



Taking Care of Your Feet to Prevent Falls

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Objectives



Leaves
are supposed
to fall.
People aren't.

- Review the impact of falls
- Discuss the multifactorial nature of falls and how foot and lower extremity function contribute to increased risk
- Review footwear choices and effect on balance

No Disclosures



Too many falls

Falls are the leading cause of accidental death and injury in people 65 and older.

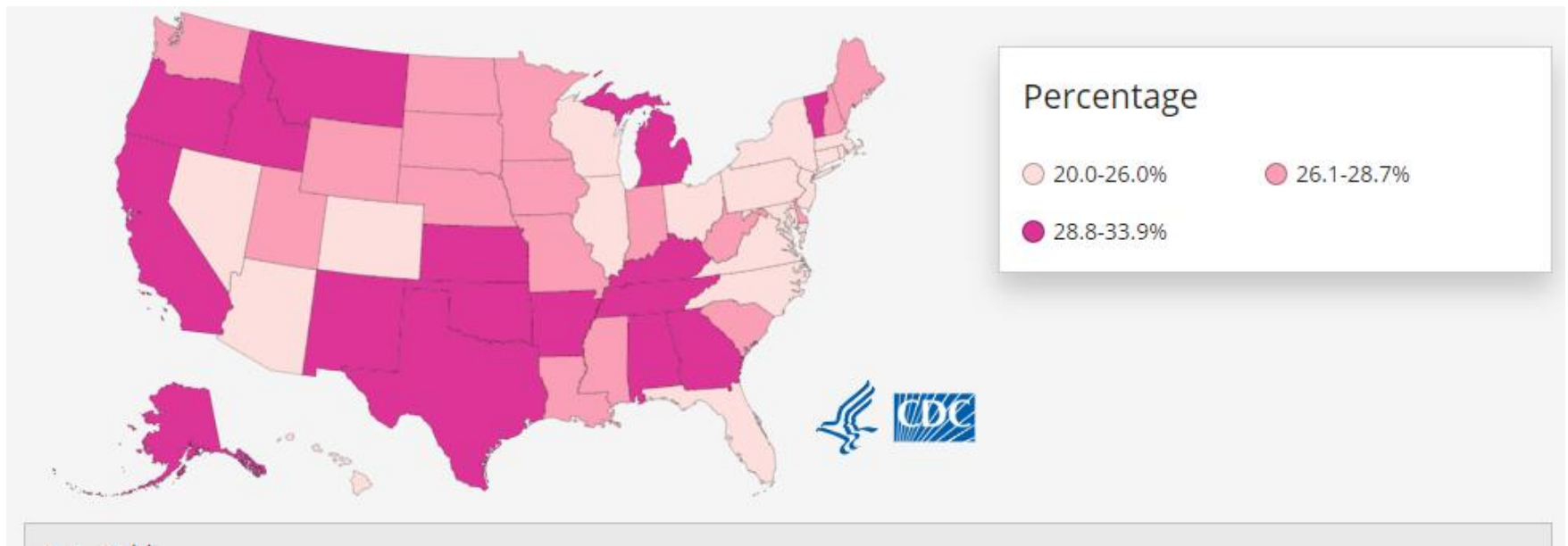
33% of older adults fall annually ...



and only 1/2 talk to their doctor about it

Percentage of older adults in New Mexico who reported falling: 29.6%

Falls reported by State (CDC 2018)



How Big is the Problem ?



Community: 30-40% fall

- 50% of those aged 80+ years
- 50% of fallers will fall 2+ times/year

Acute Care Hospitals:

700,000-1 million, tend to be injurious/fatal

Nursing Homes:

A 100 bed home typically has 100-200 falls/year

Range: 10-20% of patients per quarter

Home Care:

14% of patients fall in first month after hospital discharge

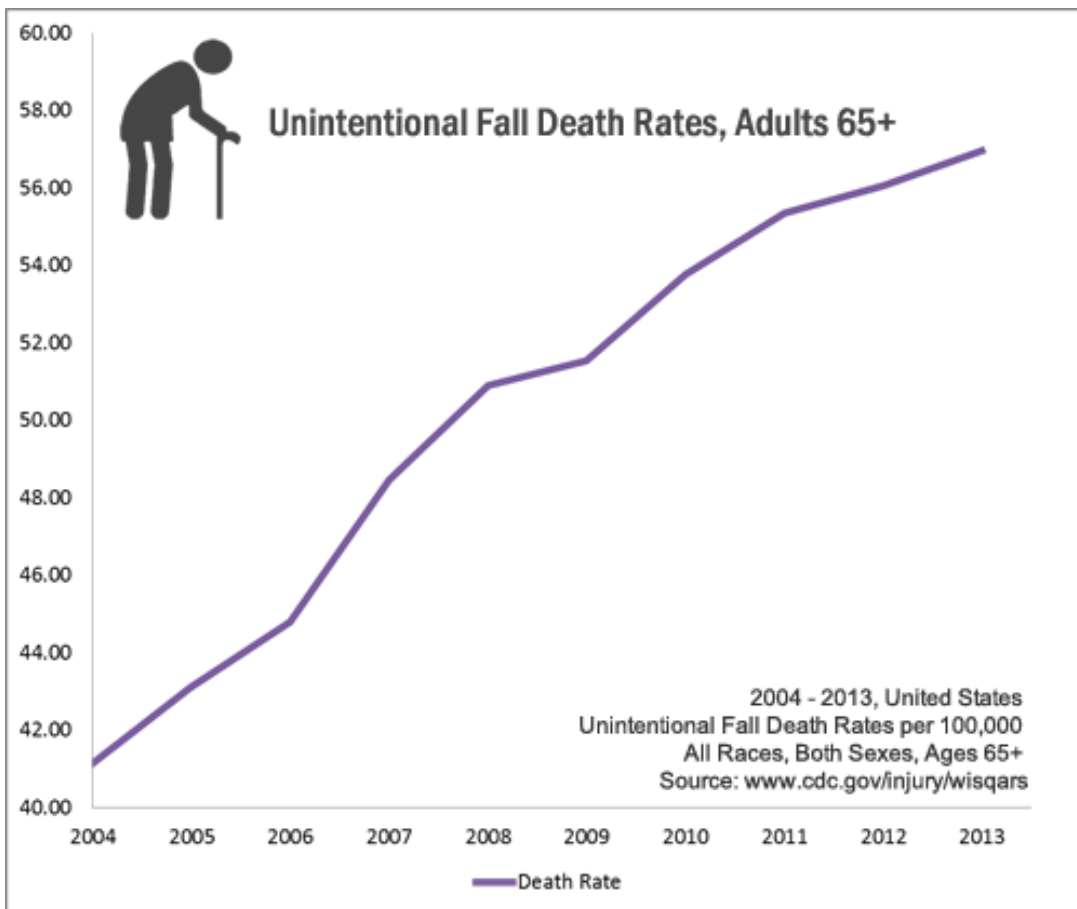
Why Are We Here? An Overview of Falls among Older Adults Dorothy Baker, Ph.D., RN, Research Scientist Internal Medicine, Geriatrics Director, CT Collaboration for Fall Prevention Yale University School of Medicine New Haven, CT

