

# BMJ Open Trajectories of future sickness absence and disability pension days among individuals with a new sickness absence spell due to osteoarthritis diagnosis $\geq 21$ days: a prospective cohort study with 13-month follow-up

Kristin Farrants,<sup>1</sup> Emilie Friberg,<sup>1</sup> Sara Sjölund,<sup>1,2</sup> Kristina Alexanderson<sup>1</sup>

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<sup>1</sup>Division of Insurance Medicine, Karolinska Institutet Department of Clinical Neuroscience, SE-171 77, Stockholm, Sweden

<sup>2</sup>Department of Health Sciences, The Swedish Red Cross University College, Stockholm, Sweden

**Correspondence to**  
Dr Kristin Farrants;  
[kristin.farrants@ki.se](mailto:kristin.farrants@ki.se)

## ABSTRACT

**Introduction** Osteoarthritis is one of the most common types of musculoskeletal diagnoses also among working-age populations, and often leads to long-term sickness absence (SA) spells or even disability pension (DP).

**The aim** was to identify future trajectories of days of SA and/or DP among people with a new SA spell due to osteoarthritis that became  $\geq 21$  long, and to investigate sociodemographic and morbidity characteristics of individuals in identified trajectories.

**Methods** This is a prospective population-based cohort study using data from several Swedish registers. We studied future SA/DP among all 4894 individuals aged 16–64 years who, during the first 6 months of 2010, had an incident SA spell due to osteoarthritis (ICD-10 codes M15-19)  $\geq 21$  days. Using group-based trajectory modelling, we identified trajectories of mean SA/DP net days/month and 95% CIs for the 13 months from the 21st day of the index SA spell. Sociodemographic and morbidity characteristics were compared by  $\chi^2$  tests and multinomial logistic regression.

**Results** We identified five trajectories of SA/DP days: ‘fast decrease’ (36% of the cohort), ‘medium fast decrease’ (29%), ‘slow decrease’ (15%), ‘fluctuating’ (12%) and ‘late decrease’ (8%). Individuals in the two trajectories who still had SA/DP days at end of follow-up (late decrease and fluctuating) were more likely to be older, born outside the EU and have indicators of more severe morbidity than those in the other trajectories.

**Conclusion** Five trajectories of future SA/DP days were identified; 80% of the cohort belonged to trajectories with no SA/DP by the end of follow-up. Identifying trajectories of future SA/DP provides new insights regarding the developments of SA/DP over time among people on SA due to osteoarthritis; not only days in the initial SA spell but also in new spells during follow-up need to be included for a better understanding.

## INTRODUCTION

Musculoskeletal diagnoses are leading sickness absence (SA) and disability pension

## Strengths and limitations of this study

- Use of entire population, that is, not a sample.
- Large number of individuals allowing for subgroup analysis.
- High-quality register data.
- Only main diagnoses included, meaning some sickness absence (SA) spells might be missed.
- Only SA days in spells  $> 14$  days included.

(DP) diagnoses in the Western world.<sup>1</sup> In Sweden in 2010, musculoskeletal diagnoses accounted for 23% of all SA spells  $> 14$  days among women and 25% among men.<sup>2</sup> Osteoarthritis is one of the most common types of musculoskeletal diagnoses,<sup>3</sup> causing joint pain and stiffness and can lead to functional limitations.<sup>4</sup> Even if most people of working ages with osteoarthritis are not on long-term SA or DP, some are, and many with hip and knee osteoarthritis have very long SA spells lasting for  $\geq 90$  days.<sup>5</sup> The rates of people with SA/DP are higher among those with osteoarthritis than in the general population<sup>6</sup> and many leave the labour market prematurely.<sup>7</sup>

In clinical settings as well as among employers, insurance agencies and affected individuals, knowledge is needed on how to identify which individuals that are at risk of long-term SA, and which individuals are likely to have a quick return to work (RTW). Studies so far have mainly focused on risk factors for becoming sickness absent.<sup>5 6 8 9</sup> There are fewer studies on people already on SA—and most of them have used dichotomous outcomes.<sup>5 10–19</sup> Examples of such outcomes are still being on SA/not RTW after 3 months<sup>15</sup>/12 months<sup>13</sup>/18 months<sup>14</sup>/2 years<sup>10</sup> or become disability pensioned.<sup>16–21</sup>

These studies have shown that high age, only elementary education, disease severity, unemployment, prior SA, as well as the extent (full-time or part-time) and duration of SA are risk factors of still being on SA/not RTW within the specified time frame<sup>10–15</sup> and of being granted DP in people with musculoskeletal diagnoses in general, including osteoarthritis.<sup>16–21</sup> However, from a clinical perspective, more detailed information about future patterns of SA/DP than is available from these dichotomous measures is needed in order to identify patients who are at high risk, and to be able to direct interventions to them and not towards those who are likely to RTW without further intervention. One way to go about this is to explore whether there are different types of SA trajectories among those with a SA spell of a specific duration and/or diagnosis.<sup>22–24</sup> This would allow the great heterogeneity often shown in patterns of SA and DP over time to be taken into consideration. When doing this it would also be of importance to include not only the duration of the first SA spell but also that of potential subsequent SA spells during the follow-up period—as a premature RTW might lead to later need for SA. Moreover, to use information on duration of only the SA spell in such analyses will lead to mistaken conclusions, as some SA spells end with a DP. Therefore, both SA and DP days need to be included in such analyses. This is of extra importance if part-time SA and DP are possible, as in, for example, the Nordic countries—that is, people can be on both part-time SA and DP at the same time.

