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Trajectories of physical functioning and their prognostic indicators: A prospective cohort study in older adults with joint pain and comorbidity

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ABSTRACT

Objectives: This study aimed to identify and characterize homogeneous subgroups of individuals with distinct trajectories of physical functioning (PF) and to examine prognostic indicators of deterioration in PF in a highly heterogeneous population of older adults with joint pain and comorbidity.
Study design: A prospective cohort study among 407 older adults with joint pain and comorbidity provided data over a period of 18 months, with 6 month time-intervals. We used latent class growth modelling (LCGM) to identify underlying subgroups (clusters) with distinct trajectories of PF. Next, we characterized these subgroups and applied multivariable logistic regression analysis to identify prognostic indicators for deterioration in PF.
Main outcome measures: We measures PF with the RAND-36 PF subscale and several potential sociodemographic, physical and psychosocial prognostic indicators.
Results: LCGM identified three clusters. Cluster 1 'good PF' contained 140 participants with good baseline PF and small improvements over time. Cluster 2 'moderate PF' contained 130 participants with moderate baseline PF and deterioration over time. Cluster 3 'poor PF' contained 137 participants with poor baseline PF and deterioration over time. After backward selection, the final model that could best distinguish between improved participants (cluster 1) and deteriorated participants (cluster 2–3) included the following prognostic indicators: higher age, more depressive symptoms, less perceived self-efficacy and more activity avoidance.
Conclusions: Older adults with joint pain and comorbidity either improved or deteriorated in PF over time. The prognostic model facilitates the classification of patients, the provision of more accurate information about prognosis and helps to narrow the focus to the high risk group of poor PF.

1. Introduction

Joint pain is one of the most prevalent health problems in older adults and the leading cause of deterioration in physical functioning (PF) [1,2]. Up to 30% of consultations in primary care are due to musculoskeletal problems, like joint pain [3]. Receiving information on prognosis is an important reason for patient consultation. To provide this information, clinicians need to be aware of the different trajectories of PF over time and their prognostic indicators.

It is known from previous studies on musculoskeletal disorders that various sociodemographic, physical and psychosocial factors may influence PF in older populations. However, results on prognostic models are conflicting [4–6]. This is probably due to the observation that most of these models were developed for single-site musculoskeletal pain (e.g. back pain, knee pain) [6], while in daily practice most pain complaints manifest in multiple joints

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[7]. Furthermore, the presence of other chronic health problems (comorbidity) besides joint pain is more often rule than exception in older populations [8], but still not always included in research.

The co-existence of multiple joint pain and other chronic diseases could have additional negative effects on levels of PF and the prognosis of PF [9]. Also, it indicates substantial heterogeneity in older populations, which should be taken into account when performing prognostic studies. However, most previous studies have provided an estimate of average change in PF over time, assuming one single trajectory that represented all individuals in the study. This approach will conceal the variety of trajectories that may occur in older populations with complex health problems. The identification of subgroups with different trajectories and their prognostic indicators may help clinicians in the provision of more accurate and individualized information to patients with joint pain and comorbidity regarding the expected course of PF. Also, it may narrow the focus to the high risk groups and support decision making regarding management of symptoms.

Therefore, this study aimed to identify and characterize homogeneous subgroups of individuals with distinct trajectories of PF and to develop a prognostic model for deterioration in PF, in a population of older adults with joint pain and comorbidity.

2. Methods

2.1. Design

A prospective cohort study was conducted among 407 participants with joint pain and comorbidity. Data were collected at baseline (questionnaire and physical tests) and at 6, 12 and 18 months follow-up (questionnaires). The Medical Ethics Committee of the VU Medical Center Amsterdam approved the study protocol and written informed consent was obtained from all participants.

2.2. Study population

Data were collected between November 2010 and April 2013. Participants were recruited from 22 general practices (GP) in the region of Amsterdam and eligible for participation if they (i) were ≥65 years, (ii) had ≥2 chronic diseases registered in the electronic medical files of the GPs, and (iii) reported joint pain on most days in the past month in at least one of eight joint pain sites: neck, back, shoulder, elbow, hand/wrist, hip, knee or ankle/foot. Participants were excluded if they lived in a nursing home, resided outside the research area, had a life threatening illness, suffered from cognitive impairments (e.g. dementia) or had insufficient knowledge of the Dutch language. Details about the study design and recruitment process have been previously published [10,11].