What Are the human consequences ?

- Fear/Loss of confidence
- Functional decline
- Injury—soft tissue, bone fractures & traumatic brain injury (TBI)
- Permanent disability especially after hip fx and TBI
- Nursing home placement:
 - 1 fall increases risk X 3
 - 1 injurious fall increases risk X 10

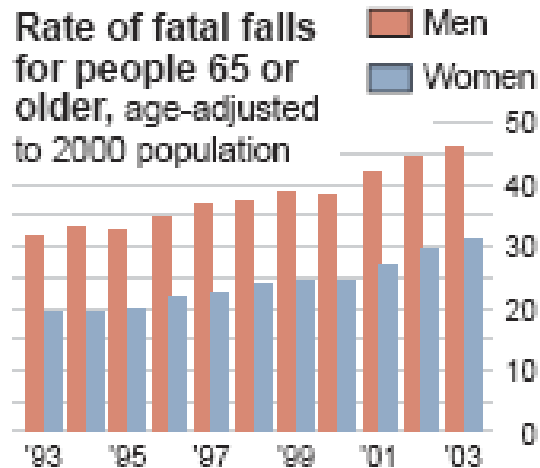
Fall Fatalities

- Leading cause of fatal injury:
~25,500 in 2013, and rising



Fatal falls rising among the elderly

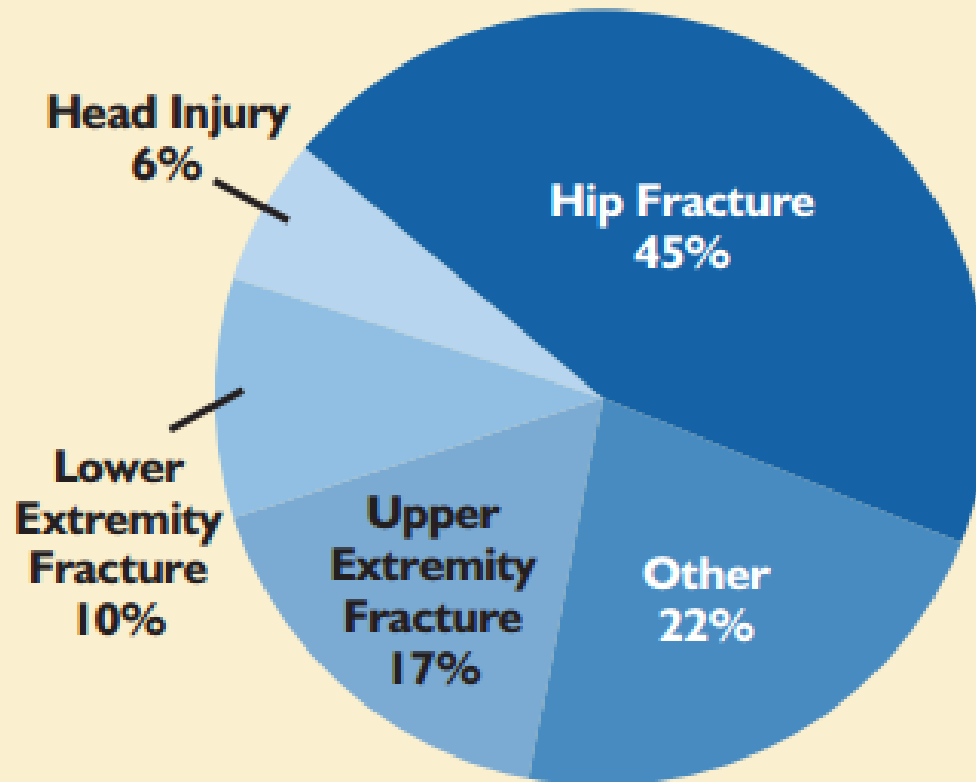
The death rate for elderly people falling has risen 55.3 percent from 1993-2003.