One way of identifying future patterns or trajectories of events, here SA/DP days, is using group-based trajectory analyses. Group-based trajectory models are increasingly used in epidemiological research.<sup>25</sup> They facilitate the identification of heterogeneity within a population, as well as descriptions of recurring and fluctuating patterns over time within subgroups.<sup>26</sup>

However, to the best of our knowledge, no study has been published on future trajectories of SA/DP among people with an incident SA spell due to osteoarthritis.

The aim of this study was to identify future trajectories of SA/DP days among individuals with a new SA spell due to osteoarthritis that lasted for 21 days or more. The aim was further to describe the sociodemographic and morbidity characteristics of the identified trajectories.

## METHODS

A prospective population-based cohort study was conducted, including all people aged 16–64 years and living in Sweden at 31 December 2009, who in the first 6 months of 2010 had an incident SA spell with a diagnosis of osteoarthritis (ICD-10 code M15-19<sup>27</sup>) that lasted for  $\geq 21$  days. We call the SA spell that led to inclusion in the cohort the index spell.

In January to June 2010, there were 5795 individuals with an incident SA spell  $\geq 21$  days due to an osteoarthritis diagnosis. If an individual had more than one such SA spell during the inclusion period (77 individuals), the

first spell was chosen as the index spell. We excluded individuals who were on part-time DP when the SA spell begun or had been on any DP in the 12 months before the start date of the index spell ( $n=744$ ) and those who previously had reached the maximum SA time allowed at any point ( $n=229$ ), as it already was known that these groups have a high risk of long-term SA/DP. (From July 2008, Swedish regulations stated a maximum duration of a SA spell to 914 days with a waiting period of 90 days before being allowed to claim SA benefits again.<sup>2</sup>) We also excluded those who died within 180 days of the start of the SA spell ( $n=3$ ). Individuals could fulfil more than one criterion for exclusion. The remaining study population was 4894 individuals.

We used anonymised data from the five following nationwide registers, linked by use of the personal identity number (a unique 10-digit number assigned to all Swedish residents): (1) Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA by Swedish acronym) held by Statistics Sweden: to identify the source population and for information on age, sex, country of birth, type of living area, family situation and educational level.

(2) MicroData for Analysis of the Social Insurance database (MiDAS) held by the Social Insurance Agency: for information on SA (dates, extent, main diagnosis, employment status at start of spell) and DP (dates and extent).

From the the National Board of Health and Welfare: (3) National Patient Register: for information regarding morbidity (date and diagnoses of inpatient and specialised outpatient healthcare), (4) the Prescribed Drug Register: for information regarding purchased prescription analgesics, antiulcer medication, soporific medication and anti-inflammatory medication, and (5) the Cause of Death Register regarding dates of death. Diagnoses were coded according to the International Classification of Diseases (ICD) version 10.<sup>27</sup>

## Variables

The outcome variable was SA/DP, measured as mean number of net days of SA and/or DP per month (30-day period) in the following 13 months, from the date of day 21 of the index SA spell. For the calculation of net days, part-time SA/DP was combined, for example, 2 days of 50% SA or DP were combined to one net day, in order to handle the possibility of being in both part-time SA and DP.

We used group-based trajectory modelling to identify trajectories of SA/DP, and investigated how individuals in the identified trajectories differed on the variables listed below (sociodemographics, current and previous SA, previous healthcare and previous medication).

## Categorisation of sociodemographics

Age: 18–39, 40–49, 50–54, 55–59 or 60–64 years (the younger age groups included a wider interval of years than the older, as there were few people <40 years on

SA due to osteoarthritis); sex: women or men; country of birth: Sweden, other Nordic country, other EU25 or rest of world including missing (n=88); educational level: elementary ( $\leq 9$  years or missing (n=554)), high school (10–12 years) or university/college ( $>12$  years); type of living area: large city (Stockholm, Gothenburg, Malmö with surrounding municipalities), medium-sized town ( $>90\ 000$  inhabitants within 30 km of municipal centre) or rural ( $<90\ 000$  inhabitants within 30 km of municipal centre); marital status: married (married, registered partnership) or single (unmarried, divorced, widowed); employment status at start of index spell: employed (employed, parental leave (n=10)), unemployed or self-employed).

### Categorisation of SA variables

Type of osteoarthritis diagnosis in index SA spell: M15 polyosteoarthritis, M16 hip osteoarthritis, M17 knee osteoarthritis, M18 osteoarthritis of first carpometacarpal joint or M19 other and unspecified osteoarthritis; extent of SA at start of index spell: full-time (100%) or part-time (25%, 50% or 75%), rate (%) of the cohort for which the index SA spell lasted for  $>120$  calendar days.

