CHAPTER 1

General introduction
In 2003, the World Health Organisation (WHO) stated that over 150 musculoskeletal conditions affect millions of people worldwide\(^1\). The most common musculoskeletal condition is arthritis, which encompasses more than 100 diseases affecting joints, surrounding tissues and other connective tissues. Arthritis is often characterized by pain, aching, stiffness and/or swelling in and around the joint. Musculoskeletal conditions are especially prevalent in older populations\(^2,3\). The Longitudinal Aging Study Amsterdam provides, *inter alia*, data on musculoskeletal conditions in a random sample of older Dutch adults. The mean age was 69 years (SD 8.6), and 44% of the respondents reported a current or previous event of arthritis, which in this study was either osteoarthritis (OA) or rheumatoid arthritis (RA)\(^2\). Musculoskeletal conditions cause pain that often manifests in and around the joints. It is known from the literature that joint pain almost never manifests in a single joint and that the frequency and severity of pain complaints differ between anatomical sites\(^4-6\). For instance, Buchman et al. showed that of the participants with pain, almost 27% reported pain in more than one anatomical pain site\(^4\). This was also the case in a Dutch study of older adults that found musculoskeletal pain in 54%, whereby 24% had pain in one joint, whereas 30% had pain in multiple joints\(^5\). Most frequently reported pain sites were (in hierarchical order): lower back, shoulder, neck, knee, wrist/hand, upper back, hip, elbow and ankle/foot\(^5\). When stratified by age, the authors found a lower prevalence of lower back pain and a higher prevalence of hip and knee pain in older aged persons. In a similar English cohort study (NorSToP) conducted in a population above the age of 50, the authors investigated the prevalence of self-reported pain, based on a body manikin, in several anatomical pain sites\(^6\). Of the participants, 66% reported having some pain in the past four weeks. In participants above the age of 60, the highest prevalence rates were reported in the knees (37%), lower back (31%), shoulder (29%) and hip (27%)\(^6\).

In addition to joint pain, many older adults suffer from other chronic diseases. In the literature, the presence of multiple chronic diseases is either defined as comorbidity – *the presence of at least one extra chronic condition along with a chronic disease of interest* (index condition) – or as multimorbidity – *co-existence of two or more chronic conditions within a single person* – (no index condition)\(^7,8\). Many studies defined multimorbidity as the presence of three or more chronic diseases, but the WHO classifies it as the presence of two or more chronic diseases\(^9\). A systematic review showed prevalence rates between 55% and 98% in older adults\(^10-12\), and commonly identified conditions are diabetes mellitus, OA, coronary heart disease, cancer, chronic obstructive pulmonary disease and visual impairment\(^12,13\). The wide variation in prevalence rates of multimorbidity between studies is probably due to differences in study designs, population selection (population-based or general practice-based), the number and type of chronic diseases included and the used cut-off value for multimorbidity\(^11\).
Despite the variation, it is obvious that multimorbidity comes with age, is more prevalent in females and more common in patients who live in deprived communities\(^8\).

**FUNCTIONAL LIMITATIONS BECAUSE OF JOINT PAIN AND COMORBIDITY**

According to the International Classification of Functioning (ICF) model, health disorders such as joint pain and other chronic diseases can influence body functioning and structure (e.g. pain), activity performance and participation\(^{14}\), as illustrated in Figure 1.

![International Classification of Functioning model](image)

