UK study examined perceptions of the association between menopause and plantar heel pain in 17 women. Overall, 76% of women did not consider any association between menopause and plantar heel pain and reported that their healthcare providers did not mention the possibility during consultations. Some participants felt that some stigma remained around menopause, particularly in minority communities, which might be a barrier to research. Participants felt the menopause and plantar heel pain relationship requires further investigation, with increased awareness among patients and healthcare providers.

Comment: This qualitative study used focus groups to explore the lived experience of women linking plantar heel pain to menopause. Plantar heel pain incidence peaks in women around age 50 years, coinciding with the average onset of menopause, and hormonal fluctuations are known to affect fascial tissue elasticity and stiffness, which may contribute to plantar fascia changes. Despite this biological plausibility, most participants reported that healthcare professionals rarely made the connection between their plantar heel pain symptoms and menopausal status during consultations. Many felt frustrated by generalist knowledge gaps regarding menopause and its musculoskeletal manifestations, prompting several to seek private treatment, alternative therapies, or undertake their own research to manage both hormone replacement therapy and heel pain concerns. One participant did recall a clinician explicitly linking hormonal changes to joint pain and stiffness, but this appeared to be the exception rather than the rule. The findings highlight a significant gap in clinical awareness and holistic care for perimenopausal and menopausal women presenting with plantar heel pain. Clinically, this study suggests podiatrists and other foot health professionals should consider menopausal status as a contributing factor when assessing plantar heel pain in women over 45 years of age, and improve interdisciplinary communication with GPs and menopause specialists to provide more comprehensive, patient-centred care.

Reference: *J Foot Ankle Res.* 2026;19(2):e70154

[Abstract](#)

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The CUBED versus ABCDE recognition tools in the detection of malignant melanomas arising in the foot: An analysis of four recent case studies in a single NHS community trust

Authors: Sherratt A et al.

Summary: This UK retrospective case series assessed four cases of foot melanoma identified in a single community podiatry department, comparing the ABCDE (asymmetry; border irregularity; colour variability/change; diameter; evolution) and CUBED (coloured marks; uncertain diagnosis; bleeding, oozing or hypergranulation; enlargement; delay in healing – more than 2 months) recognition tools, and described responses to improve early detection. The cases were all toe-based melanomas (lentigo maligna, nail-bed malignant melanoma, and two acral melanomas). Presentation included irregular colour, bleeding or ulceration, delayed healing, diagnostic uncertainty, and lesion enlargement. Concerning features were more consistently identified using CUBED than ABCDE criteria, prompting urgent referral. One patient was disease-free after excision, one died after developing distant metastasis, and two required toe amputation and systemic treatment. Service responses included case-based teaching and CUBED and ABCDE recognition campaigns across local clinical networks.

Comment: This retrospective case series examined four consecutive cases of foot melanoma (2019-22) from a single NHS community podiatry service, comparing the diagnostic performance of the traditional ABCDE criteria with the CUBED tool, developed specifically for atypical plantar and subungual lesions. CUBED criteria were more consistently flagged as concerning features than the ABCDE criteria across the series, prompting an urgent dermatology referral in every case. Outcomes varied considerably, underscoring the serious consequences of diagnostic delay in foot melanoma, which carries a poorer prognosis than cutaneous melanoma elsewhere due to concealment in interdigital spaces, under nail plates, or on plantar surfaces. Clinically, this reinforces podiatrists' pivotal role in early melanoma detection and supports wider adoption and education on the CUBED tool, alongside traditional ABCDE criteria, to reduce misdiagnosis and diagnostic delay.

Reference: *J Foot Ankle Res.* 2026;19(2):e70159

[Abstract](#)

Malignant melanoma misdiagnosis in the diabetic foot. What can we learn from the published literature?

Authors: Bristow IR et al.

Summary: This systematic literature review assessed 20 case studies (14 males, 7 females; mean age 73 years) reporting delayed or misdiagnosed melanoma (mean Breslow thickness 3.58 mm) on the foot or toenail in diabetes patients using a structured content analysis. Melanoma lesions were located on the heel, forefoot, toe, subungual regions and arch, and the most common misdiagnosis was diabetes-related foot ulcer (DFU). Common themes suggest that ulceration despite lack of risk factors, hypergranulation and no improvement are keys to suggest an alternative diagnosis.