Also, seven SA variables regarding SA the 365 days preceding the start date of the index spell: number of net SA days: 0.25–49.75, 50–89.75, 90–179.75 or 180–365 net days; any SA (yes or no), SA due to osteoarthritis (ICD-10 M15–19) (yes or no), SA with other joint diagnoses (M00–14, M20–25) (yes or no), SA with other musculoskeletal diagnoses (yes or no), SA with mental diagnoses (F00–99) (yes or no), SA with other diagnoses (all other SA spells) (yes or no).

### Categorisation of healthcare

The following variables about healthcare in the 365 days before the start date of the index SA spell and during the first 21 days of the index spell, respectively: any such *specialised outpatient healthcare* (yes or no), with osteoarthritis (ICD-10 M15–19) (yes or no), other joint diagnoses (M00–14, M20–25) (yes or no), other musculoskeletal diagnoses (M30–99) (yes or no), mental diagnoses (F00–99) (yes or no) or other diagnoses (all others excluding O80 ‘uncomplicated delivery’ and Z00–99 ‘factors influencing health status and contact with health services’) (yes or no); at least 1 day in *inpatient healthcare* in the same period (yes or no), with osteoarthritis (ICD-10 M15–19) (yes or no), other joint diagnoses (M00–14, M20–25) (yes or no), other musculoskeletal diagnoses (M30–99) (yes or no), mental diagnoses (F00–99) (yes or no) or other diagnoses (all others excluding O80 uncomplicated delivery and Z00–99 factors influencing health status and contact with health services) (yes or no).

### Categorisation of medication

Purchase of prescribed analgesics, anti-inflammatory medication, ulcer medication or soporific medication, respectively, in the 365 days preceding the start date of the index spell; purchase of prescribed analgesics,

anti-inflammatory medication, ulcer medication or soporific medication, respectively, during the first 21 days of the index spell.

### Public SA insurance in Sweden

All people living in Sweden aged  $\geq 16$  years with an income from work or unemployment benefits, who due to disease or injury have a reduced work capacity, are covered by the national public SA insurance providing SA benefits. After a first qualifying day, the employer pays sick pay for the first 14 days of a SA period, thereafter, SA benefits are paid by the Social Insurance Agency. Self-employed have more qualifying days. Unemployed get SA benefits from the Social Insurance Agency after the first qualifying day. A physician certificate is required after 7 days of self-certification. In this study, data on SA with benefits from the Social Insurance Agency were used. SA spells  $<15$  days were not included in the study, so as not to introduce bias regarding, for example, unemployed, and net days in spells  $\geq 15$  days were only counted from day 15. All residents in Sweden aged 19–64 years, whose work capacity is permanently or long-term reduced due to disease or injury, can be granted DP from the Social Insurance Agency.

Both SA and DP can be granted for part-time or full-time (25%, 50%, 75% or 100% of ordinary work hours). SA benefits cover 80% and DP benefits 64% of lost income, up to a certain level.<sup>2</sup>

### Statistical analyses

Descriptive analyses of the sociodemographic make-up of the cohort were produced.

We used group-based trajectory modelling (Proc traj in SAS) to identify trajectories of future mean number of SA/DP net days/months and 95% CIs for each of the following 13 months among those with an incident SA spell  $\geq 21$  days. Group-based trajectory modelling is useful when you wish to identify subgroups of the population with similar trajectories. There are several ways to model changes over time that do not assume one homogenous subpopulation—however, group-based trajectory analysis has several advantages over similar methods. Unlike growth-curve models, group-based trajectory models allow for different order polynomial functions to describe the shape of the trajectory between different individuals. Moreover, unlike growth mixture modelling, group-based trajectory modelling does not assume that the population is made up of literally distinct groups—it is rather a tool to approximate different groups when there is reason to believe that there is a continuous distribution of trajectories in the population (for a more in-depth discussion of the differences between growth-curve modelling, growth-mixture modelling and group-based trajectory modelling, see Nagin and Odgers<sup>28</sup>). Since we do not believe individuals following different trajectories of SA/DP are distinct subpopulations that could be distinguished if we had information on the one variable that



differed between groups, we chose to use group-based trajectory modelling.

Months were calculated as 30-day periods from day 21 of the SA spell. We used the Bayesian Information Criterion (BIC) to determine model fit.<sup>25</sup> In order to keep to a manageable number of groups, a requirement of a minimum of 5% of the study population in each group was introduced.<sup>29</sup> The individual probabilities of belonging to a particular group were estimated using a multinomial logit function. Individuals were assigned to the group they had the highest probability of belonging to. Côté *et al*<sup>30</sup> recommend that the mean probability for each group should be higher than 0.7. The final model was chosen on the basis of the BIC value, each group having at least 5% of the study population, and each group having a mean probability of at least 0.7.

Log likelihood  $\chi^2$  tests were used to compare the groups regarding sociodemographic, previous SA, medication and healthcare use variables. To find how much each covariate explained variance in trajectory groups, we used multinomial logistic regression and calculated the difference between the Nagelkerke  $R^2$  of the full model and a model without the covariate of interest. Again, we did this for each covariate, running models for each SA diagnosis group separately. Since the Nagelkerke  $R^2$  is a pseudo- $R^2$ , caution is needed when interpreting these results.

