

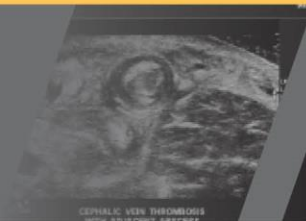
2024 MID-ATLANTIC CONFERENCE
12th ANNUAL CURRENT CONCEPTS IN
VASCULAR THERAPIES

2024



Hilton Virginia Beach Oceanfront
Virginia Beach, Virginia

APRIL 18-20



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**Caring for the
Infected Diabetic
Foot is a Team
Sport**

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Financial Disclosures

- Nothing to disclose

Today's Agenda

- Diabetes facts
- Multidisciplinary team members
- Podiatrist's role in:
 - Preventative care
 - Outpatient care
 - Inpatient care
- Future of diabetic foot treatment
- Summary

Discussion Points

- My role in the healthcare team
- Key pathology in a Podiatry practice
- Key procedures for successful treatment of diabetic foot infections

Diabetes Prevalence (US pop. 333mil)

Diabetes

- **Total:** 38.4 million people have diabetes (11.6% of the US population)
- **Diagnosed:** 29.7 million people, including 29.4 million adults
- **Undiagnosed:** 8.7 million people (22.8% of adults are undiagnosed)

Prediabetes

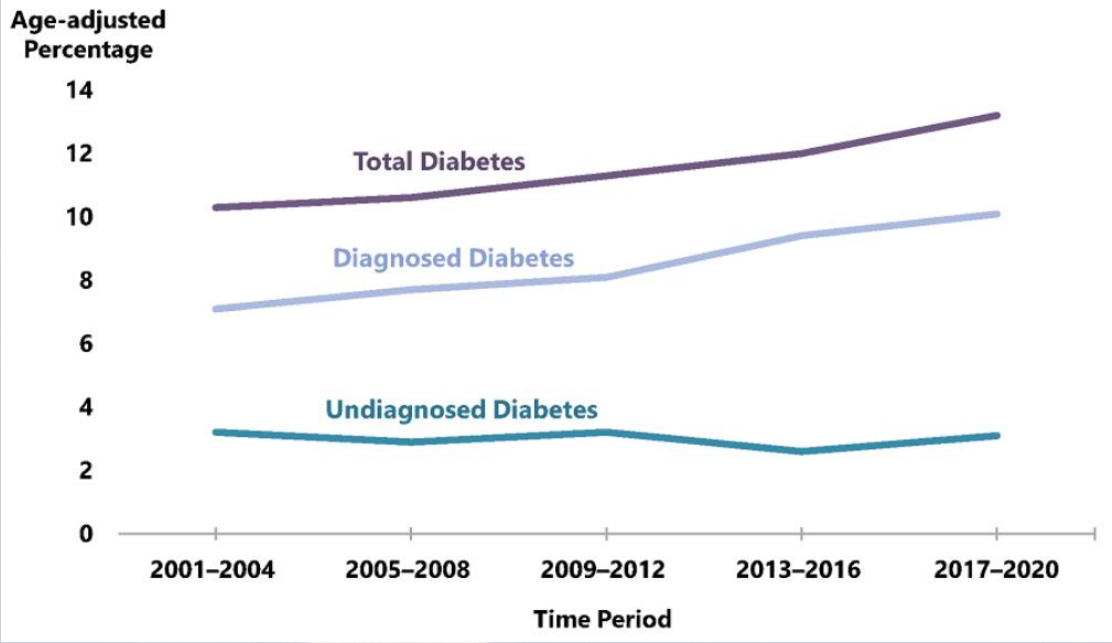
- **Total:** 97.6 million people aged 18 years or older have prediabetes (38.0% of the adult US population)
- **65 years or older:** 27.2 million people aged 65 years or older (48.8%) have prediabetes

[National Diabetes Statistics Report | Diabetes | CDC](#)

A1C	Total
-----	-------

<6.5%	32.6 (27.2–38.6)
6.5%–6.9%	20.0 (16.5–24.0)
7.0%–7.9%	22.9 (18.7–27.8)
8.0%–8.9%	11.0 (7.9–15.1)
9.0%–9.9%	6.9 (4.8–9.8)
≥10.0%	6.6 (5.0–8.5)