SOURCE: Centers for Disease Control and Prevention

AP

FIGURE 5:
Injuries Associated with Falls

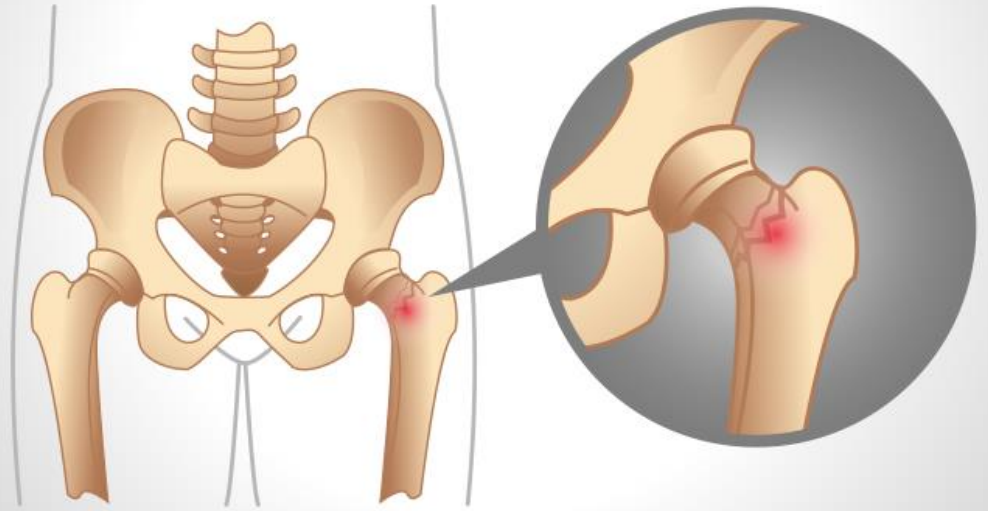


250,000 Hip Fractures



95%

OF **BROKEN HIPS**
HAPPEN BECAUSE
THE PERSON FALLS



Falls are the most common cause of
traumatic brain injuries (TBI)

What are the financial consequences?

CDC 2015 estimate:

Direct medical costs of falls: \$50 billion

Includes hospital and nursing home care, doctors and other professional services, rehabilitation, community based services, use of medical equipment, prescription drugs, changes made to the home, and insurance processing.

Medicare and Medicaid shouldered 75% of these costs.

Fall Risk Factors

- Sedentary or immobilized → Deconditioned State
- Polypharmacy = 4+ scripts on regular basis
- Postural hypotension (Feeling dizzy when standing)
- Sensory Deficits: vision , hearing, feet, cognitive
- Environmental factors → hazards including inappropriate footwear, unsafe fit, assistive device disuse.

Polypharmacy Risks

Antidepressants	OR 1.68
Neuroleptics and antipsychotics	OR 1.59
Benzodiazepines	OR 1.57
Sedatives and hypnotics	OR 1.47
Antihypertensive agents	OR 1.24
Nonsteroidal anti-inflammatory drugs	OR 1.21
Diuretics	OR 1.07
Beta-blockers	OR 1.01
Narcotics	OR 0.96

Woolcott, John C., Kathryn J. Richardson, Matthew O. Wiens, Bhavini Patel, Judith Marin, Karim M. Khan, and Carlo A. Marra. "Meta-Analysis of the Impact of 9 Medication Classes on Falls in Elderly Persons." *Archives of Internal Medicine* 169, no. 21 (November 23, 2009): 1952–60. doi:10.1001/archinternmed.2009.357.

Speak with your Physicians about your medications:

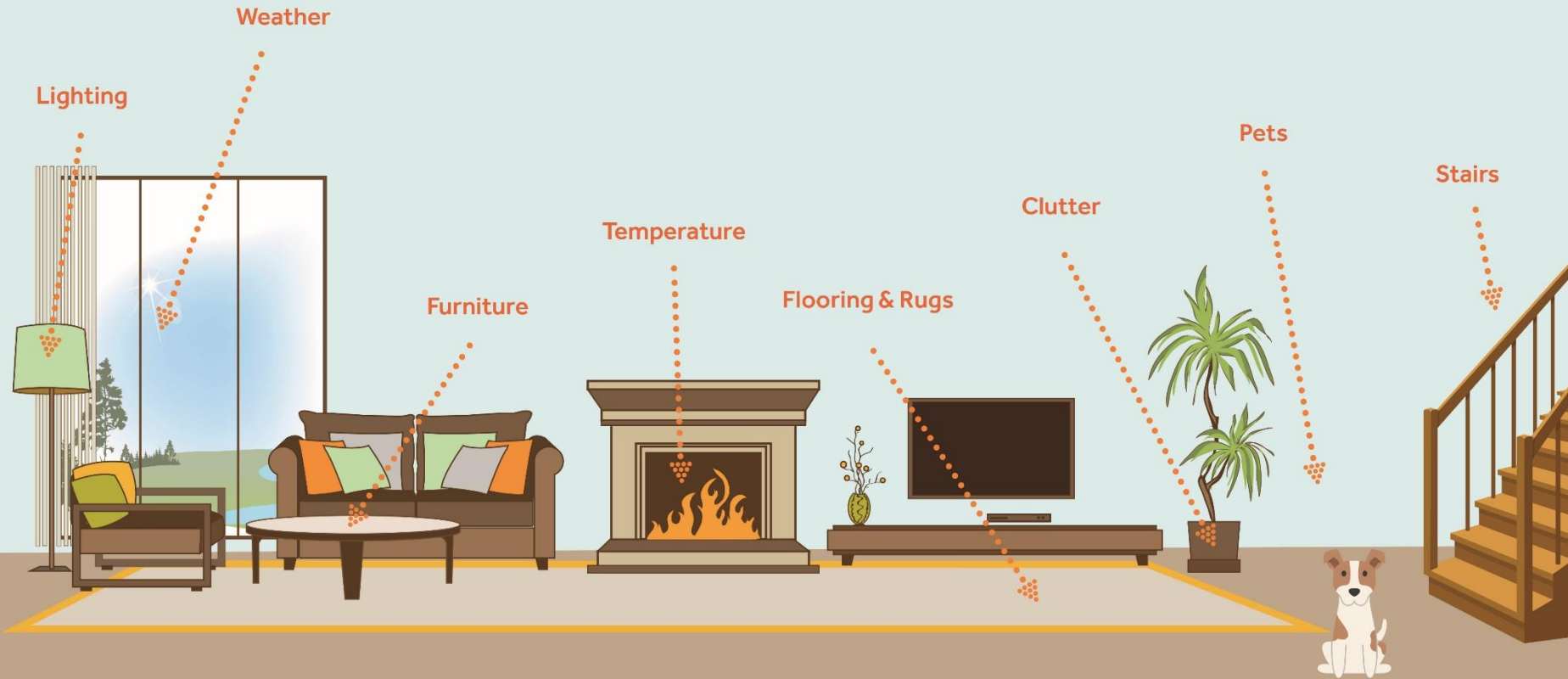
Questions to ask:

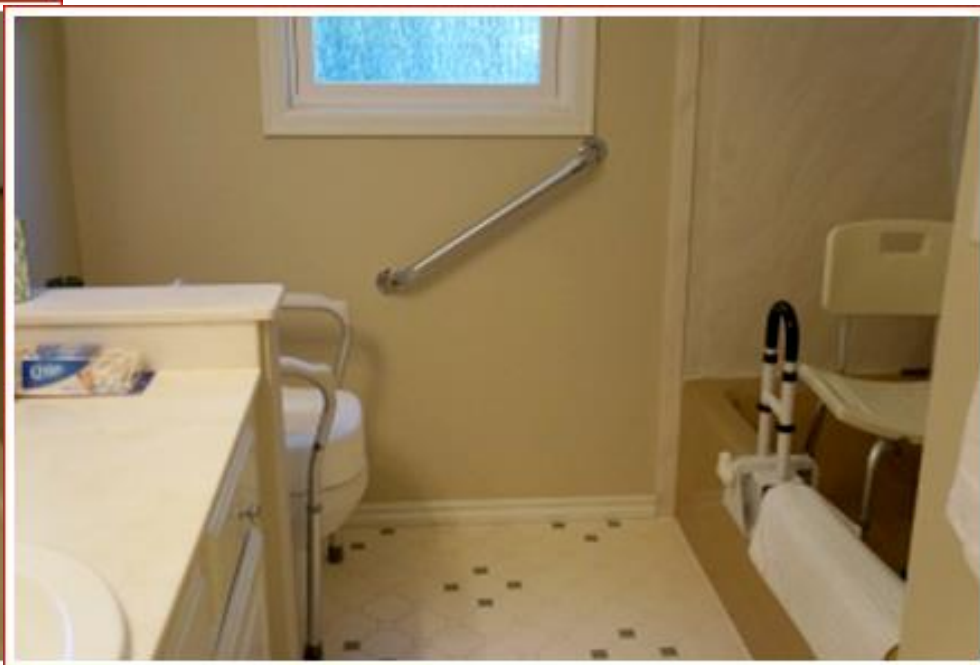
What problem is this medication meant to treat or manage? What other options are available to manage this problem? (Don't forget to ask about non-drug treatments!)

What are the benefits of continuing the medication? What are the likely risks and benefits of discontinuing the medication?

Is a lower dose of this medication an option? What are the pros and cons of trying a lower dose?

What causes falls within the home?





Outside Fall Factors



Traditional Falls Prevention Programs Target

- Lower-limb muscle weakness
- General balance improvements
- Medication intervention
- Environmental modification

STEADI

Stopping Elderly
Accidents, Deaths & Injuries

Neglected Risk ?

Foot problems

Estimated to impact one in three community dwelling people older than 65 years.

Spink, MJ , HB Menz , MR Fotoohabadi , et al. Effectiveness of a multifaceted podiatry intervention to prevent falls in community dwelling older people with disabling foot pain: randomised controlled trial. *BMJ* 342:d3411. 2011.

Dunn, JE , CL Link , DT Felson , et al. Prevalence of foot and ankle conditions in a multiethnic community sample of older adults. *Am J Epidemiology* 159:491. 2004.

Podiatric Risk Factors

Severe Hallux Valgus (RR 2.36) ¹

Lesser Toe Deformities (RR 1.32) ¹



Going barefoot or in socks (OR=11) ²

Heel height > 2.5cm (OR 1.9) ³

¹ Mickle, Karen J., Bridget J. Munro, Stephen R. Lord, Hylton B. Menz, and Julie R. Steele. "ISB Clinical Biomechanics Award 2009: Toe Weakness and Deformity Increase the Risk of Falls in Older People." *Clinical Biomechanics (Bristol, Avon)* 24, no. 10 (December 2009): 787–91. doi:10.1016/j.clinbiomech.2009.08.011.

² Koepsell, Thomas D., Marsha E. Wolf, David M. Buchner, Walter A. Kukull, Andrea Z. LaCroix, Allan F. Tencer, Cara L. Frankenfeld, Milda Tautvydas, and Eric B. Larson. "Footwear Style and Risk of Falls in Older Adults." *Journal of the American Geriatrics Society* 52, no. 9 (September 1, 2004): 1495–1501. doi:10.1111/j.1532-5415.2004.52412.x.

Menant, Jasmine C., Julie R. Steele, Hylton B. Menz, Bridget J. Munro, and Stephen R. Lord. "Optimizing Footwear for Older People at Risk of Falls." *Journal of Rehabilitation Research and Development* 45, no. 8 (2008): 1167–81.

Podiatric Risk Factors



- **Fallers had 12% less AJ dorsiflexion**
- **22.7% more fallers failed lesser digital grip test**
- **Fallers had reduced tactile sensation at 1st MPJ**
- **Fallers 18% prevalence of disabling foot pain**
- **HAV deformity worse in fallers vs non-fallers**

Menz Foot & Ankle Risk Factors for Falls
in Older People: A Prospective Study J of Gerontology 2006, 8:866

Myth: Foot pain is normal as you age.

Don't ignore pain. Pain IS NOT a normal part of aging.