In this observational study, based on population-based deidentified register microdata, informed consent was not applicable. The project was approved of by the Regional Ethical Review Board of Stockholm, Sweden.

### Patient and public involvement

We did not involve the public or people on SA in the study process of this observational study, based on population-based deidentified register microdata. Results of this study are disseminated to the Swedish Social Insurance Agency, physicians and the public through websites and lectures.

## RESULTS

Table 1 shows descriptive statistics for the study population of the 4894 individuals who had an incident SA spell due to osteoarthritis lasting  $\geq 21$  days in the first 6 months of 2010. A third of these spells lasted for  $\geq 120$  days, the maximum time for SA due to osteoarthritis recommended by the Swedish National Board of Health and Welfare.<sup>31 32</sup>

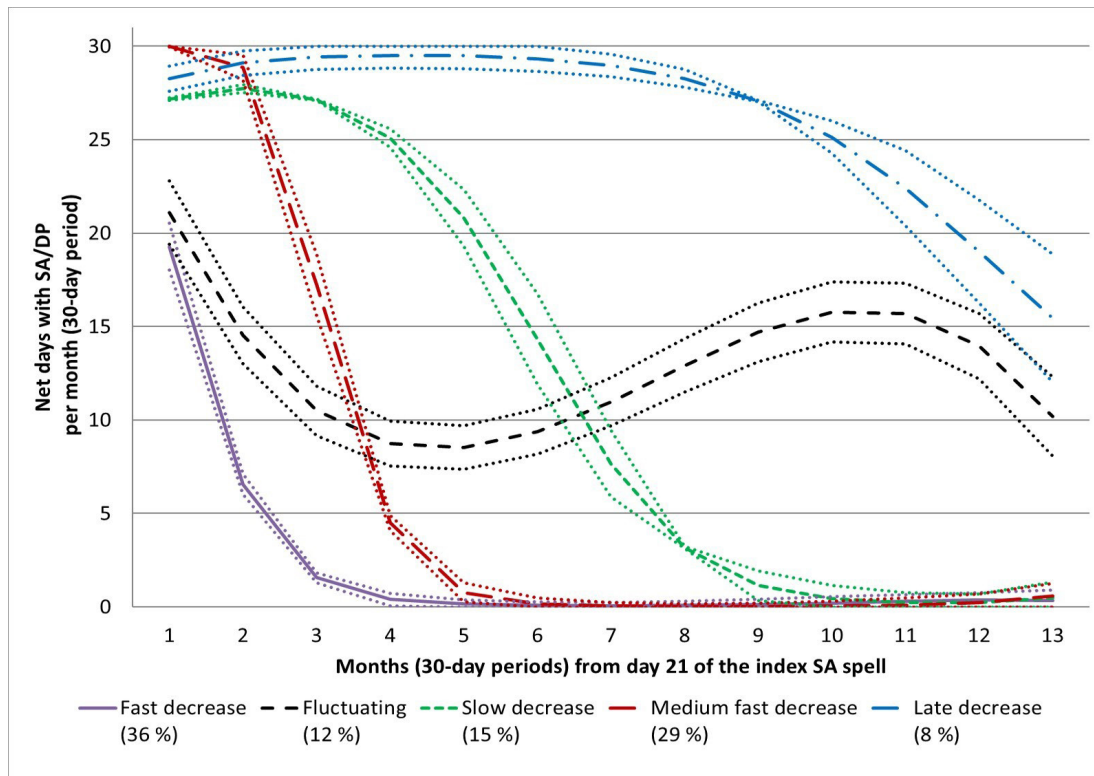
There was a slightly larger proportion of women in the cohort (52.4%). Over 60% of the cohort was  $\geq 55$  years, and the youngest age group (age 20–39 years) had lower rates of SA  $\geq 120$  days. Among those born in the Nordic countries excluding Sweden and those born outside of EU25, higher proportions had SA  $\geq 120$  days. Those with university/college education had a lower proportion of SA  $\geq 120$  days. Among the self-employed a greater proportion had SA  $\geq 120$  days.

We identified five trajectories based on the mean number of SA/DP days per month from day 21 of the

**Table 1** Sociodemographic characteristics of the cohort of all people who had a new sickness absence (SA) spell  $\geq 21$  days due to osteoarthritis that begun between 1 January and 30 June 2010 and proportion of them for whom the SA spell lasted  $\geq 120$  days

