



UNIVERSITY  
OF WOLLONGONG  
AUSTRALIA

University of Wollongong  
Research Online

---

Faculty of Health and Behavioural Sciences - Papers  
(Archive)

Faculty of Science, Medicine and Health

---

2008

# High plantar pressures and foot pain: Are they contributing to falls in older adults?

Karen J. Mickle

*University of Wollongong*, kmickle@uow.edu.au

Bridget J. Munro

*University of Wollongong*, bmunro@uow.edu.au

S. R. Lord

*Prince of Wales Medical Research Institute*

Hylton B. Menz

*LaTrobe University*

Julie R. Steele

*University of Wollongong*, jsteele@uow.edu.au

---

## Publication Details

This conference paper was originally published as Mickle, KJ, Munro, BJ, Lord, SR, Menz, HB and Steele, JR, High plantar pressures and foot pain: Are they contributing to falls in older adults?, Emed Scientific Meeting 2008, Dundee, Scotland, 28-31 July 2008. Original conference information available [here](#)

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: [research-pubs@uow.edu.au](mailto:research-pubs@uow.edu.au)

---

# High plantar pressures and foot pain: Are they contributing to falls in older adults?

## **Abstract**

Falls, the leading cause of injuries in older adults, typically occur during ambulation. As such, gait and balance abnormalities are frequently cited as falls risk factors. During normal gait, the foot is the only source of direct contact with the ground and, therefore, it plays a substantial role in maintaining stability and balance. Foot pain has been found to impair balance and gait in women (Leveille, 1998), and has been shown to be falls risk factor in institutionalised elders (Menz, 2006), however it unknown whether foot pain is a risk factor for falling in community-dwelling older adults. As foot pain is a common complaint in older adults, it is important to determine whether foot pain is a falls risk factor. Despite providing detailed information about the function of the foot during gait, dynamic plantar pressures have not been investigated as a falls risk factor. Therefore, the purpose of this study was to determine whether foot pain and/or plantar pressures are associated with falls in the elderly.

## **Keywords**

Falls, foot pain, high plantar pressures

## **Disciplines**

Arts and Humanities | Life Sciences | Medicine and Health Sciences | Social and Behavioral Sciences

## **Publication Details**

This conference paper was originally published as Mickle, KJ, Munro, BJ, Lord, SR, Menz, HB and Steele, JR, High plantar pressures and foot pain: Are they contributing to falls in older adults?, Emed Scientific Meeting 2008, Dundee, Scotland, 28-31 July 2008. Original conference information available [here](#)

# HIGH PLANTAR PRESSURES AND FOOT PAIN: ARE THEY CONTRIBUTING TO FALLS IN OLDER ADULTS?

Karen. J. Mickle (1), Bridget. J. Munro (1), Stephen. R. Lord (2), Hylton. B. Menz (3), Julie. R. Steele (1)

1. Biomechanics Research Laboratory, University of Wollongong, NSW, Australia
2. Prince of Wales Medical Research Institute, NSW, Australia
3. Musculoskeletal Research Centre, LaTrobe University, VIC, Australia

## INTRODUCTION

Falls, the leading cause of injuries in older adults, typically occur during ambulation. As such, gait and balance abnormalities are frequently cited as falls risk factors. During normal gait, the foot is the only source of direct contact with the ground and, therefore, it plays a substantial role in maintaining stability and balance.

Foot pain has been found to impair balance and gait in women (Leveille, 1998), and has been shown to be falls risk factor in institutionalised elders (Menz, 2006), however it unknown whether foot pain is a risk factor for falling in community-dwelling older adults. As foot pain is a common complaint in older adults, it is important to determine whether foot pain is a falls risk factor.

Despite providing detailed information about the function of the foot during gait, dynamic plantar pressures have not been investigated as a falls risk factor. Therefore, the purpose of this study was to determine whether foot pain and/or plantar pressures are associated with falls in the elderly.

## METHODS

Three hundred and twelve older men and women aged between 60-90 years were randomly recruited to participate in the study. Subjects completed the Manchester Foot Pain and Disability Index (Garrow, 2004) to assess the presence of foot pain. The subjects then walked across an emed AT-4 pressure platform (25 Hz; Novel<sub>gmbh</sub>) using the second-step method.. Participants were then followed prospectively to determine their falls incidence over 12 months.

Pressure data were analysed for each subject's dominant foot, using Novel Projects, by dividing each footprint into 10 regions using the Novel mask set. Peak plantar pressures (kPa) and pressure-time integrals (kPa.s; PTI) were calculated for each region.

Each subject was categorised as a non-faller, single faller or multiple faller based on the number of falls experienced throughout the year. Chi-square values were calculated to determine whether the incidence of foot pain differed for each fall category while a one-way ANOVA design was used to determine any significant differences in the pressure variables between the fall groups.

## RESULTS

Multiple fallers (n = 36) displayed a significantly higher incidence of foot pain than non-fallers (n = 196;  $\chi^2=8.42$ ;  $p = 0.004$ ). However, there was no difference in foot pain between the single fallers (n = 71) and the other two subject groups. Multiple fallers generated significantly higher peak plantar pressures when walking compared to the single or non-fallers in the heel, midfoot, 2<sup>nd</sup> toe and total regions of the foot. Multiple fallers also had significantly higher PTIs at the heel, midfoot, 1<sup>st</sup> MTH, 2<sup>nd</sup> toe, toes 3-5 and total foot regions than their counterparts (see Figure 1).

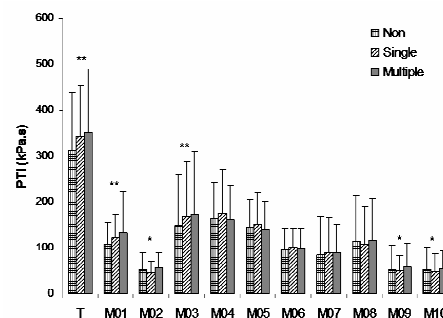


Figure 1: Mean (+SD) PTI generated under each masked region. \*\* multiple and single vs. non-fallers; \* multiple vs. single fallers ( $p \leq 0.05$ ).

## CONCLUSION

The results from this study are the first to confirm that older people who incur multiple falls generate higher plantar pressures during gait relative to single fallers or non-fallers. It is postulated that these high plantar pressures are contributing to the increased foot pain and discomfort suffered by multiple fallers, which, in turn, may cause gait and balance disturbances, predisposing these individuals to falls. Providing interventions those older individuals with foot pain and high plantar pressures may result in reducing their risk of future falls.

## REFERENCES

- Garrow *et al*, Pain 110:378-84, 2004.  
Leveille *et al*, Am J Epidemiol 148:657-65, 1998.  
Menz *et al*, J Gerontol 61A:866-870, 2006.