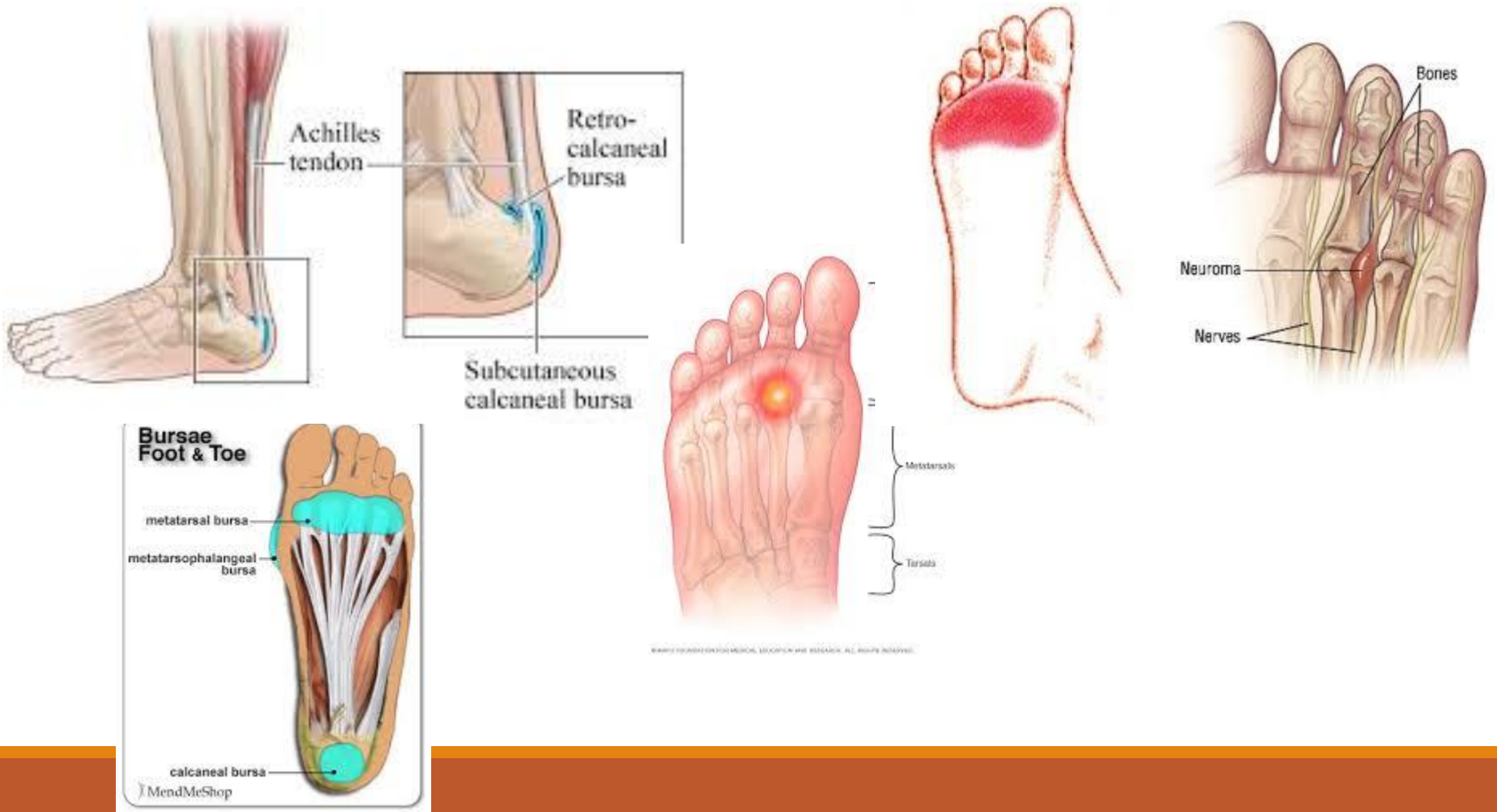
Understand and ask questions about your care plan for pain.

Use relaxation methods to decrease anxiety and muscle tension.

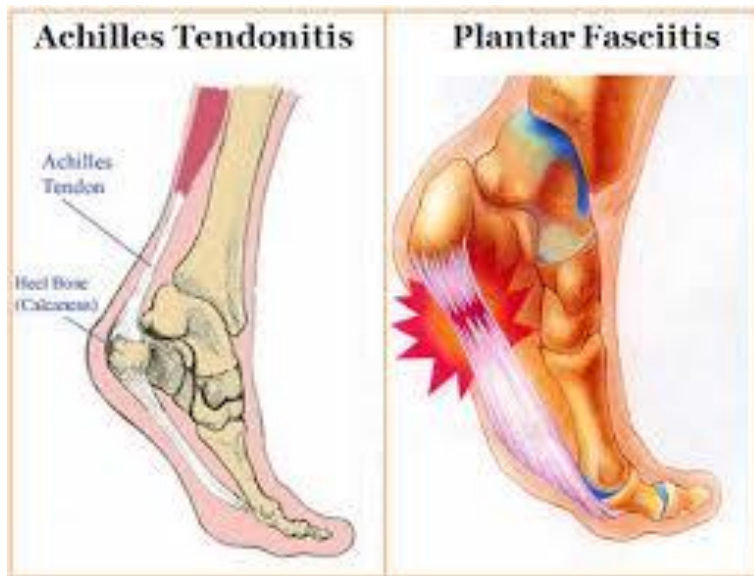
Team Approach in the Treatment & Rehab Process

Common Causes for Pain in Feet/Ankles/Legs

Bursitis /Capsulitis / Metatarsalgia/Neuroma(Neuritis)



Overuse Tendon injuries (tendinopathies)