	n	Proportion (column %) of the cohort	Proportion (row %) with SA spell $\geq 120$ days
All	4894	100	34.1
Sex			
Male	2329	47.6	32.9
Female	2565	52.4	35.2
Age (years)			
18–39	244	5.0	23.8
40–49	837	17.1	30.3
50–54	877	17.9	34.2
55–59	1342	27.4	35.6
60–64	1594	32.6	36.3
Birth country			
Sweden	4404	90.0	33.6
Other Nordic countries	201	4.1	41.3
Other EU25	91	1.9	30.8
Rest of the world	198	4.0	38.4
Educational level			
Elementary ( $\leq 9$ years)	984	20.1	39.2
High school (10–12 years)	2607	53.3	36.3
University/college ( $> 12$ years)	1303	26.6	25.8
Type of living area			
Large city	1524	31.1	31.0
Medium-sized town	1675	34.2	35.8
Rural	1695	34.6	35.2
Marital status			
Single	2070	42.3	36.3
Married/registered partnership	2824	57.7	32.5
Employment status			
Employed	4330	88.5	33.3
Unemployed	286	5.8	37.8
Self-employed	278	5.7	42.8

index SA spell. (When we tested six trajectory groups, the BIC value increased and two groups each had  $< 5\%$  of the study population.) We named the trajectories after the progression of mean SA/DP days per month. Figure 1 shows the five trajectories and the names we gave them, as well as the 95% CI for each trajectory. The largest trajectory (36% of the study population) had no or very few SA/DP days/month after 4 months and was called 'fast decrease', 29% had no SA/DP after 5 months and was called 'medium fast decrease' and 15% after 10 months,



**Figure 1** Group-based trajectories of mean net sickness absence (SA) and/or disability pension (DP) days per month and 95% CIs (dotted lines) in a cohort of 4894 people with an incident SA spell  $\geq 21$  days due to osteoarthritis. Percentages in the legends indicate proportion of the cohort in each trajectory.

called ‘slow decrease’. Together, they made up 80% of the cohort. Of the rest, 8% first had  $>25$  mean days/month for the first 9 months and then decreased to about 15 days/month, which we called ‘late decrease’, and a trajectory of 12% had first a decrease and then an increase: this group we called ‘fluctuating’. All trajectories had a mean probability of above 0.9, which is well above the 0.7 level suggested by Côté *et al*<sup>30</sup> as good model fit.

Table 2 shows associations between trajectory membership and sociodemographic variables, and table 3 shows associations between trajectory membership and previous healthcare and SA variables. The trajectory fast decrease was characterised by a larger proportion of younger people ( $\leq 49$ ), a larger proportion of people with university education and a larger proportion of people in employment than other groups. During the first 21 days of the index SA spell, this trajectory had the largest proportion of specialised outpatient healthcare, and of osteoarthritis-related specialised outpatient healthcare. It had the smallest proportion of SA in the 365 days prior to the index spell, along with the group medium fast decrease.

The trajectory medium fast decrease had the largest proportion of individuals born in Sweden. Almost all (99.7%) of this trajectory had full-time SA at the start of the index spell. This trajectory had the largest proportion of inpatient healthcare during the preceding year, and of previous inpatient healthcare due to osteoarthritis. This trajectory was also characterised by the largest proportion

of individuals who had purchased prescribed analgesics during the first 21 days of the index spell.

The trajectory slow decrease had the smallest proportion of specialised outpatient healthcare and osteoarthritis-related specialised outpatient healthcare in the first 21 days of the SA spell.

The two trajectories that did not decrease their SA/DP to 0 days by the end of the study period (late decrease and fluctuating) had a smaller proportion of individuals aged 20–39 years and a larger proportion of individuals born outside EU25 than other groups. They also had larger proportions of individuals with SA due to mental diagnoses in the year preceding the start date of the index SA spell.

The late decrease trajectory was distinct on a number of characteristics. This trajectory was characterised by the largest proportion of people living in rural areas and the largest proportion of unemployed. The trajectory also had the largest proportions of individuals who in the 356 days preceding the start date of the index spell had any SA, who had been hospitalised due to mental diagnoses and who had purchased prescribed analgesics, respectively. However, this trajectory also had the smallest proportion of individuals who had purchased prescribed analgesics during the first 21 days of the index spell.

The trajectory fluctuating had the largest proportion of self-employed. This trajectory also had the largest proportion of part-time SA at the beginning of the index spell

**Table 2** Sociodemographic characteristics of the individuals in each of the five identified trajectories; (%),  $\chi^2$ -test value and Nagelkerke  $R^2$  with variable removed, and difference in Nagelkerke  $R^2$  with variable removed and Nagelkerke  $R^2$  of full model ( $R^2=0.294$ )