**Figure 1** | International Classification of Functioning model

Limitations in the activities domain may be expressed in mobility problems, whereby people experience problems with walking or climbing stairs. Joint pain and comorbidity can also cause problems in performing Activities of Daily Living (ADL), e.g. bathing or getting dressed\(^{15}\) or performing Instrumental Activities of Daily living (IADL), e.g. running a household or doing the groceries\(^{16}\), two measures that are very indicative of someone’s level of dependency. Besides limitations in activities, joint pain and comorbidity may also influence a person’s level of participation: occupational functioning, social functioning (relationships with family, friends and neighbours) and involvement in the community. In particular, older adults themselves mention involvement and being part of the community as extremely important\(^{17}\); these are classified in the participation domain in Figure 1.
Joint pain is among the top 10 leading causes of reduced disability-adjusted life years\textsuperscript{18}. Many studies have attempted to describe the impact of joint pain on several aspects of functioning\textsuperscript{4,5,19-23}. For instance, in a population with a mean age of 80 years, Buchman et al. found limitations in mobility, ADL and IADL in 42%, 9% and 46% of the participants, respectively\textsuperscript{4}. Additionally, they found that of the participants without limitations at baseline, about 57%, 34% and 61% developed limitations in mobility, ADL or IADL over a mean follow-up period of 5.6 years. Having pain at multiple sites even strengthened this relationship. Such findings were also seen in an earlier Dutch cohort study\textsuperscript{5}. Fewer studies are available on the relationship between joint pain and participation restriction\textsuperscript{22,23}. A population-based study in the United Kingdom (the NorSToP study) found that over half of the older participants reported some participation restriction\textsuperscript{22}. These numbers increased linearly with age. Previous studies also reported a significant negative relationship between comorbidity and functioning\textsuperscript{24-26}. For example, a recent Dutch study showed that 71% of female participants with multimorbidity were, to an extent, dependent in performing ADL and/or IADL tasks. In males, this percentage was 40%\textsuperscript{25}.

We should bear in mind that these frequencies will probably increase substantially in the coming decade, as the prevalence rates of joint pain and comorbidity are both expected to rise because of increased life expectancy\textsuperscript{27,28}.

**RATIONALE BEHIND THE STUDY**

We hypothesize that older adults with joint pain and comorbidity are especially vulnerable to experiencing functional limitations and to encountering poorer prognosis of functioning over time, for two main reasons.

First, joint pain affects functioning, and the presence of comorbidity may have an additional deleterious effect on functioning. Both conditions can influence each other negatively. Joint pain can lead to reduced activity, which can subsequently negatively influence other chronic conditions like diabetes (exercise is an important component of managing diabetes). Vice versa, chronic conditions, like chronic obstructive pulmonary disease, angina and obesitas, could make it more difficult for older adults to exercise, thereby limiting physical performance and subsequently enhancing the negative outcome of joint pain due to, for example, increased stiffness. The same applies to its management, as exercise is one of the most important recommendations in current guidelines for managing OA in order to relieve pain and reduce limitations in activities. Comorbidity may interfere with the deployment of exercise therapy\textsuperscript{29}. For instance, only moderate-intensity resistance training is recommended for patients with heart diseases.
Second, health care delivery may be suboptimal for this specific group. In the Netherlands, the general practitioner is often the first health care professional consulted by patients for joint pain and pain-related functional limitations. The first problem in care delivery is that only 17-30% of older adults with joint pain consult their general practitioner\textsuperscript{30-32}. This may be due to the observation that older adults with joint pain are often reluctant to consult their doctor, because they downplay their joint pain and see it as an inevitable, irreversible and incurable process that comes with age ('wear and tear')\textsuperscript{17,29}. Furthermore, certain myths exist regarding musculoskeletal conditions like osteoarthritis. Three examples of identified myths are: ‘nothing can be done to treat my pain’, ‘the only treatment options are paracetamol and surgery’ and ‘don’t exercise when you have joint pain’. It seems that patients have low expectations of treatment and their effectiveness, and find it difficult to determine the threshold that justifies consultation\textsuperscript{32-33}.

The second problem in care delivery is that, when older adults do decide to see their general practitioner, research indicates that joint pain is often poorly recognized and treatment is suboptimal. Several explanations have been mentioned. There may be lack of awareness, both in patients and clinicians, regarding the impact of joint pain on daily functioning and possibilities for the management of pain and pain-related functional limitations. Previous studies have also shown that the presence of comorbid diseases interferes with the recognition, assessment and management of joint pain\textsuperscript{32,34}. One reason may be that the treatment of other chronic diseases receives more priority from both patient and clinician. Furthermore, in the presence of other chronic diseases, health care professionals may be more reluctant to prescribe pain medication (even in a case of severe pain), because of the high prevalence of poly-pharmacy, the risk of drug-drug interactions and negative side effects. For example, patients who are taking warfarin for atrial fibrillation should not take NSAIDs. Moreover, the presence of chronic conditions, like angina, COPD, previous stroke or obesitas, could interfere with a patient’s ability to adhere to exercise, while exercise is important in the management of both joint pain and many other chronic diseases. It seems likely that effective recognition and treatment of joint pain and pain-related functional limitations, in order to delay or prevent the prognosis and hence improve functioning, has not been fully realised in primary care, especially when older adults also suffer from comorbidity.