2.3. Outcome

Physical functioning was measured with the RAND-36 PF subscale, which asks about difficulties in a hierarchical range of 10 activities: vigorous activities, moderate activities, lift/carry groceries, climb several flights, climb one flight, bend/kneel, walk 1 km, walk 0.5 km, walk 100 m, bath/dress [12]. Items were scored on an ordinal 3-point scale (severe, some, no limitations), recoded, summed into scale scores and transformed to a 0–100 score, with a lower score reflecting more limitations. The RAND-36 has proven to be reliable and valid in a Dutch older population [12].

2.4. Potential prognostic indicators

Based on available literature, the following prognostic indicators were included in the baseline questionnaire [5,6]: *age*, *gender*, *educational level* (primary, secondary, college/university), *living situation* (alone, not alone), *number of joint pain sites*: neck, back, shoulder, elbow, wrist/hand, hip, knee and ankle/foot; score range 1–8; higher score indicates more pain sites, *pain severity*: 3 items of the Chronic Pain Grade (CPG); score range 0–100; higher score indicates more pain [13], *number of chronic diseases* (2, ≥3) [10], *frailty* (yes, no): positive when participants met three or more of five frailty component criteria: weight loss, weakness, slowness, exhaustion, low activity [14,15], *depressive symptoms*: 7 items of the 14-item Hospital Anxiety and Depression Scale (HADS); score range 0–21; higher score indicates more symptoms [16], *self-efficacy*: 6-item Arthritis Self Efficacy Scale (ASES); score range 6–60; higher score indicates more self-efficacy (thus positive) [17,18], *activity avoidance*: 5-item resting subscale of the Pain Coping Inventory (PCI); score range 5–20; higher score indicates more activity avoidance [19], *catastrophizing*: 2-item Coping Strategy Questionnaire (CSQ); score range 0–6; higher score indicates more catastrophizing [18,20], and *social support*: 12-item Social Support Scale (SSS); score range 12–60; higher score indicates less perceived social support [21].

2.5. Statistical analyses

Whereas conventional longitudinal analyses determine only one single trajectory, latent class growth modelling (LCGM) is able to identify more underlying trajectories (clusters) that describe developmental patterns. Each identified cluster contains its own intercept (baseline value) and slope (growth value), which in LCGM are fixed to zero, to make trajectories within-clusters homogeneous and between-clusters heterogeneous [22]. To identify the optimal number of clusters, we started with a single cluster model, as comparable with normal longitudinal growth modelling. Since we had four time points, we first tested this model with a quadratic component. If the quadratic component was not significant, we fitted a linear model. However, if the quadratic component turned out to be significant, we had the most optimal model for 1 cluster. Next, we tested a two cluster model with first two quadratic components and in case of significances only a linear component. This 'forward procedure' was repeated for a three, four and five cluster model. Constantly, the Vuong-Lo-Mendell Rubin Likelihood Ratio Test (LMR-LRT), Bootstrapped Likelihood Ratio Test (BLRT) and the Bayesian Information Criterion (BIC) fit indices were compared [23]. A model indicated better fit when the LMR-LRT and BLRT were significant and the BIC was lower compared to the model with one less cluster [23]. Internal reliability of the clusters was assessed with the entropy statistics and average posterior probabilities. Statistics >0.80 indicated good classification [23]. Finally, we looked at the interpretability of the trajectories, the sample size and usefulness of the identified clusters. As LCGM allows missing data, we performed a sensitivity analysis in which we compared the forward procedure in a sample with complete and incomplete PF data. For the final model, we determined the baseline value (intercept = I) and level of change (slope = S) over time for all identified clusters.

Next, we described the characteristics of the identified clusters and performed multinomial regression analysis to examine which indicators were able to discriminate between the identified clusters. Since we found three clusters with two distinct trajectories over time (improvement versus deterioration), we decided to develop a prognostic model for deterioration (belonging to cluster 2–3) versus improvement in PF (belonging to cluster 1). Indicators that were univariately associated ($P < 0.10$) with the outcome were entered into multivariable regression analysis, in which manual backward selection procedure was carried out ($P_{removal} = 0.05$) to obtain a final model with prognostic indicators for deterioration in PF (cluster 2–3). The performance of the model was tested,