Int Arch Occup Environ Health (2011) 84:491–499
DOI 10.1007/s00420-011-0620-0

ORIGINAL ARTICLE

Previous sick leaves as predictor of subsequent ones

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Received: 19 April 2010 / Accepted: 26 January 2011 / Published online: 12 February 2011

Abstract
Purpose There is evidence that a history of sick leave (SL) increases the risk of suffering a new episode. However, little is known about the effect of the number of previous SL on subsequent ones. The aim of this paper was to quantify the effect of prior episodes on the risk of experiencing a new one and the effect on the duration of episodes, by diagnosis.
Methods Prospective study. Sample comprises 1,542 workers from a university hospital, whose first contract started during 2000–2007.
Results The studied workers accumulated 5,138 episodes, 21,250 days of absence and 45,324.2 months of follow-up. For all the causes, recurrence density was higher than incidence density. The higher the number of prior SL, the greater is the hazard of presenting a new episode. This is particularly true for episodes due to mental and behavioral disorders, diseases of the skin and subcutaneous tissue, and diseases related to nervous system. The adjusted hazard of suffering an SL episode due to mood disorders was increased 21.44 times when the worker had previously had one SL. The corresponding figures were 14.58 and 13.92 for SL due to skin and mucous membrane diseases and due to neurotic or stress-related disorders, respectively.
Conclusions The results obtained provide evidence that having suffered previous SL episodes implies a significant increase in the risk of experiencing a new one. High recurrence density of certain diagnoses should be interpreted as a general indication that something is wrong in the occupational setting.

Keywords Sick leave · Recurrence · Cohort studies · Occupational health · Risk factors

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Introduction

Sick leave (SL) is considered an indicator of health status and functioning and it can be understood as a product of the interaction among health status, productive and reproductive demands, and personal resources in terms of control over work, and social support, in a specific economic, regulatory, and social context that involves differential exposures according to social class and gender (Moncada et al. 2002).

Return to work is conceptualized as a dynamic process that not only involves an off-work phase and a work re-entry phase but also includes a maintenance phase of sustainability of work performance. If phase-specific goals are not achieved, then there is risk of a relapse to the off-work phase (Young et al. 2005). Therefore, recurrence of SL could be seen as an indicator of the maintenance of the work status. Similarly, short SL with high recurrence may be indicative of the use of coping strategies by active workers wanting to protect their health, i.e., by limiting noxious occupational exposures through absences from work (Kristensen 1991).

However, among the vast number of studies describing the association between numerous factors and SL, none have been designed with the exclusive objective of investigating the possible association between number of previous episodes and the occurrence of a new one or its duration. There is evidence that a history of SL increases the risk of suffering a new episode (Andrea et al. 2003; Dekkers-Sanchez et al. 2008; Koopmans et al. 2008, 2010). In a recent study, Roelen et al. (2010) present an interesting analysis in this sense. It shows that the incidence density of episodes is higher among recurrent SL, for all diagnoses. However, they grouped all recurrences into a single category, without specifying the exact number of such episodes.

Currently, little is known about the effect of the number of previous SL on the risk of occurrence of a new SL. In a study about sickness absences due to psychosocial health complaints, Duijts et al. (2006) found that, in men, in comparison with workers without any SL episodes, the odds of occurrence of a new episode were 1.95, 3.32 and 4.43 times higher when the workers already had one, two or three prior absences, respectively. In a methodological study (Navarro et al. 2009) dealing with statistical models used to analyze SL, it was found that the risk of suffering an episode of SL, for any cause, increases depending on the number of prior episodes experienced. Thus, the risk of experiencing the second (first recurrence) is twice that of suffering the first occurrence. After the seventh episode, the risk of a new occurrence is over 12 times higher than that corresponding to an initial SL.

While it would thus seem logical to think that in general suffering one SL episode will increase the risk of suffering another, at the same time we would expect this effect to differ depending on the particular diagnosis associated with the SL.

The aim of this paper was to quantify the effect of prior SL episodes, due to the most common causes, on the risk of occurrence of a new one as well as the effect on the duration of subsequent spells.

Methods

Participants and design

The data come from a cohort of workers in the Hospital das Clínicas da Universidade Federal de Minas Gerais, Brasil (HC UFMG) (Reis et al. 2008). This is a dynamic cohort that includes all workers formally registered with the human resources department of the hospital on January 1, 2000, or later. The HC UFMG cohort database combines sociodemographic and occupational information, obtained from the hospital human resources department, with data about appointments and SL episodes generated by each worker, provided by the health service granting the SL.