Comment: This systematic review of published case studies (2010-25) examined delayed diagnosis and misdiagnosis of melanoma arising on the foot or toenail in people with diabetes. From 1485 identified papers, 20 cases across 19 papers from 10 countries met inclusion criteria, indicating advanced disease at diagnosis. The majority (85%) were initially misdiagnosed as DFU, likely reflecting diagnostic anchoring bias toward familiar diabetic foot presentations in this population. Content analysis identified recurring themes suggesting alternative diagnosis, including ulceration occurring despite the absence of typical risk factors (neuropathy, ischaemia), lack of healing despite appropriate offloading and treatment, and lesion enlargement or hypergranulation. The authors emphasise biopsy as the gold standard for definitive diagnosis and stress it should be undertaken without delay whenever malignancy is suspected in a non-healing foot ulcer. Clinically, this reinforces that clinicians should maintain a high index of suspicion for atypical, non-healing, or unusually presenting foot lesions in people with diabetes, using tools such as CUBED alongside standard risk factor assessment, given that delayed melanoma diagnosis significantly worsens prognosis and mortality risk.

Reference: *J Foot Ankle Res.* 2026;19(2):e70162

[Abstract](#)

Clinical outcomes of custom foot orthoses in progressive collapsing foot deformity: A retrospective cohort analysis

Authors: Robb K et al.

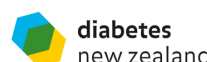
Summary: This Canadian, multicentre, retrospective analysis of clinical records (130,365 appointments) assessed patients with progressive collapsing foot deformity (PCFD) and examined demographic factors, clinical and self-reported outcomes after custom foot orthoses (CFOs) use. PCFD was more common in females and older adults. Unilateral PCFD limbs had higher Foot Posture Index (FPI) scores (flatter feet) than healthy limbs. A significant reduction in pain was observed in both sexes upon CFOs use; female patients exhibited greater pain at baseline and follow-up. The mean pain rating decreased from 6.52 to 3.69 at follow-up ($p < 0.0001$). Symptom improvement was reported by 80% of patients, and 56% wore orthoses for >6 hours per day. Comfort was associated with wear time and pain reduction.

Comment: This large retrospective cohort study analysed clinical records from 25 Canadian podiatric clinics between 2016 and 2025, extracting 669 PCFD encounters and 12,621 asymptomatic controls from over 130,000 appointments, to evaluate outcomes of CFOs. PCFD was more prevalent in females and older adults (peak incidence in 61-75-year-olds), with affected limbs showing higher FPI scores (more pronated foot posture) than the contralateral healthy limbs. Following CFO dispensing, mean pain scores decreased from 6.52 to 3.69 over a mean follow-up of 39.7 days, with 80% of patients reporting symptom improvement and 56% wearing orthoses for over 6 hours daily. Comfort was positively associated with both wear time and magnitude of pain reduction. Both sexes showed pain reduction, though females reported higher pain at both baseline and follow-up. The findings indicate that CFOs are an effective and cost-efficient first-line conservative treatment for PCFD and provide key data for a future randomised controlled trial focusing solely on CFOs.

Reference: *J Foot Ankle Res.* 2026;19(2):e70153

[Abstract](#)

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Discomfort avoidance and desire for normality are decision-making drivers of footwear choice in underserved communities at risk of diabetic foot ulcer

Authors: Anil K et al.

Summary: This UK qualitative study examined the psychological mechanisms underlying footwear choice and adherence in people with diabetes at moderate to high risk of foot ulceration from underserved groups including low socioeconomic and South Asian populations, using one-to-one interviews informed by the COM-B model (Capability, Opportunity, Motivation: Behaviour; n = 11) and a 'think aloud' session examining reasoning strategies behind footwear choices (n = 14). Two reasoning mechanisms emerged; "Discomfort Avoidance Prioritised Over Clinical Advice" prioritising comfort over medical recommendations, and "Desire for Normality", a preference for familiar or 'normal' footwear.