Left: adult a1c levels (2017-2020)



[National Diabetes Statistics Report | Diabetes | CDC](#)

Direct Healthcare Costs of Diabetes

- \$412.9 billion in 2022 (\$327 billion in 2017)
- Annual expenditures per capita are 2.6x higher
 - Adjusted for age and sex
 - \$19,736 with diabetes
 - \$7,714 without diabetes
 - Outpatient Podiatry care: 1.9x higher with diabetes

Parker ED, et al. Economic Costs of Diabetes in the U.S. in 2022. *Diabetes Care*. 2024;47(1):26-43.

Indirect Healthcare Costs of Diabetes

Indirect burden of diabetes in the U.S.—2022 estimates (in billions, USD)

Cost component	Productivity loss
Workdays absent	17.3 million days
Reduced performance at work	112.7 million days
Reduced productivity days for those not in labor force	15.5 million days
Reduced labor force participation due to disability	107.2 million days
Mortality	339,000 deaths →
Total	

103,294 deaths, diabetes was underlying cause of death (CDC, 2021)

339,401 deaths, diabetes was a cause of death (CDC, 2021)

[National Diabetes Statistics Report | Diabetes | CDC](#)

Parker ED, et al. Economic Costs of Diabetes in the U.S. in 2022. *Diabetes Care*. 2024;47(1):26-43.

8th

15 Leading Causes of Death ↓	→ Deaths ↑↓	↔ Population ↑↓
#Diseases of heart (I00-I09,I11,I13,I20-I51)	695,547	331,893,745
#Malignant neoplasms (C00-C97)	605,213	331,893,745
#COVID-19 (U07.1)	416,893	331,893,745
#Accidents (unintentional injuries) (V01-X59,Y85-Y86)	224,935	331,893,745
#Cerebrovascular diseases (I60-I69)	162,890	331,893,745
#Chronic lower respiratory diseases (J40-J47)	142,342	331,893,745
#Alzheimer disease (G30)	119,399	331,893,745
#Diabetes mellitus (E10-E14)	103,294	331,893,745
#Chronic liver disease and cirrhosis (K70,K73-K74)	56,585	331,893,745
#Nephritis, nephrotic syndrome and nephrosis (N00-N07,N17-N19,N25-N27)	54,358	331,893,745
#Intentional self-harm (suicide) (*U03,X60-X84,Y87.0)	48,183	331,893,745
#Essential hypertension and hypertensive renal disease (I10,I12,I15)	42,816	331,893,745
#Influenza and pneumonia (J09-J18)	41,917	331,893,745
#Septicemia (A40-A41)	41,281	331,893,745
#Parkinson disease (G20-G21)	38,536	331,893,745

[Underlying Cause of Death, 2018-2021, Single Race Results Form \(cdc.gov\)](https://www.cdc.gov)

Multidisciplinary Team Members

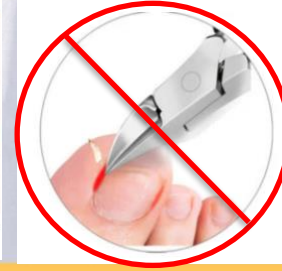
- Internal Medicine
- Endocrinology
- Infectious Disease
- Podiatry
- Vascular Surgery
- Cardiology
- Neurology
- Ophthalmology
- Pharmacy
- Nutritionist/Dietician
- Podorthist/Prosthetist

Treatment Team Goals

- Educate
- Control primary disease process
- Prevent secondary effects (DKA, wounds, CKD, heart disease, retinopathy)
- Reduce symptoms
- Improve quality of life
- Appropriate consultations and referrals

Preventative Care - Podiatry

- Routine exams
 - q3-6 months, q12 months
 - Based on level of risk, symptoms, level of care needed
 - Testing, referrals, office procedures to mitigate risk
 - Reduce misuse of instruments:



Preventative Care

140 - Therapeutic Shoes for Individuals with Diabetes

(Rev.241, Issued: 02-02-18, Effective: 04-01-18, Implementation: 04-02-18)

Coverage of therapeutic shoes (depth or custom-molded) along with inserts for individuals with diabetes is available as of May 1, 1993. These diabetic shoes are covered if the requirements as specified in this section concerning certification and prescription are fulfilled. In addition, this benefit provides for a pair of diabetic shoes even if only one foot suffers from diabetic foot disease. Each shoe is equally equipped so that the affected limb, as well as the remaining limb, is protected. Claims for therapeutic shoes for diabetics are processed by the Durable Medical Equipment Medicare Administrative Contractors (DME MACs).

[r241bp.pdf \(cms.gov\)](#)

- 1 pair accommodative shoe, 3 pairs custom multilayered orthotics for diabetics with risk factors
- Rx from Podiatrist, office notes from Primary Physician
- One prescription per year, free of charge

Preventative Care

Review

> [Diabetes Metab Res Rev. 2016 Jan;32 Suppl 1:99-118. doi: 10.1002/dmrr.2702.](#)

Footwear and offloading interventions to prevent and heal foot ulcers and reduce plantar pressure in patients with diabetes: a systematic review

S A Bus ¹, R W van Deursen ², D G Armstrong ³, J E A Lewis ⁴, C F Caravaggi ⁵, P R Cavanagh ⁶;
International Working Group on the Diabetic Foot

- N = 8000 studies down to 80 (level 1, 2 studies)
- Sufficient evidence → therapeutic footwear can prevent recurrent plantar foot ulcers
- No evidence → therapeutic footwear can prevent initial ulcer

Outpatient Care

Review

> [JAMA. 2023 Jul 3;330\(1\):62-75. doi: 10.1001/jama.2023.10578.](#)

Diabetic Foot Ulcers: A Review

David G Armstrong ¹, Tze-Woei Tan ¹, Andrew J M Boulton ², Sicco A Bus ³

- 1.6 million diabetic foot ulcers annually in US
- Diabetic foot ulcers (DFUs) precede 80% of amputations
- 50-60% of ulcers become infected
- 30% 5-year mortality rate of those with DFUs
- 70% 5-year mortality rate of major amputees with DFUs

Outpatient Care - Podiatry

- Podiatrist's role in diabetic foot management
 - Treatment of wounds
 - X-ray and imaging, culture, labs, offloading, oral antibiotics
 - Office procedures
 - Debridement, incision & drainage, skin plasty, foreign body removal, tenotomy, capsulotomy, nail removal
 - Surgery for associated pathology
 - Saucerization, arthrodesis, amputation, reconstruction

Outpatient Care - Procedure

- Charcot neuroarthropathy
 - Destructive non-infectious joint event
 - 10% of diabetics
 - 37% subsequently develop wounds
 - Restore stable, plantigrade foot

[J Clin Orthop Trauma](#). 2021 Jun; 17: 88–93.

Published online 2021 Feb 8. doi: [10.1016/j.jcot.2021.01.017](https://doi.org/10.1016/j.jcot.2021.01.017)

The current burden of diabetic foot disease

[Michael Edmonds](#)^{a,b,*} [Chris Manu](#)^a and [Prashanth Vas](#)^{a,b}

Outpatient Care - Procedure



Outpatient Care - Procedure

- Achilles lengthening (TAL) with transmetatarsal amputation (TMA)
 - 35% developed wounds, TMA without TAL
 - 3% developed wounds, TMA with TAL
 - N = 85
 - 5.5 year follow up
 - $p < 0.001$

> [J Bone Joint Surg Am.](#) 2022 Oct 5;104(19):1722-1729. doi: 10.2106/JBJS.21.00888.
Epub 2022 Aug 18.