	Late decrease (%)	Fluctuating (%)	Slow decrease (%)	Medium fast decrease (%)	Fast decrease (%)	$\chi^2$ -test p value	Nagelkerke $R^2$ with variable removed	Difference in Nagelkerke $R^2$ to full model
<b>Sex</b>								
Male	44.3	43.4	47.6	46.6	50.4	0.018	0.291	0.003
Female	55.7	56.6	52.4	53.4	49.6			
<b>Age (years)</b>								
18–39	2.6	3.3	4.6	4.0	7.0	<0.001	0.289	0.005
40–49	15.8	15.2	15.8	14.5	20.6			
50–54	16.9	19.6	18.5	16.7	18.3			
55–59	30.3	27.8	27.6	29.0	25.3			
60–64	34.3	34.0	33.4	35.7	28.9			
<b>Birth country</b>								
Sweden	88.1	87.7	88.6	92.5	89.7	<0.001	0.292	0.002
Other Nordic	4.5	4.9	5.4	4.1	3.3			
Other EU25	1.3	2.1	1.8	1.1	2.5			
Rest of the world	6.1	5.3	4.2	2.3	4.5			
<b>Educational level</b>								
Elementary	26.1	20.1	24.5	19.7	17.3	<0.001	0.283	0.011
High school	58.0	56.4	55.8	52.5	50.8			
University/college	15.8	23.5	19.8	27.7	31.9			
<b>Type of living area</b>								
Large city	28.0	29.6	30.6	28.9	34.3	0.004	0.291	0.003
Medium-sized town	31.9	38.5	35.7	35.0	32.1			
Rural	40.1	31.9	33.7	36.1	33.6			
<b>Marital status</b>								
Single	45.4	47.8	44.1	40.4	40.7	0.008	0.292	0.002
Married/registered partnership	54.6	52.2	55.9	59.6	59.3			
<b>Employment status</b>								
Employed	81.8	87.0	86.6	88.2	91.4	<0.001	0.288	0.006
Unemployed	12.9	4.0	5.4	7.0	4.2			
Self-employed	5.3	8.9	8.0	4.8	4.4			

**Table 3** Sickness absence (SA) and healthcare use characteristics of individuals in each of the five trajectories; (%),  $\chi^2$ -test value and Nagelkerke  $R^2$  with variable removed, and difference in Nagelkerke  $R^2$  with variable removed and Nagelkerke  $R^2$  of full model ( $R^2=0.294$ ) among the 4894 people with a new SA spell  $\geq 21$  days due to osteoarthritis.

Type of osteoarthritis diagnosis in the index SA spell	Late decrease (%)	Fluctuating (%)	Slow decrease (%)	Medium fast decrease (%)	Fast decrease (%)	$\chi^2$ -test p value	Nagelkerke $R^2$ with variable removed	Difference in Nagelkerke $R^2$ to full model
M15 polyosteoarthritis	1.8	2.5	0.7	0.5	1.5	<0.001	0.279	0.015
M16 osteoarthritis of hip	31.4	24.5	31.5	41.1	29.1			
M17 osteoarthritis of knee	37.7	41.0	41.3	38.2	38.2			
M18 osteoarthritis of first carpometacarpal joint	6.3	9.5	5.8	10.7	7.0			
M19 other and unspecified osteoarthritis	22.7	22.6	20.7	9.5	24.3			
Extent of SA at start of index SA spell								
Part-time 25%–75%	9.0	30.5	14.5	0.3	12.9	<0.001	0.271	0.023
Full-time 100%	91.0	69.5	85.5	99.7	87.1			
Preceding SA in the 365 days before start of index SA spell								
0.25–49.75 net days	23.5	21.5	17.3	12.1	16.3	<0.001	0.288	0.006
50–89.75 net days	7.1	6.5	6.1	6.0	3.7			
90–179.75 net days	5.3	6.3	7.4	4.6	3.3			
180–365 net days	6.6	3.2	3.4	1.0	1.2			
Diagnosis in preceding SA*								
Any	42.5	37.5	34.2	23.7	24.5	<0.001	0.294	<0.001
Osteoarthritis(M15–M19)	15.0	15.4	15.3	10.6	10.4	<0.001	0.293	0.001
Other joint diagnoses (M00–14, M20–25)	4.7	3.7	3.0	2.6	3.2	0.270	0.292	0.002
Other musculoskeletal diagnoses (M30–99)	9.0	8.9	5.1	4.0	5.3	<0.001	0.292	0.002
Mental diagnoses (F00–F99)	4.2	2.1	2.3	1.4	1.6	0.006	0.293	0.001
Other diagnoses	15.0	14.2	12.2	7.9	7.5	<0.001	0.293	0.001
Inpatient healthcare in the 365 days preceding the index SA spell								
At least 1 day (all diagnoses)	17.9	15.2	18.3	25.1	19.5	<0.001	0.294	<0.001
Osteoarthritis(M15–M19)	9.0	6.8	11.6	21.2	13.9	<0.001	0.293	0.001
Other joint diagnoses (M00–14, M20–25)	0.8	0.2	0.8	0.1	0.6	0.105	0.293	0.001
Other musculoskeletal diagnoses (M30–99)	1.3	0.7	1.6	1.3	1.3	0.693	0.293	0.001
Mental diagnoses (F00–F99)	1.1	0.7	0.4	0.1	0.2	0.008	0.293	0.001
Other diagnoses†	7.4	8.4	6.0	4.8	5.3	0.016	0.293	0.001
Inpatient healthcare in the first 21 days of the index SA spell								
At least 1 day (all diagnoses)	21.6	26.3	42.2	73.0	38.6	<0.001	0.293	0.001