Comment: This qualitative study explored footwear decision-making among people living with diabetes who are at risk of foot ulceration, a population in which professional footwear adherence averages only 63%. Through interviews, two key psychological reasoning mechanisms emerged: discomfort avoidance prioritised over clinical advice, and a desire for normality. Participants consistently choose footwear based on immediate comfort or personal/social rules (e.g., house rules, event formality) rather than long-term foot health considerations, even when presented with free therapeutic footwear options. This was not a conscious rejection of clinical guidance; participants respected clinicians as health authorities, but rather a tendency to self-validate footwear choices through lived, everyday experience, prioritising short-term relief over long-term risk reduction. The desire for normality manifested as reverting to familiar, "normal" shoes once therapeutic or recommended footwear wore out. These findings align with previous research indicating that people balance individual needs and social norms against clinical foot-health symptoms, and that footwear adherence is a complex psychological process rather than simple non-compliance. Clinically, the authors call for a person-centred approach to footwear advice that explicitly addresses comfort and normalcy needs, rather than guideline-only prescriptions, to help bridge the persistent gap between recommendations and real-world adherence.

Reference: *J Foot Ankle Res.* 2026;19(3):e70186

[Abstract](#)

One shoe doesn't fit all: A contextual approach to therapeutic footwear for people at risk of diabetes-related foot ulceration

Authors: Jarl G et al.

Summary: This paper explores a contextual approach to considering therapeutic footwear in people at risk of diabetes-related foot ulcers. Seven contexts in which therapeutic footwear use is challenging are considered: home, workplace, social occasions, places-of-worship, water-related activities, hotter climates and holidays. A contextual approach involves a trade-off between functional benefits and adherence leading to novel designs for different contexts. Six footwear solutions are proposed that incorporate more aesthetically pleasing features that are cooler, lighter, cheaper or waterproof, while providing protection and functional offloading.

Comment: This research challenges the traditional 'one-size-fits-all' guideline approach to therapeutic footwear prescription for people at risk of diabetes-related foot ulceration. Although guidelines suggest custom insoles, rocker-bottom outsoles, wide toe boxes, and firm heel counters to prevent trauma, actual compliance is often low. The authors argue this stems from a mismatch between static, comprehensive guideline recommendations and the dynamic, varied contexts of patients' daily lives; patients often engage in 'strategic non-adherence', consciously deviating from recommendations to maintain normal daily functioning. A particular challenge concerns occupational safety footwear requirements, where patients may spend the bulk of their weight-bearing hours in footwear that cannot accommodate therapeutic features; the authors call for manufacturers to develop safety footwear that fulfils both regulatory and offloading requirements, and for clinicians to negotiate with employers where possible. The research advocates for a contextual, person-centred approach to footwear prescription that accounts for varying activities, environments, and social demands throughout a patient's day, rather than prescribing a single therapeutic shoe for all situations. Clinically, this reframes footwear adherence as a design and communication challenge rather than simply a patient compliance issue.

Reference: *J Foot Ankle Res.* 2026;19(2):e70176

[Abstract](#)

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INDEPENDENT COMMENTARY BY

Professor Matthew Carroll

Matthew Carroll is Head of School – Allied Health and Professor of Podiatry at Auckland University of Technology. His research focuses on chronic lower-limb and foot conditions, with an emphasis on improving clinical outcomes and quality of life. Matthew has published extensively in peer-reviewed journals and presented at national and international conferences. He has held associate editorial positions with the Journal of Foot & Ankle Research, PLoS ONE, and BMC Musculoskeletal Disorders. He is recognised as an experienced academic leader, having held several senior leadership roles.

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The effect of micronutrient intake and supplementation on prevalent diabetes-related foot ulcer and incident hospitalisation for diabetes-related foot ulcer in type 2 diabetes: The Fremantle diabetes study phase 2

Authors: Hamilton EJ et al.