The sample used in this paper comprises all workers whose first employment relation with the hospital started during the period from 1/1/2000 to 31/12/2007, $n = 1{,}542$. Only people working twenty or more hours per week were included. The median of follow-up per worker was 24.4 months (percentiles 10 and 90 were 3.3 and 62.7, respectively). The workers are mostly women (71.2%), young (75.2% under 35 years old, mean = 29.6 (SD = 7.6)) and with a good educational level (only 7.3% below secondary grade). All of them are permanent workers. Half of the workers are nursing personnel, 51.0%. Table 1 shows the occupational characteristics of the study subjects.

This is a prospective study, workers being followed up from their first day working in the hospital until either the end of their contract or the end of the study period, 31/12/2007, whichever was earliest.

Measures

The number of episodes of medically certified SL and their duration were obtained for each worker. These certificates are emitted by a general practitioner from the hospital occupational health department on the first day of illness. The SL duration was calculated from the number of calendar days absent from work and expressed in three different ways: total days, average per month, and median of days per SL. The frequency of SL was studied by looking at four outcomes: total density (number of SL divided by total worker-time of follow-up), incidence density (number

Table 1 Sample description

Characteristics	*n*	%
Occupation[a]		
Science or art professionals	248	16.1
Middle-level technicians	809	52.5
Administrative workers	394	25.6
Other workers	91	5.9
Employee's working hours		
20–39 h	581	37.7
40 h or more	961	62.3
Employment relation		
Civil servant	514	33.3
Outsourced	1,028	66.7
Type of work		
Medical assistance	829	53.8
Supporting	586	38.0
Infrastructure	127	8.2

[a] According to the Brazilian Classification of Occupations

of new SL divided by total worker-time at risk for the first SL), recurrence density (number of recurrent SL divided by total worker-time at risk for the second or subsequent SL) and, finally, the hazard of suffering an episode. The analyses take into account that during the SL, the worker is not at risk of a new episode, and an SL was considered recurrent when there had been any previous episode, regardless of the number of days between them. Every SL was classified according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, (ICD-10) (World Health Organisation 2005). All SL related to pregnancy, childbirth, and the puerperium were discarded. For the purposes of the study, SL was categorized in two different ways, both based on the ICD-10 diagnosis code: first, each SL was classified according to the twenty-one large groups of the ICD, and, second, we used a classification based on the first three characters of the code. In this case, we considered that there was recurrence only when the worker in question had previously had another episode classed in the same category.

Statistical analysis

To analyze the effect of the number of prior SL, we used the recurrences as a factor in an Andersen-Gill model (Andersen and Gill 1982; Kelly and Lim 2000), a natural extension of the Cox model for recurrent events. This survival analysis was done stratifying by employment relation. In order to ensure consistency in the results, as a general rule, we analyzed the hazard of suffering a given SL when at least 60 workers were at risk. This forced us to select the most common pathological groups and resulted in the number of previous SL being different depending on the diagnosis examined. Possible differences in the distribution of SL episode duration, depending on the number of previous SL, were analyzed by means of the Mann–Whitney U test (when variable "previous SL" had 2 categories) and the Kruskal–Wallis K test (when "previous SL" had more than 2 categories). All analyses were performed with the R statistical package (version 2.7.2, The R Foundation for Statistical Computing).

Results

The workers account for 5,138 SL episodes, 21,250 days of absence and 45,324.2 months of follow-up. The crude rate is 11.34 SL per 100 worker-months.

Table 2 presents the causes of absence classified according to the large groups of the ICD-10. It may be seen that the most frequent causes are the diseases of the respiratory system, accounting for more than 20% of the

Table 2 Number and percentage of SL and total density, incidence density and recurrence density of sick leave episodes per 100 worker-months according to ICD-10 category