Continued

Table 3 Continued

	Late decrease (%)	Fluctuating (%)	Slow decrease (%)	Medium fast decrease (%)	Fast decrease (%)	$\chi^2$ -test p value	Nagelkerke R <sup>2</sup> with variable removed	Difference in Nagelkerke R <sup>2</sup> to full model
Osteoarthritis(M15-M19)	17.2	24.5	39.5	70.9	36.0	<0.001	0.293	0.001
Other joint diagnoses (M00-14, M20-25)	0.8	0.4	0.5	0.4	0.3	0.722	0.293	0.001
Other musculoskeletal diagnoses (M30-99)	0.3	0.7	1.1	0.7	1.2	0.288	0.293	0.001
Mental diagnoses (F00-F99)	0.3	0.0	0.0	0.0	0.0	0.018	0.325	-0.031
Other diagnoses†	4.5	0.9	2.7	2.5	2.0	0.005	0.292	0.002
Specialised outpatient healthcare in the 365 days preceding the index SA spell								
At least 1 day (all diagnoses)	68.9	74.1	78.9	90.4	78.9	<0.001	0.292	0.002
Osteoarthritis(M15-M19)	45.1	48.3	61.3	80.1	54.6	<0.001	0.292	0.002
Other joint diagnoses (M00-14, M20-25)	7.7	8.4	6.5	6.2	11.4	<0.001	0.292	0.002
Other musculoskeletal diagnoses (M30-99)	9.2	12.4	11.6	9.3	12.4	0.043	0.293	0.001
Mental diagnoses (F00-F99)	3.4	1.8	1.6	0.6	1.2	<0.001	0.293	0.001
Other diagnoses†	40.4	42.9	39.2	40.0	37.2	0.149	0.293	0.001
Specialised outpatient healthcare in the first 21 days of the index SA spell								
At least 1 day (all diagnoses)	30.9	28.2	24.8	26.0	33.6	<0.001	0.293	0.001
Osteoarthritis (M15-M19)	19.8	19.6	17.7	18.3	23.7	0.001	0.293	0.001
Other joint diagnoses (M00-14, M20-25)	1.6	2.8	0.9	1.0	3.4	<0.001	0.292	0.002
Other musculoskeletal diagnoses (M30-99)	2.1	1.8	1.5	1.7	2.6	0.244	0.293	0.001
Mental diagnoses (F00-F99)	0.3	0.2	0.0	0.1	0.1	0.627	0.293	0.001
Other diagnoses†	10.3	6.5	6.1	7.2	7.2	0.124	0.293	0.001
Dispensed prescribed drugs in the 365 days preceding the index SA spell								
Analgesics	60.2	53.1	57.8	51.4	43.3	<0.001	0.289	0.005
Anti-inflammatory	67.3	66.4	67.3	64.7	59.0	<0.001	0.293	0.001
Ulcer medication	21.6	23.3	20.4	16.0	14.3	<0.001	0.292	0.002
Soporific medication	12.1	13.1	10.0	9.8	9.5	0.091	0.293	0.001
Dispensed prescribed drugs in the first 21 days of the index SA spell								
Analgesics	49.3	49.7	61.7	84.8	60.3	<0.001	0.289	0.005
Anti-inflammatory	32.5	27.1	24.8	23.8	28.4	0.002	0.293	0.001
Ulcer medication	6.3	5.1	6.5	5.5	3.9	0.044	0.293	0.001
Soporific medication	4.2	3.9	3.9	3.0	3.4	0.688	0.293	0.001

\*Individuals who had more than one SA spell with different diagnoses are represented in each diagnosis group that they have had a spell with.

†All other diagnoses excluding O80 'Uncomplicated delivery' and Z00-99 'Factors influencing health and encounters with health services'.



(30.5%, twice as high as the second largest slow decrease, 14.5%).

The Nagelkerke pseudo- $R^2$  of the full model was 0.294. The variable with the greatest difference between the full model  $R^2$  and the  $R^2$  of a model with the variable removed, was extent of SA at the start of the index spell, with a difference of 0.023. This is, thus, the variable with the greatest explanatory power regarding trajectory membership in our analysis.

## DISCUSSION

In this exploratory prospective cohort study of future trajectories of SA/DP days among all people with a new SA spell  $\geq 21$  days due to osteoarthritis, 80% had no SA/DP days at the end of follow-up, 13 months later. The main result of this study is the identification of five distinct trajectories regarding mean number of SA/DP days per month during these 13 months, here named: fast decrease, medium fast decrease, slow decrease, fluctuating and late decrease, respectively. The trajectories were different from each other regarding the sociodemographic make-up, and especially regarding the different indicators of morbidity.

The study shows the importance of having more than a dichotomous outcome when studying the future SA/DP among people on SA due to osteoarthritis; it shows that the pace at which individuals decrease their SA/DP differs, and that some decrease their SA/DP days only to increase them again, which would have been missed with a dichotomous outcome or by only following the index spell and not including new SA and/or DP. Also, a large variety of factors are associated with duration of an initiated SA spell, for example, previous SA, comorbidity (mental and somatic), use of prescription medication, employment status, birth country and educational level, and therefore we recommend to include a wide variety of factors when creating models of SA spell duration and future SA/DP situation.