Since the presence of comorbidity besides joint pain is more often the rule than the exception\textsuperscript{35,36}, the above-mentioned observations underline the importance of understanding the scope of functional limitations, the course of functioning, the determinants that are related to these outcomes and the health care needs in older adults with joint pain and comorbidity, in order to provide adequate care. However, we identified some gaps in the literature.
Gaps in literature

Many studies have described the impact of either joint pain or other chronic conditions on several aspects of functioning\textsuperscript{19-26}. Moreover, some studies with a particular focus on the relationship between musculoskeletal pain and functioning identified comorbidity as an additional risk factor for functional limitations\textsuperscript{37,38}. However, no studies were found that fully described the impact of the combination of joint pain and comorbidity on functioning and the course of functioning. As comorbidity is often present alongside joint pain, more information is needed regarding frequency and severity of limitations in this group. Furthermore, research should focus on the full scope of functioning, according to the earlier mentioned ICF model, thus measuring functional problems in both the activity domain and the participation domain. Especially the latter domain has received less attention in research, while older adults emphasised the importance of this aspect of functioning\textsuperscript{17} and the WHO mentioned it as a key indicator of well-being\textsuperscript{39}.

Receiving information on prognosis is an important reason for patient consultation. Such information could facilitate providing patients with joint pain and comorbidity more accurate and individualized information regarding the expected course of physical functioning. A previous study in older adults with musculoskeletal pain showed that 8 out of 10 patients believe in the importance of receiving prognostic information, as this could facilitate future planning. However, in practice only 33% of the patients discuss the prognosis with their care provider\textsuperscript{40}. This could be partly due to lack of knowledge about the prognosis of physical functioning. In the literature, substantial longitudinal evidence exists on the course of physical functioning in participants with, for instance, osteoarthritis in the hip or knee\textsuperscript{41,42}. However, it is not clear whether these results are generalizable to a sample of older adults with multiple joint pain and comorbidity.

It is well-documented that more severe levels of pain contribute to poorer physical functioning in older adults, but on an individual level it seems there are substantial variations in this relationship: participants with similar levels of pain experience different levels of functional limitations. This variation may be explained by several factors. Systematic reviews have summarized the many factors that contribute to functioning\textsuperscript{43,44}. These reviews suggest that prognostic factors could be \textit{sociodemographic factors}, e.g. age and social-economic status, \textit{physical factors}, e.g. pain severity, comorbidity and frailty, and \textit{psychosocial factors}, e.g. social support, depressive symptoms, cognitive appraisals and coping strategies. Despite the wealth of evidence in the literature, it remains questionable whether these results can be applied to our population of interest, most importantly because of heterogeneity in other study populations, selected outcomes, included prognostic indicators, measurements to assess outcomes and prognostic indicators, and heterogeneity in approaches to analysing the data. It would be helpful to study the influence of the factors mentioned in our sample,
as identification of highly contributing modifiable factors may help to optimize care for this group. Such relationships can be studied both cross-sectionally and longitudinally. Cross-sectional studies may provide some initial insights into factors that are related to functioning. Longitudinal studies with repeated measures can test the temporality of relationships (e.g., does the determinant precede the outcome in time?), and make it possible to study the time-varying nature of determinants in relation to changes in physical functioning. Additionally, longitudinal studies can identify prognostic factors for poor functioning. More insight into contributing factors may help clinicians to better inform their patients about the prognosis and facilitate the identification of patients at risk of poor functioning, in order to narrow the focus to these high risk groups. Such modifiable prognostic factors for poor functioning can be interesting targets for the treatment of pain-related functional limitations.