Concomitant Achilles Tendon Lengthening with Transmetatarsal Amputation for the Prevention of Late Forefoot Ulceration

Mark J Bullock ^{1 2}, Christopher M Gill ¹, Ronald Thomas ³, John Blebea ⁴

Inpatient Care - Podiatry

- Podiatrist's role in diabetic foot infections
 - Abscess, osteomyelitis workup
 - Operations
 - Debridement, saucerization, amputation, muscle flaps, split thickness skin grafting, soft tissue balancing
 - Helping organize after-care
 - Wound vacs, packing, splinting, dressings

Inpatient Care - Team Approach

> [J Vasc Surg.](#) 2020 Apr;71(4):1433-1446.e3. doi: 10.1016/j.jvs.2019.08.244. Epub 2019 Oct 30.

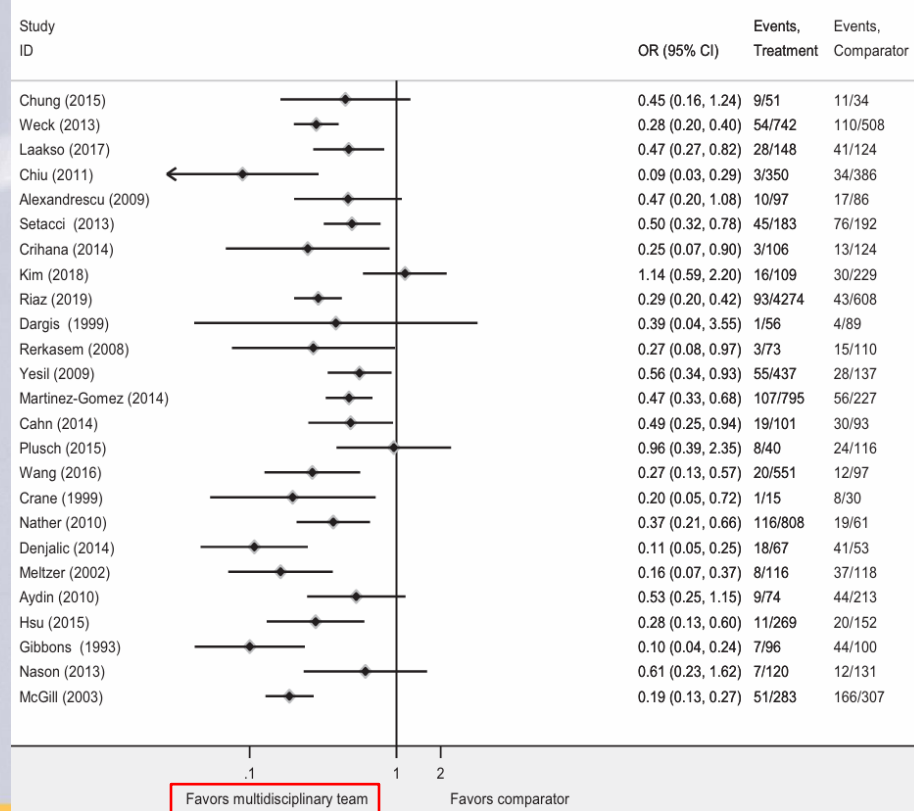
A systematic review of multidisciplinary teams to reduce major amputations for patients with diabetic foot ulcers

Jackson Musuuzo ¹, Bryn L Sutherland ², Suleyman Kurter ³, Prakash Balasubramanian ⁴,
Christie M Bartels ², Meghan B Brennan ⁵

- Themes of success
 - Clear referral pathways
 - Larger teams had a captain
 - Medical and surgical disciplines involved
 - Treat glucose, wounds, vascular disease, infection
- 94% of studies (31/33) reported multidisciplinary teams reduced major amputations

Inpatient Care – Team Approach, cont.

- Could calculate odds ratio for 25/33 studies
- Odds ratio for the change in major amp rates after initiating multidisciplinary care vs standard care



[A systematic review of multidisciplinary teams to reduce major amputations for patients with diabetic foot ulcers - PubMed \(nih.gov\)](#)



Inpatient Care - Amputation

- N = 435
- Mean follow-up: 26 mo.
- 20% revision amp rate:
 - 37% adjacent toe amp
 - 33% TMA
 - 29% BKA



[Diabet Foot Ankle](#). 2012;3. doi: 10.3402/dfa.v3i0.12169. Epub 2012 Jan 20.