The two trajectories that did not reduce their SA/DP to 0 days per month during the follow-up (late decrease and fluctuating) differed from the other trajectories on several aspects, both regarding their sociodemographic variables and morbidity characteristics. Individuals in the two trajectories tended to be older and less likely to be born in Sweden or the EU. They were also more likely to have more indicators of serious morbidity, with both higher rates of full-time SA at the start of the index spell and higher rates of SA in the 365 days preceding the start date of the index spell, as well as higher rates of health-care and SA due to mental diagnoses. These are known risk factors for long-term SA<sup>33</sup> and for DP,<sup>18 21 34 35</sup> and a previous study showed that those who have a mental comorbidity have a higher risk of DP than those who 'only' have osteoarthritis.<sup>36</sup>

There was a clear difference between the trajectories regarding extent of SA at the start of the index spell: the proportion of individuals with part-time SA was twice as

large in the group fluctuating than in any other trajectory. In Sweden, part-time SA for people with osteoarthritis is promoted,<sup>37</sup> and it is recommended that people do not stay away completely from work as that has been shown to delay recovery.<sup>38</sup> A review of studies found conflicting results for whether individuals on partial SA had longer or shorter duration of SA, and whether they have less recurring SA or not.<sup>37</sup> Our finding that those with fluctuating SA/DP were more likely to have part-time SA at the beginning of the index spell does not fit with the suggestion that they have less recurring SA. Therefore, the role of part-time SA in both duration and recurrence of SA/DP needs to be investigated further.

Despite having higher rates of prescribed analgesics in the preceding year, the two trajectories that did not reduce their SA/DP to 0 days per month (late decrease and fluctuating) had lower rates of prescribed analgesics during the first 21 days of the index SA spell. Conversely, the trajectory medium fast decrease had very high rates of prescribed analgesics during the first 21 days of the SA spell, despite low rates in the preceding year. There is thus a discrepancy between previous medication and medication during the three first weeks of the index spell. One study showed that higher pain is associated with longer SA spells.<sup>39</sup> However, the association between pain and use of analgesics is not perfect: it may be that those who have purchased fewer prescribed analgesics have higher pain levels due to a lack of analgesics, rather than fewer purchases due to less need, or that they have not purchased analgesics during the first 21 days of the SA spell because they already have some at home. A longer time frame than 21 days might show different results.

This study increases the knowledge on future SA/DP patterns by studying more than a dichotomous outcome of the end of follow-up. We identified not just those who are at SA and/or DP at a specific follow-up time point, but also those who decreased and then increased their SA/DP, as well as those who end their SA/DP slower or faster. A dichotomous outcome of RTW/SA/DP at a particular time point may underestimate or overestimate SA/DP.<sup>40</sup> With more knowledge regarding different patterns and characteristics that are associated with such patterns it might in the future be possible to predict the most likely pattern at the start of an SA/DP spell, and could be of use identifying those who might need more support in returning to work. However, although we were able to identify different trajectories of SA/DP, further studies are needed within the area of insurance medicine to expand on this first explorative study.

## Methodological considerations

The main strength of this study is that it is based on the entire population, covering all people of working age in Sweden via high-quality nationwide registers, not a sample.<sup>41 42</sup> Another strength is the large number of individuals, allowing for subgroup analysis, and further, that there were no dropouts. Moreover, all information used was register based, not self-reports affected by recall bias.

That a very wide spectrum of characteristics regarding sociodemographics, morbidity, healthcare use, medication, and SA and DP details could be included are additional strengths. It is rare to have all these characteristics included in the same study.

By including all SA spells  $\geq 21$  days, we reduced bias that stems from the differing rules applied to when individuals receive compensation from the Social Insurance Agency depending on employment status (employed, self-employed or unemployed). This also means that only the more severe cases were included, that is, the ones in most need of attention regarding risk of future long-term SA or even DP.

A topic of frequent discussion in this research field is the validity of SA diagnoses. A study conducted in Sweden in 1991 showed high validity of SA diagnoses when comparing them to the diagnoses in the medical records.<sup>43</sup> Only the main SA diagnosis is registered in the Social Insurance Agency's MiDAS database, that is, the disease that the sickness certifying physician assesses that most contributes to the work incapacity. This means that SA spells where osteoarthritis was a contributing factor, but not the main cause, of the reduced work capacity were not included in the study.

The results are generalisable to the Swedish population of working ages on SA due to these diagnoses. The high employment frequency among both women and men, also in higher ages, and that also people with unemployment benefits are covered, means that results are affected by the healthy worker effect to a very low extent. However, this means that generalisability to countries with lower employment frequency and other social insurance rules might be less than optimal. In many other countries, it is not possible to be on part-time SA, which is why we combined part-time SA and DP days to net days to make the results more comparable to other systems.

## CONCLUSION

We identified five different trajectories of future SA/DP days among those with a new SA spell  $\geq 21$  days due to osteoarthritis. We also found that there were differences between the individuals in the five trajectories regarding sociodemographics and morbidity indicators. The majority (80%) reduced their SA/DP to 0 days per month during the study period. Those who did not were more likely to be older, born outside the EU and have indicators of more severe morbidity. The results provide new insights regarding the developments of SA/DP over time among people on SA due to osteoarthritis; not only days in the initial SA spell but also in new spells during follow-up should be included for a better understanding.

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