In order to provide more adequate care, obtaining greater insight into the care needs of this population could also prove relevant. The trend these days is for people to live independently as long as possible in their own environment. As ageing comes with certain limitations, receiving sufficient care is important for sustaining quality of life. In order to provide sufficient care, an essential step is to identify the care needs of patients with health problems. The identification of especially unmet care needs could facilitate the implementation of early treatment strategies that aim to improve physical functioning and quality of life, and could subsequently prevent or delay deterioration in functioning, hospital (re)admission, placement in nursing homes and mortality. The Camberwell Assessment of Need for the Elderly (CANE) is a structured interview that can be used to assess met and unmet care needs in older adults. The CANE identifies needs in several domains, like accommodation, household, mobility, self-care, and social interaction, and assesses the amount of informal and formal care provided and levels of satisfaction about the care received. Up till now, only three studies used the CANE to explore care needs in a primary care sample of older adults. No such data are available for our population of interest, though it could be interesting to identify unmet care needs and factors that contribute to even more unmet needs in this population. Moreover, no qualitative studies exist in this field of research, though such studies provide deeper knowledge about experience involving identified needs by using a complementary qualitative approach with in-depth interviews. Interviewing can help to better understand why needs exist, what the impact is of existing needs on daily living and how needs can be tackled with current care delivery.
OUTLINE OF THE THESIS

Based on the identified gaps in literature, we aimed to answer the following research questions in our study:

1. What is the frequency and severity of functional limitations in older adults with joint pain and comorbidity?
2. Which sociodemographic, physical and psychosocial factors are associated with functional limitations?
3. Which factors are longitudinally associated with changes in functioning?
4. What is the course of functioning in older adults with joint pain and comorbidity?
5. Which factors are predictive of deterioration in physical functioning?
6. How do older adults with joint pain and comorbidity rate current health care delivery, which (unmet) needs exist and which bottlenecks do they experience in the current health care system?

We conducted a prospective cohort study which included 407 participants aged 65 years and older with joint pain and comorbidity. The studies and findings described in this thesis are all based on data derived from this cohort. The study described in chapter 3 used additional data from the NorSToP study (United Kingdom).52

Figure 2 summarizes the outline of the thesis. Chapter 2 describes the protocol of the cohort study. In order to adequately reply to the main research questions, we first performed two methodological studies which are described in chapters 3 and 4; chapter 3 shows the results of a study that evaluated the measurement properties of the Dutch version of the Keele Assessment of Participation and chapter 4 presents a study that explored the possibility of aggregating four functional measures (i.e. physical functioning, ADL, IADL and participation) into one general functional measure. Chapters 5-7 present the findings of three studies in which we extensively examined functioning and possible related factors, both cross-sectionally and longitudinally. First, chapter 5 presents the results of a cross-sectional study in which we examined the frequency, severity and determinants of functional limitations in four functional measures that comprise the ICF domains. In chapter 6 we examined the prognosis of physical functioning and identified prognostic indicators of poor physical functioning. Chapter 7 presents the results of a study in which we explored longitudinal associations of cognitive appraisals and coping strategies with physical functioning. Chapter 8 provides the results of a mixed method study that aimed to assess self-perceived care needs in the defined sample. Chapter 9 discusses the main findings of the thesis, provides an overview of clinical implications and provides suggestions for further research.
### Observational cohort in older adults with joint pain and comorbidity

<table>
<thead>
<tr>
<th>General introduction: chapter 1</th>
<th>Study protocol: chapter 2</th>
<th>General discussion: chapter 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodological issues</td>
<td>Frequency and determinants</td>
<td>Trajectories of physical functioning and prognostic indicators of poor PF: chapter 6</td>
</tr>
<tr>
<td>Frequency and determinants of functional limitations: chapter 5</td>
<td>Prognosis and longitudinal associations</td>
<td>Longitudinal association between cognitive-behavioural responses and PF: chapter 7</td>
</tr>
<tr>
<td>Care needs</td>
<td></td>
<td>Self-perceived care needs: mixed method study: chapter 8</td>
</tr>
</tbody>
</table>

- **Measurement properties of the Keele Assessment of Participation: chapter 3**
- **Exploring aggregation of four measures of physical functioning: chapter 4**
- **Frequency, severity and determinants of functional limitations: chapter 5**
REFERENCES


