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## Feature Article

## Optimal choice of footwear in the elderly population

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## ABSTRACT

To discover whether changes in foot morphology and pain tolerance may favor the use of inadequate footwear in old age. 100 participants, mean age  $81.60 \pm 8.26$  years attended an outpatient clinic where self-reported demographic data, frequency checked their feet, measurements of foot sensitivity, foot size and shoe size. Only 19% checked their feet every day, 73% revealed symptoms of neuropathy and 83% used inadequate footwear on at least one foot. In a bivariate analysis, no significant differences were observed. Distinct physical changes affect the feet in the elderly population. Decreased sensitivity and absence of regular foot checks can contribute to use of inadequate footwear. Often, it is necessary to use a different shoe size to ensure that the footwear matches the actual dimensions and true needs of each foot in order to improve functionality and prevent the onset of severe medical conditions and/or foot deformities.

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## Introduction

The prevalence of foot complications among the elderly population has increased as a consequence of longer lifespan. Such problems currently affect between 71 and 87% of senior citizens and are a frequent cause of medical foot care.<sup>1</sup> These issues have a negative influence on functional capacity and quality of life.<sup>2,3</sup>

The frequency of podiatric pathology in the population over 65 years old in Spain is approximately 90%.<sup>4</sup> Further, the recent study conducted by Martínez-Gallardo Prieto in 171 institutionalized women, determined that 93% exhibited some type of podiatric condition; the most frequent alteration found were hammer toes

followed by lesser toes callus, nail changes and hallux valgus abductus and fungal infection.<sup>5</sup> Diseases and disorders of the foot and related anatomical structures in the older patient induce pain and limit function that can affect their quality of life, dignity, and ability to remain independent.<sup>6</sup> The improper fit of a shoe can lead to painful bunions, functional limitations, and falls.<sup>7,8</sup> These problems occur more frequently in females than in males, with the most common pathologies being the presence of bunions and plantar keratoses that often become both permanent and painful.<sup>3,9</sup>

Furthermore, changes of the foot morphology occur during this period of life, resulting in an increased foot width and length, combined with increased pain tolerance, which together may favor the use of inadequate footwear. The negative consequence of this combination is foot pain, limited walking mobility, and changes in pressure distribution between the feet due to a loss of balance, all of which can severely impact personal health, independence and general well-being.<sup>10–13</sup> These physical changes to the feet in combination with many pathological conditions, such as osteoarthritis, rheumatoid arthritis, gout, pes planus, and others frequently contributes to the need of shoe modifications in the geriatric population; however, often those affected do not realize it.<sup>14</sup>

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The study of Nixon et al,<sup>15</sup> with a veteran population showed that individuals with diabetic foot ulceration were 5.1 times more likely to have poorly fitting shoes than those without a wound. This association was also evident when assessing only the 32.3% of the total population with diabetes and loss of protective sensation. Based on previous reports of this age group, the aim of our research was to determine whether changes in foot morphology and pain tolerance contributed to the use of inadequate footwear in the elderly population.

We hypothesized that age-related changes to the foot, including loss of sensitivity and low frequency of foot health checks, all favour the use of inadequate footwear in the elderly population.

## Methods

### Participants

A total of 100 older people participated in the study. This descriptive observational study was carried out in a health podiatric centre in the city of A Coruña (Spain) between January and September 2013. A non-randomized and consecutive sampling method was used to select the 132 participants, of which 100 gave consent and were enrolled into the study. Inclusion criteria: age 65 or over. Exclusion criteria: under 65 years of age, immunocompromised, previous foot trauma or foot surgery, neurological condition, non- or semi-autonomous in daily activities, and unable to understand instructions relating to the study and/or carry them out. This research was approved by the Research Ethics Committee at the University of A Coruña (Spain), case number CE 11/2013. All participants gave informed written consent before being included, and the ethical standards in human experimentation contained in the WMA Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine, the UNESCO Universal Declaration on the Human Genome and Human Rights and those of the relevant national bodies and institutions were observed at all times.