Posterior
Tendonitis



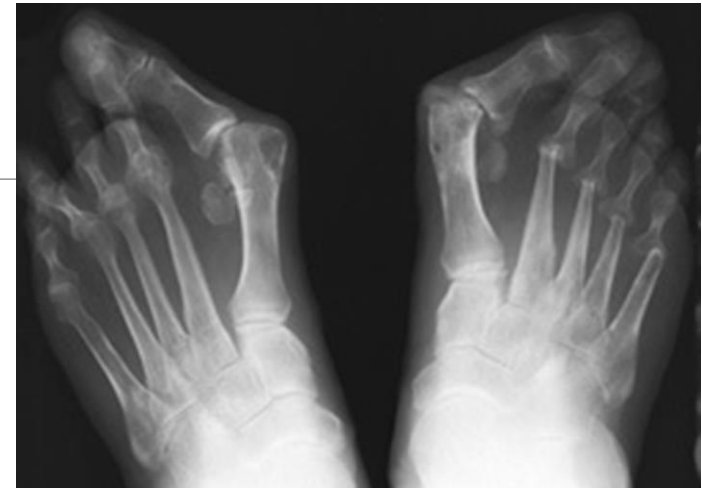
Arthritis



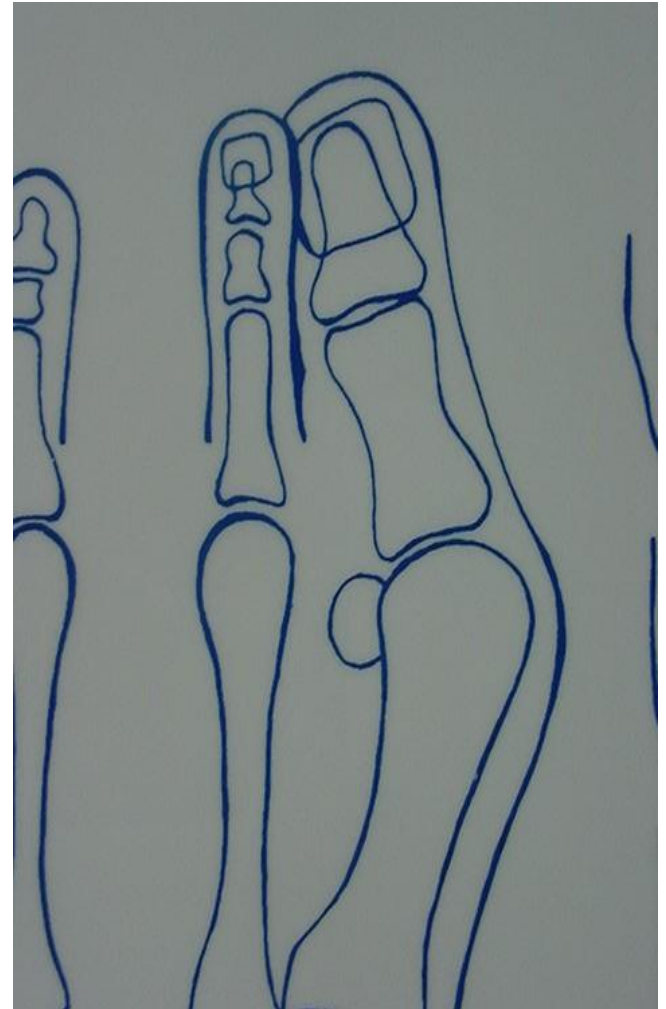
© Healthwise, h00026140



RA



Bunion /HAV Deformities







Hammertoe

Mickle -Toe Weakness & Deformity Increase the Risk of Falls in Older People. Clin Biomech 2009, 787

Prospective trial of 312 elderly

Findings

- **35% of subjects fell 1 time during 12 months**
 - **33.6% of fallers fell 2+ times (12% of total cohort)**
- **A total of 178 falls occurred**
- **55% of falls resulted in injury**
 - **5% required hospitalization**
 - **30% required medical treatment**
- **Fallers had less grip strength for all digits**
- **Fallers more likely to have severe HAV (RR:2.36)**
- **Fallers more likely to have lesser toe deformity (RR:1.32)**

Prevent a Fall



PTTD – Tendon Dysfunction



Dropfoot and other muscle weakness/imbalance

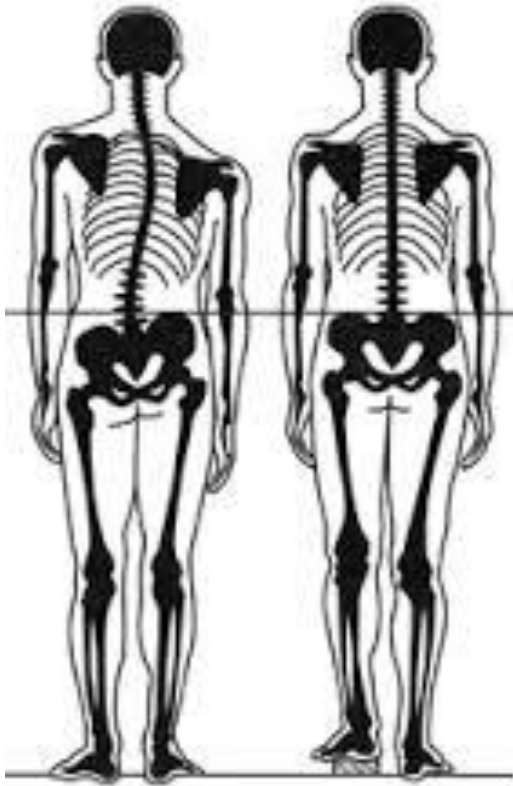


People suffering Drop Foot drag their toes along the ground or bend their knees to lift their foot higher than usual to avoid them dragging



Short Limbs

(Leg Length Discrepancy – LLD)



If You Suffer With

PERIPHERAL NEUROPATHY

"Come learn more about this condition. In 1 hour, that you have in your entire lifetime."



- Pins and Needles
- Numbness/Tingling
- Loss of Balance
- Pain Feet/Hands
- Burning Sensation
- Can't Feel The Ground

Does an Increase in Neuropathy Severity Increase the Fear of Falling?

34 Diabetic Adults with differing levels of neuropathy

82% of participants had a moderate to high concern about falling

Conclusion: The fear of falling is prevalent among older adults with diabetes mellitus but appears to be unrelated to level of neuropathy

Kelly, C , A Fleischer , S Yalla , et al. Fear of falling is prevalent among older adults with diabetes mellitus but unrelated to level of neuropathy. JAPMA 103:480. 2013.

Can Podiatric Surgical Intervention Reduce Falls?

Explored whether corrective hallux valgus (HV-Bunion) surgery might improve gait and balance performance in an adult patient population.

- 40 Adults with HV-Bunion
- Postoperative patients exhibited significant balance improvements on average by 29% and 63% than preoperative patients during double and single support balance assessments.

Sadra, S , A Fleischer , E Klein , et al. Hallux valgus surgery may produce early improvements in balance control: results of a cross-sectional pilot study. JAPMA 103:489. 2013.