Summary: This analysis of data from the community-based Fremantle Diabetes Study Phase II assessed the association between micronutrient intake and/or supplementation with DFU and/or incident hospitalisation for DFU in 1499 patients (mean age 65.4 years, 51.8% males) with type 2 diabetes. Self-reported food frequency, including vitamin C, zinc and iron intake, vitamin supplements and B12 and iron levels were not associated with prevalent DFU or incident DFU hospitalisation. Prevalent DFU was associated with younger age at diagnosis, marital status, retinopathy, distal symmetrical polyneuropathy, and diabetes-related amputation, peripheral revascularisation or bypass. An association was seen between incident DFU hospitalisation male sex, age, marital status, HbA1c level, DFU history, and a history of peripheral revascularisation or bypass, N-terminal pro B-type natriuretic protein, and heart rate.

Comment: Using data from the Fremantle Diabetes Study Phase II (1499 participants with type 2 diabetes followed to 2016), this study examined whether dietary micronutrient intake or supplementation was associated with prevalent or incident DFU hospitalisation. Despite prior hospital-based studies reporting common micronutrient deficiencies (vitamins C, D and A, zinc, iron and selenium) among people with active DFU, this large community-based cohort found no independent association between self-reported dietary micronutrient intake, vitamin supplement use, or measured B12/iron levels and either prevalent DFU or incident DFU hospitalisation. Instead, established risk factors, younger age at diabetes diagnosis, unmarried status, retinopathy, peripheral neuropathy, and prior amputation or revascularisation, were the dominant independent associates. Anaemia and lower serum iron were more common among those with DFU, likely reflecting comorbid chronic kidney disease and inflammation rather than primary nutritional deficiency. The authors suggest nutritional deficiencies identified in specialist clinic-based studies may reflect a more severely affected, selected subgroup rather than the broader diabetes population, or that food frequency questionnaires inadequately capture true micronutrient status. Clinically, this suggests routine micronutrient supplementation is unlikely to meaningfully prevent DFU development in general community-based diabetes populations, reinforcing current guidelines that do not recommend routine nutritional intervention for DFU prevention.

Reference: *J Foot Ankle Res.* 2026;19(3):e70181

[Abstract](#)



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Advancing conservative treatment of knee osteoarthritis: 3D-printed shoe soles for passive toe-out gait modification

Authors: Jiang Z et al.

Summary: This study examined whether a 3D-printed rotational hind-sole and a variable stiffness fore-sole ('RVS' shoes) could passively replicate the biomechanics of toe-out gait and reduce knee adduction moment (KAM) and knee adduction angular impulse (KAAI) achieved with active toe-out gait retraining in 21 healthy adults. KAM's second peak was reduced after toe-out retraining at angles of 5° (13.6%; $p = 0.002$), 10° (20.2%; $p < 0.001$) and 15° (31.7%; $p < 0.001$). The use of RVS shoes reduced KAM by 16.3% ($p < 0.001$), and reduced KAAI by 8.6% ($p < 0.001$). Regression analysis suggested that the changes in KAM were strongly (95%) predicted by mediolateral ground reaction force and knee centre-of-pressure offset.

Comment: This biomechanical study developed a prototype shoe (RVS shoe) with a 3D-printed sole incorporating a rotational unit that passively replicates the knee-unloading effects of toe-out gait retraining in knee osteoarthritis. Toe-out gait modification is an established but poorly adhered-to conservative strategy for reducing the late-stance peak KAM, a key driver of medial compartment loading and disease progression. Participants underwent supervised gait retraining at three toe-out targets (5°, 10°, 15°) using real-time visual biofeedback, achieving average modifications of 4.0°, 6.9°, and 10.6°, respectively, and reductions in second-peak KAM of 13.6-31.7%, consistent with prior literature. The RVS shoe achieved KAM reductions comparable to, or exceeding, those from active toe-out retraining, without requiring ongoing patient effort or supervision. However, all footwear conditions produced an unfavourable increase in first peak KAM, partially offsetting benefits to the overall KAAI. The authors note the RVS shoe should be considered a passive orthotic device rather than a full gait-retraining replacement. Clinically, this offers a promising alternative for knee osteoarthritis patients who struggle with the poor long-term adherence typical of active gait retraining programmes.

Reference: *J Foot Ankle Res.* 2026;19(2):e70174

[Abstract](#)

Risk factors for foot-related hospitalisations in adults with and without diabetes: A systematic review

Authors: Weerasuriya SR et al.

