

## SUMMARY

### **The impact of the outdoor physical environment on older adults with osteoarthritis**

Osteoarthritis (OA) is a degenerative joint disease, which is mainly characterized by damage and loss of articular cartilage. Osteoarthritis is one of the most common forms of musculoskeletal disorders worldwide and its incidence increases with age. The condition is associated with joint pain, functional limitations, loss of quality of life and considerable societal costs.

Theories from environmental gerontology suggest that characteristics of the outdoor physical environment can facilitate or impede functioning and well-being in older adults. The ecological model of aging from Lawton assumes that unique combinations of personal competence and environmental characteristics determine an individual's level of functioning. Derived from this ecological model, the environmental docility hypothesis suggests that the less competent the individual, the greater the impact of environmental factors on that individual. Due to the experience of more joint pain and functional limitations, older adults with OA may have lower competence than those without the condition and may therefore be more vulnerable to environmental demands. As a consequence, the impact of environmental factors on functioning and well-being may be greater in older adults with OA than in those without the condition. Subjective outdoor physical environment characteristics refer to perceptions of one's outdoor physical environment and objective outdoor physical environment characteristics refer to area-level indicators that can be characterized independent of a person's own perception. Knowledge on how perceived and objective outdoor physical environment characteristics affect aspects of daily functioning of older adults with OA could be used to guide environmental interventions and policy interventions that aim to promote functioning and well-being in older people with OA. Research on the influence of the outdoor physical environment on functioning in older adults with OA is, however, limited.

This thesis aimed to contribute to the understanding of the impact of the outdoor physical environment on the daily lives of older adults with OA in Europe. The main objective was to examine the associations of outdoor physical environmental characteristics with various aspects of daily functioning in older adults with OA. A second aim was to examine whether environmental factors have a greater impact on aspects of daily functioning in older adults with OA than in those without the condition.

In this thesis, data from the population-based European Project on OSteoArthritis (EPOSA) were used. Furthermore, additional data from the Hertfordshire Cohort Study (HCS) and the Longitudinal Aging Study Amsterdam (LASA), both participating in the EPOSA study, were used separately in this thesis. The EPOSA project studies the personal and societal burden and its determinants of OA in the ageing European population. The EPOSA project is a collaborative study including pre-harmonized data from six ongoing cohort studies on older community-dwelling persons aged 65 to 85 years. These cohort studies were from six European countries, including Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom.

In Chapter 2, the association between joint pain and self-perceived weather sensitivity was examined in older adults with OA, by using data from the EPOSA study. In addition, characteristics of older persons with OA were identified that are most predictive of perceived weather sensitivity. The majority of older adults with OA reported that their joint pain was affected by weather conditions. It was observed that self-perceived weather sensitivity was associated with more pain in older adults with OA. Furthermore, it was found that women and more anxious persons were more likely to report weather sensitivity. Older people with OA from Spain and Italy were more likely to indicate themselves as weather-sensitive persons in comparison to those from Sweden.

In Chapter 3, the associations of joint pain with objectively measured daily weather conditions, 3-day average weather conditions, and day-to-day changes in weather conditions were examined in older adults with OA, by using data from the EPOSA

study. It was found that higher daily average relative humidity levels and higher 3-day average humidity levels were associated with more joint pain in these individuals. Furthermore, it was found that joint pain in older adults with OA was more strongly affected by daily average humidity in relatively cold weather conditions compared to relatively warm weather conditions. The associations between day-to-day weather changes and joint pain did not confirm causation.

In Chapter 4, the association between outdoor physical activity (PA) and objectively measured weather conditions was examined in older adults from six European countries, by using data from the EPOSA study. In addition, it was assessed whether outdoor PA and weather conditions were more strongly associated in older persons with OA than in those without the condition. The findings showed that increased temperature was associated with increased outdoor PA in older adults. Furthermore, increased humidity levels were associated with decreased outdoor PA in older persons. Temperature was more strongly associated with outdoor PA in older people without OA than in those with OA. Furthermore, it was observed that with increased humidity levels, older adults without OA spent less time walking outdoor than those with the condition. Thus, outdoor PA was more strongly associated in older adults without OA than in their counterparts with OA.

In Chapter 5, the associations of perceptions of neighbourhood cohesion and neighbourhood problems and objectively measured neighbourhood deprivation with the use of neighbourhood resources were examined in older adults with and without lower limb OA (LLOA), by using data from the HCS. Furthermore, it was assessed whether these relationships were stronger in older persons with LLOA than in those without the condition. A trend for a positive association between use of public transport and perceived neighbourhood problems was observed in older adults without LLOA, whereas a trend for a negative association was found in older persons with LLOA. Perceived neighbourhood problems did not impact the use of other neighbourhood resources, including parks and walking areas, places to sit and rest, and public facilities, in older adults with and without LLOA. Regardless of LLOA, perceived neighbourhood cohesion and objectively measured neighbour-

hood deprivation were not associated with use of neighbourhood resources in older adults.

In Chapter 6, the associations of objectively measured neighbourhood built environment characteristics with objectively measured PA were assessed in Dutch older people with and without LLOA, by using data from the LASA. It was also examined whether these relationships were stronger in older adults with LLOA than in their counterparts without the condition. It was observed that street connectivity and distances to specific resources within a neighbourhood had no impact on the total time spent on PA in the full sample. Larger distances to specific health care resources (general practice and physiotherapist) and retail resources (supermarket) were found to be associated with more time spent on PA in older adults with LLOA than in those without the condition. In particular, it was observed that with increased distances to these specific resources, older adults with LLOA spent more time on high-light PA (e.g., slow walking) than those without LLOA.

In Chapter 7, the association of quality of life (QoL) with perceived neighbourhood problems was examined in older adults with and without OA, by using data from the HCS. Furthermore, it was assessed whether this relationship was stronger in older adults with OA than in those without OA. In addition, it was examined whether the association between perceived neighbourhood problems and QoL in older adults was mediated by outdoor PA. The findings showed that the cross-sectional associations between QoL and perceived neighbourhood problems were not significant in the full sample at baseline and at follow-up, and it was observed that these relationships did not differ between older adults with and without OA. However, over time, perceiving more neighbourhood problems was associated with a stronger decrease in QoL in older adults with OA than in those without the condition. No support was found for a possible explanation that older adults with OA experience more difficulties with regard to spend time on outdoor PA when they perceive more neighbourhood problems, and that this results in poor QoL.

In Chapter 8, the general discussion, the most important results and conclusions were discussed. Methodological strengths and limitations were described, and practical implications were given. Furthermore, suggestions for future research were provided. The findings from this thesis suggest that specific perceived and objectively measured characteristics of the outdoor physical environment facilitate or impede aspects of daily functioning in older adults with and without OA. Some supportive evidence was observed for the environmental docility hypothesis. Some specific environmental characteristics, such as distances to specific resources and perceived neighbourhood problems, are more strongly associated with functioning and well-being in older adults with OA than in those without the condition. The current findings suggest that there are potentially important environmental factors (e.g., perceived neighbourhood problems) that can be addressed to improve functioning and well-being in the growing group of older adults with OA. More research is needed to confirm our findings and to further examine how other outdoor physical environmental factors are associated with functioning and well-being in older adults with and without OA.