Footwear Risks



Available studies

- Walking barefoot/socks increased risk by 11 times as compared to athletic or canvas shoes (Koepsell, 2004)
- 33% of hospitalized fall induced hip fractures were wearing slippers at time of fall (Hourihan, 2000)
- Poor fitting shoes contributed to 51% of falls in hospitals (Barbieri, 1983)
- Underlying Factors for Selection of Footwear Among Older Adults – Esthetics and loss of decision-making (Davis, 2013)

Must be why they're called "slippers"

Walking in socks or slippers is a strong independent factor for falls (OR=5.5)



Larsen ER, Mosekilde L, Foldspang A. Correlates of falling during 24 h among elderly Danish community residents. *Prev Med.* 2004;39(2):389–98. [[PMID: 152260511](#)]

107 older people who were admitted to hospital following a fall-related hip fracture, 33% were wearing slippers and 68% wore shoes with flexible heel counters at the time of fracture



Hourihaan F, Cumming RG, Taverner-Smith KM, Davidson I. Footwear and hip fracture-related falls in older people. *Aust J Ageing* 2000; 19: 91–3.

Suboptimal Footwear



- 72% of rehab unit residents wore ill-fitting shoes
 - 90% were either too long or too wide
- 53% of geriatric outpt unit wear appropriate shoes (Finlay, 1986)
- 128 residents of geriatric unit
 - 28% wore inadequately fixed shoes leading to heel slippage
 - 25% wore shoes with an elevated heel height
 - 11% wore shoes that were beyond repair

Menant, et al Optimizing footwear for older people at risk for falls. J of Rehab Res Devel, 2008 45, 8, 1167-82

Optimal House Shoes



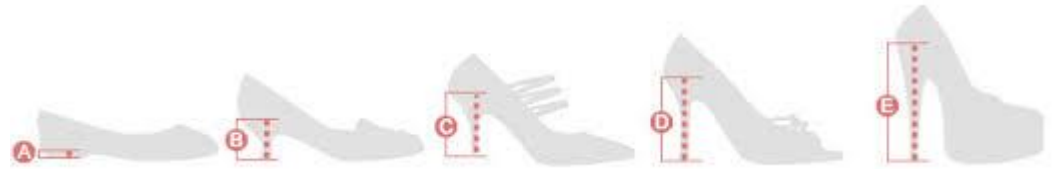
Walking on Slippery Surfaces: Are Nonslip Socks Effective?



Examined gait parameters of 15 older people performing five trials of the fast-paced Timed Up and Go (TUG) test on a slippery surface, wearing nonslip socks, compared with standard socks and barefoot conditions.

- Results suggest that older people took significantly longer to complete the TUG when walking in standard socks compared with barefoot and nonslip socks.

Hatton, AL , DL Sturnieks , SR Lord , et al. Effects of nonslip socks on the gait patterns of older people when walking on a slippery surface. JAPMA 103:471. 2013.



Heel Height

- Heel height of $>2.5\text{cm}$ increased odds of fall by double (OR:1.9) as compared to athletic or canvas shoes
- Shifts COM forward- Impairs balance control
- Increased FF loading with greater pressure in medial FF
 - Associated with pain and callus
- Gait changes
 - Slower walking speed, shorter stride length, increased cadence
- Muscle Activity
 - Reduced PL endurance
 - Imbalance of medial and lateral gastrocnemius heads (causes lateralization of COP under heel and 1st met head)
 - Decreased gastrocnemius activity

Sole Cushioning

- Shore A-15 =soft, Shore A-58=hard soles
 - Sole hardness by itself doesn't appear to affect balance
- Thick & soft soled shoes impair stability during walking by reducing foot position awareness and mechanical stability
- Midsole instability results in frontal plane movements at ankle level

Collar Height



- Provide greater mechanical stability to ankle joint
- High tops resist inversion better and reduce ankle inversion velocity as compared to low tops
- Additional sensory input enhances positional sense
 - Improves medial-lateral balance control
 - A tactile stimulus applied to neuropathic patients reduced standing body sway

Menant, et al Optimizing footwear for older people at risk for falls. J of Rehab Res Devel, 2008 45, 8, 1167-82

Are Orthotic inserts helpful ?



Is Bracing Effective ?



Best-case scenarios: AFOs can compensate for existing balance deficits, reducing fall risks, improving confidence, and facilitating greater activity and participation.

AFOs also have the potential to further compromise balance with the undesirable sequelae of possible falls and related injury, an increased fear of falling, and subsequent activity restriction.

Complex Issue – Currently Case by Case Evidence

Research is currently happening to help answer this important question.



"Bad news. You have to start wearing sensible shoes."

How Do Older Adults Perceive Footwear Beneficial for Improving Balance?

Patient centered study – 16 interviewees

- **Footwear choice influenced their balance confidence to undertake daily tasks.**
- **Most found their therapeutic footwear “difficult” to walk in, “heavy,” or “slippery bottomed.”**
- **The authors suggest design recommendations for enhanced balance including a close fit with tight fastening, a lightweight and substantial tread, and a firm molded sole/insole.**

Paton, JS , A Roberts , GK Bruce , et al. Does footwear affect balance? The views and experiences of people with diabetes and neuropathy who have fallen. JAPMA 103:508. 2013.

What's "key" in Shoe Fit ?

- Proper sizing
- Fastener /closure system of shoe
- Correct shoe matched with activity requirements