Summary: This systematic review examined risk factors for hospitalisations due to foot-related conditions amongst community-dwelling adults (with or without diabetes) based on 14 studies. In total 22 independent risk factors were identified, including eight reported in multiple studies and in studies with a low risk of bias. The eight risk factors were male sex, diabetes, increased HbA1c, insulin management, chronic kidney disease, peripheral neuropathy, peripheral artery disease and lack of footcare in the previous 12 months.

Comment: This systematic review synthesised evidence on risk factors from 14 studies involving nearly 1.8 million community-dwelling adults and examined hospitalisations for any foot-related condition. Of 97 variables assessed, 22 were identified as independent risk factors, with eight consistently reported across multiple studies: male sex, diabetes, increased HbA1c, chronic kidney disease, peripheral neuropathy, peripheral artery disease, insulin management, and lack of foot care within 12 months. Notably, nearly all included studies focused exclusively on foot disease-related hospitalisations in diabetes populations, despite evidence that roughly half of all foot-related hospitalisations occur in people without diabetes, and that musculoskeletal, dermatological, and traumatic foot conditions were entirely unexamined as causes of hospitalisation. Studies rated as low risk of bias additionally identified increased height, type 1 diabetes, and younger age at type 2 diabetes diagnosis as risk factors. Half of all included studies were rated as moderate to high risk of bias, primarily due to weaknesses in participant selection, prognostic measurement, attrition, and confounding. This review highlights a critical evidence gap: there is minimal research on foot-related hospitalisation risk in general (non-diabetic) populations or on non-disease-related foot conditions. Clinically, it reinforces well-established diabetic foot risk factors while calling for broader research addressing foot health risks across the whole community.

Reference: *J Foot Ankle Res.* 2026;19(2):e70164

[Abstract](#)

The effect of footwear on walking biomechanics in individuals with anterior cruciate ligament reconstruction

Authors: Dennis JD et al.

Summary: This study compared ACL reconstruction and contralateral limb walking biomechanics in 36 individuals walking barefoot, in laboratory standard footwear, and in personal footwear. In all footwear conditions, the ACL reconstruction limb had smaller sagittal plane moments and angles, smaller vertical ground reaction force (vGRF) and larger frontal plane moments versus the contralateral limb. Barefoot walking had smaller frontal plane moments and smaller vGRF but larger vGRF instantaneous loading rate compared with laboratory standard or personal footwear. Laboratory footwear had smaller peak vGRF but larger vGRF instantaneous loading rate than personal footwear, while the vGRF linear loading rate was smaller with barefoot walking than personal footwear. The ACL reconstruction limb had a smaller vGRF linear loading rate while barefoot than the contralateral limb and a smaller vGRF linear loading rate than the ACL reconstruction limb in personal footwear.

Comment: This study compared walking biomechanics between the ACL reconstruction limb and contralateral limb in individuals with unilateral ACL reconstruction, across three footwear conditions: barefoot, laboratory-standard footwear, and personal footwear. Consistent with prior literature, the ACL reconstruction limb exhibited smaller sagittal-plane knee moments and angles, greater knee abduction moments (KABM), and a smaller peak vGRF compared to the contralateral limb, regardless of footwear condition. Footwear influenced the magnitude of frontal-plane loading and peak vGRF in both limbs; barefoot walking produced smaller KABM and vGRF than shod conditions, but aside from vGRF loading rate, footwear did not differentially affect inter-limb differences. This indicates that the well-documented quadriceps-avoidance gait pattern seen post-ACL reconstruction is robust across footwear types, meaning findings from studies using different footwear protocols remain broadly comparable when examining inter-limb asymmetry. However, absolute biomechanical magnitudes (e.g., KABM, vGRF) vary with footwear, so caution is warranted when directly comparing biomechanical values across studies that use different footwear conditions. Clinically, this reinforces that footwear choice during gait assessment need not compromise detection of asymmetries central to post-ACL reconstruction osteoarthritis risk monitoring.

Reference: *Gait Posture* 2026;Jun 6 [Epub ahead of print]

[Abstract](#)

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