Incidence of re-amputation following partial first ray amputation associated with diabetes mellitus and peripheral sensory neuropathy: a systematic review.

[Borkosky SL¹](#), [Roukis TS](#).

Inpatient Care - Amputation

- N = 410
- 35% underwent unplanned revision amputation within 30 days
- 5% mortality rate within 30 days

Multicenter Study > [Ann Vasc Surg. 2019 Jan;54:84-91. doi: 10.1016/j.avsg.2018.10.002.](#)
Epub 2018 Oct 17.

Neutrophil to Lymphocyte Ratio as a Predictor of Outcomes after Amputation

Willythssa S Pierre-Louis ¹, Jonathan Bath ², Sesank Mikkilineni ³, Michael C Scott ⁴,
Michael Harlander-Locke ⁵, Zachary Rasor ⁶, Matthew Smeds ³

Inpatient Care – Limb Salvage

> J Am Podiatr Med Assoc. 2023 Mar-Apr;113(2):20-176. doi: 10.7547/20-176.

Multidisciplinary Limb Salvage Service Reduces Major Amputations in Diabetic Foot Infections

Eric Pillado¹, Christian de Virgilio¹, Eli Ipp¹, Richard Murphy², Fred Bongard¹, Kimberly Lauer¹, Ashley J Miller¹

- Prospective cohort
 - N = 250
 - 92 with standard care
 - 158 with multidisciplinary team for limb salvage care
 - 9.4% lower rate of BKA in multidisciplinary group
 - P < 0.001

Inpatient Care – Limb Salvage

- Intrinsic foot muscle flaps
 - N = 32 (19 diabetic, 13 trauma)
 - 91% success rate
 - 2 required BKA, 1 died
 - Diabetes did not affect success rate



[Plast Reconstr Surg. 2002 Sep 15;110\(4\):1047-54; discussion 1055-7.](#)

The role of intrinsic muscle flaps of the foot for bone coverage in foot and ankle defects in diabetic and nondiabetic patients.

[Attinger CE¹](#), [Ducic J](#), [Cooper P](#), [Zelen CM](#).

Future of Diabetic Foot Treatment

- Clinical Research aimed at preventing and quickly healing diabetic foot ulcers

> [Int Wound J.](#) 2022 Dec;19(8):2062-2070. doi: 10.1111/iwj.13809. Epub 2022 Apr 3.

Wound repair, safety, and functional outcomes in reconstructive lower extremity foot and ankle surgery using a dehydrated amnion/chorion allograft membrane

Jordan Z Tackill ¹, Zachary Rasor ², Josh Adams ³, Gary Driver ³, Logan Shannon ³, Scott Hudzinski ³, Marissa J Carter ⁴, Adam L Isaac ², Charles M Zelen ³

> [Plast Reconstr Surg Glob Open.](#) 2022 Oct 28;10(10):e4588. doi: 10.1097/GOX.0000000000004588. eCollection 2022 Oct.

Autologous Minimally Manipulated Homologous Adipose Tissue (AMHAT) for Treatment of Nonhealing Diabetic Foot Ulcers

David G Armstrong ¹, Steven G Harris ², Zachary Rasor ³, Charles M Zelen ⁴, Jeehee Kim ⁵, Mark Swerdlow ¹, Adam L Isaac ⁶

> [Int Wound J.](#) 2023 Mar;20(3):853-860. doi: 10.1111/iwj.13932. Epub 2022 Aug 24.

A single arm prospective feasibility study evaluating wound closure with a unique wearable device that provides intermittent plantar compression and offloading in the treatment of non-healing diabetic foot ulcers

David G Armstrong ¹, Dennis P Orgill ², Paul M Glat ³, Robert D Galiano ⁴, Zachary L Rasor ⁵, Adam Isaac ⁵, Marissa Carter ⁶, Charles M Zelen ²

Summary

- Team approach improves outcomes of diabetic foot infections
- Podiatry is critical in preventative, outpatient and inpatient for diabetic foot management
- Foot ulcers and lower extremity amputations are complicated and burdensome
- Achilles lengthening with TMA is beneficial