### Procedure

Data were collected at a single clinic. Demographic characteristics (age, gender, marital status, income, education) and the frequency with which they checked their feet were recorded a single examiner. Participants then removed their footwear and hosiery, after which a single researcher assessed the degree of flexibility toes were deformed using the Kelikian push-up test. This test involved pressing upward on the plantar aspect of the metatarsal head, and in flexible deformities, the MTP joint will align and the proximal phalanx will assume a more normal position.<sup>16</sup>

### Measurements

The foot sensitivity exam utilized a 10 g Semmes-Weinstein 5.07 monofilament nylon wire which is reliable and specific for identifying loss of protective sensation in older adults ( $\kappa = 0.74$ ;  $r_s = 0.89$ – $0.93$ ).<sup>17</sup> The monofilament was pressed against the following areas of the foot: the dorsal surface, between the base of the first and second toe, the plantar surface, on the ball of the foot (distal phalanges) of the first, third and fifth toes, the first, third and fifth metatarsal heads; the lateral and mid points of the internal and external longitudinal arches, and the heel.<sup>18,19</sup> A positive result (insensitivity) was recorded if the participant gave a negative response for a minimum of 4 out the 10 pressure points assessed on each foot.<sup>20,21</sup> A validated Brannock Device (BD) measuring instrument, shown to be reliable with an intraclass correlation coefficient (ICC)  $[3,1] = 0.96$ – $0.99$ , was used to record foot size measurement, length and width.<sup>22</sup> Each participant stood in a

relaxed posture, barefoot with feet slightly apart and their weight evenly distributed. The same researcher helped them to place their foot correctly in the device, with the heel located against the back of the heel cup, and measured the distance to the end of the longest toe (which is not necessarily the first toe).<sup>23,24</sup> The same protocol was used for the other foot as well as to measure shoe size.

### Data analysis

Qualitative variables are shown as absolute values and percentages, whilst the quantitative variables described are the mean, median, standard deviation (SD) and maximum and minimum values. A chi-square test was used to compare the qualitative variables and Student's *t*-test to compare the means. To test whether continuous data were normally distributed, the Kolmogorov Smirnov test was used. Data were not normally distributed, so non-parametric tests were used to confirm significant differences between groups. For categorical variables, the Chi-square test was used and for continuous variables that were not normally distributed, the Mann–Whitney *U* test was used. In the analyses,  $P < 0.05$  (with a 95% confidence interval) was considered statistically significant. Data analysis was conducted with SPSS software, version 19.0 (SPSS Science, Chicago, Illinois).

## Results

### Sample characteristics

A total of 100 senior citizens completed all stages of the research process (26 men, 30.4%; 74 women, 69.6%). The mean age was  $81.60 \pm 8.26$  years (range 65–95 years). The majority of participants lived in an urban environment, were widowed, had a low level of education and enjoyed a medium level of income (Table 1).

A majority of the participants (88%,  $n = 88$ ) stated they suffered from foot problems, and a subsequent physical examination revealed that 17% had deformed toes, 43% had nail or keratotic disorders and 28% had bunions. Furthermore, 73% of the senior citizens who participated in the survey suffered from sensory impairment, defined as the lack of feeling in eight of the twenty points on the two feet upon Semmes-Weinstein monofilament examination.

### Self-reporting questionnaire: frequency of foot health check

Responses to the self-reporting questionnaire revealed that the frequency with which participants carried out foot health checks

**Table 1**  
Socio-demographic characteristics of the sample.

	Total	Women ( $n = 74$ )		Men ( $n = 26$ )	
	N	N	%	N	%
Place of residence					
Urban	73	58	78.38	15	57.69
Rural	27	16	21.62	11	42.31
Level of income					
High	10	3	4.05	7	26.9
Medium	24	15	20.27	9	34.61
Low	66	56	75.68	10	38.46
Level of education					
High	12	3	66.67	9	34.61
Medium	29	20	27.78	9	64.61
Low	59	51	5.55	8	30.77
Marital status					
Single	10	6	8.11	4	15.38
Married	35	30	40.54	5	19.23
Widowed	45	34	45.95	11	42.31
Separated	10	4	5.41	6	23.08

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