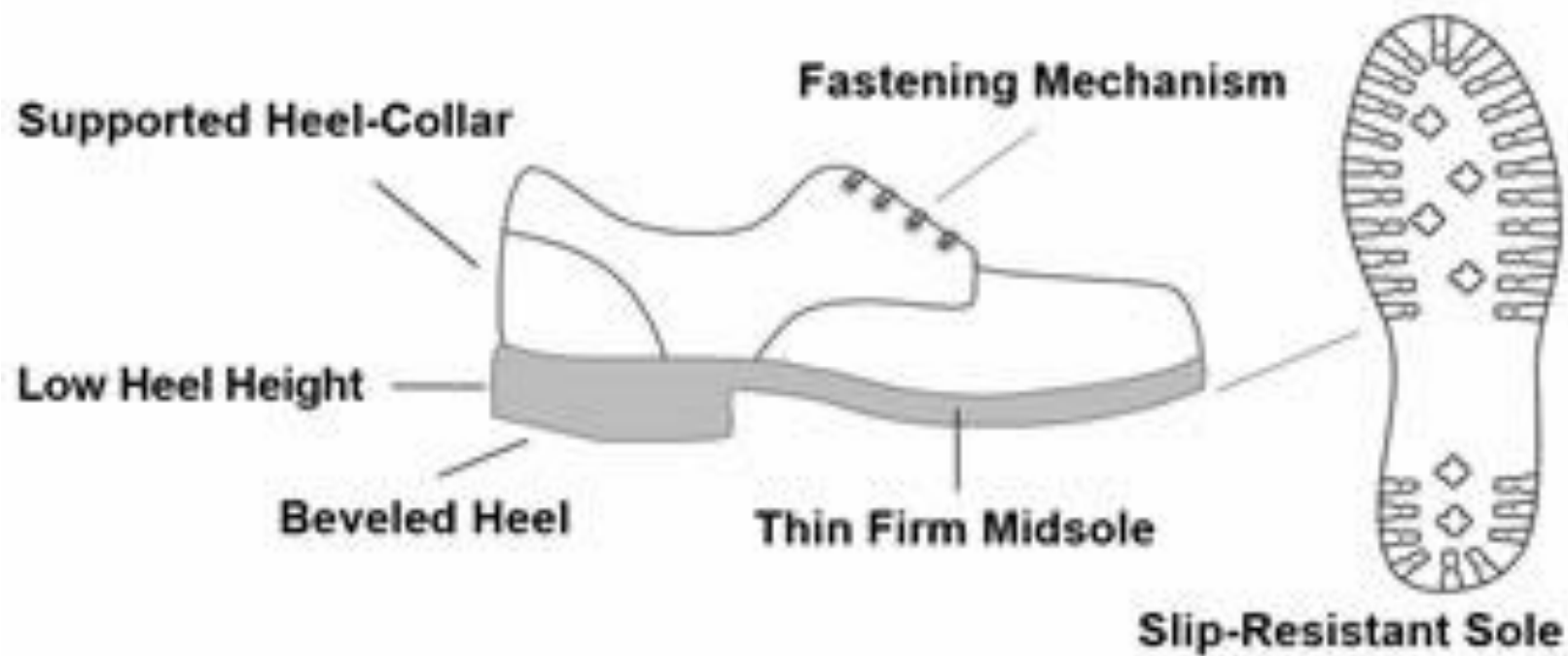


Figure.

Recommended shoe features for older people.

Worn-Out Shoes – Discard !

Footwear not providing needed shock absorption and support.



You Choose -



VS





VS





VS



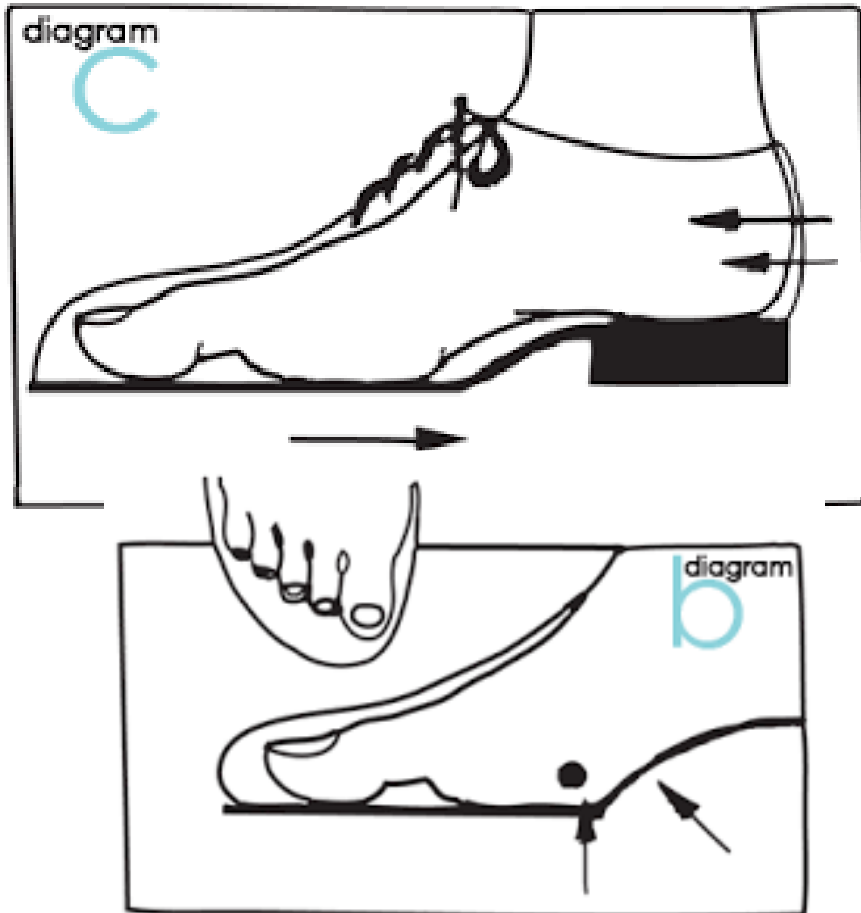
Therapeutic Footwear 20th Century



Therapeutic Footwear 2020



Shoe Fit Pointers



Myth: A snug fitting shoe supports your foot better.

Myth busted: The opposite is true here. Having a snug fit is like having a corset for your feet. Tight lacing and snugness prevents the natural spread of the transverse arch on landing and the longitudinal arch on functional pronation. These two functions are critical for shock absorption. Snugness in the toe box prevents the natural spread of the toes, neglecting them of their function in propulsion and stability.

Flexible Vamps accommodate deformities



Other Shoe Fit Advice -

- Try on shoes later in the day when your feet may be “fuller” in size.
- Keep in mind not all brands have the same sizing. Do not expect even within the same brand of shoes that sizing of different styles are the same.
- No two feet are the same size. Shoes need to fit your larger/wider foot optimally.
- Shoes should feel comfortable when initially fit – the materials may “break-in” with time but the fit should be optimal at time of purchase.
- Using other people’s shoes is not advised but if necessary disinfect insides of shoes with spray disinfectant or dilute bleach solution.

Q& A Thank You

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