Cause (ICD-10 codes)	*n*	%	Total density	Incidence density	Recurrence density
Diseases of the respiratory system (J00–J99)	1,063	20.7	2.35	1.60	4.20
Diseases of the musculoskeletal system (M00–M99)	665	12.9	1.47	0.75	5.20
Infectious and parasitic diseases (A00–B99)	571	11.1	1.26	0.93	2.83
Symptoms, signs, and abnormal clinical and laboratory findings (R00–R99)	443	8.6	0.98	0.68	3.00
Mental and behavioral disorders (F00–F99)	324	6.3	0.71	0.33	6.72
Factors influencing health status and contact with health services (Z00–Z99)	304	5.9	0.67	0.56	1.41
Injury, poisoning, and consequences of external causes (S00–T98)	294	5.7	0.65	0.49	2.03
Diseases of the genitourinary system (N00–N99)	271	5.3	0.60	0.42	2.52
Diseases of the digestive system (K00–K93)	249	4.8	0.55	0.47	1.39
Diseases of the eye and adnexa (H00–H59)	244	4.7	0.54	0.40	2.10
Diseases of the nervous system (G00–G99)	188	3.7	0.41	0.28	2.42
Diseases of the skin and subcutaneous tissue (L00–L99)	180	3.5	0.40	0.27	2.45
Diseases of the circulatory system (I00–I99)	128	2.5	0.28	0.19	2.59
External causes of morbidity and mortality (V01–Y98)	79	1.5	0.17	0.14	1.08
Diseases of the ear and mastoid process (H60–H95)	69	1.3	0.15	0.12	1.36
Neoplasms (C00–D48)	35	0.7	0.08	0.04	4.11
Endocrine, nutritional, and metabolic diseases (E00–E90)	20	0.4	0.04	0.04	1.23
Diagnosis not available	6	0.1	0.01	0.01	2.58
Diseases of the blood and blood-forming organs (D50–D89)	5	0.1	0.01	0.01	0.92
Total	5,138	100.0	11.34	4.67	17.37

total absences, and the associated total density is 2.35 per 100 worker-months. For this cause, every month, 1.6 workers out of every 100 present their first SL, while 4.2 in every 100 experience a recurrence. For all the causes studied, recurrence density is higher than incidence density (for example, recurrence density for "Mental and behavioral disorders" category is more than 20 times the incidence density, 6.72 versus 0.33 per 100 worker-months). Diseases of the respiratory system have the highest incidence, 1.60 per 100 worker-months, while the causes accounting for more recurrent SL are the mental and behavioral disorders, 6.72 per 100 worker-months, and the musculoskeletal diseases, 5.20 per 100 worker-months.

Table 3 presents information related to SL episode duration in days in terms of the various diagnoses. Although SL episodes related to the musculoskeletal system and to mental and behavioral disorders are not the most frequent (Table 2), they account for more days of absence (7.7 and 7.0 days per 100 worker-months, respectively) than the most frequent group of causes, i.e., those related to the respiratory system with 5.8 days per 100 worker-months. These three causes account for 16.5, 14.8, and 12.3% of SL days, respectively. In general, half of the working days lost are due to recurrent SL. Differences may be observed in the distribution of episode durations by diagnosis: for recurrent SL, the first three diagnoses represent 58% of the total days, whereas for first SL episodes, this figure is only 29.3%. In this case, the most frequent categories are Z00–Z99 and S00–T98.

In general, of the total number of workers, 34.8% present an SL at some point in the study period and 9.5% of the workers account for 47.4% of all SL. Table 4 presents

Table 3 Accumulated days, average per month, median of days per sick leave and percentage over the total of days according to ICD-10 category

Cause (ICD-10 codes)	All sick leaves				First sick leaves				Recurrent sick leaves		
	Total	Monthly	Median	%	Total	Monthly	Median	%	Total	Monthly	Median
Diseases of the musculoskeletal system (M00–M99)	3,508	7.7	2	16.5	1,008	2.2	2	9.5	2,500	5.5	3
Mental and behavioral disorders (F00–F99)	3,152	7.0	6	14.8	1,030	2.3	5	9.7	2,122	4.7	7
Diseases of the respiratory system (J00–J99)	2,618	5.8	2	12.3	1,062	2.3	2	10.0	1,556	3.4	2
Factors influencing health status and contact with health services (Z00–Z99)	1,793	4.0	2	8.4	1,341	3.0	2	12.7	452	1.0	2
Injury, poisoning, and consequences of external causes (S00–T98)	1,772	3.9	4	8.3	1,178	2.6	4	11.1	594	1.3	4
Infectious and parasitic diseases (A00–B99)	1,267	2.8	1	6.0	758	1.7	1	7.2	509	1.1	2
Symptoms, signs, and abnormal clinical and laboratory findings (R00–R99)	992	2.2	1	4.7	502	1.1	1	4.7	490	1.1	1
Diseases of the genitourinary system (N00–N99)	984	2.2	2	4.6	584	1.3	2	5.5	400	0.9	2
Diseases of the eye and adnexa (H00–H59)	945	2.1	3	4.4	627	1.4	3	5.9	318	0.7	3
Neoplasms (C00–D48)	777	1.7	10	3.7	210	0.5	7	2.0	567	1.3	17
Diseases of the digestive system (K00–K93)	776	1.7	2	3.7	568	1.3	1	5.4	208	0.5	2
Diseases of the skin and subcutaneous tissue (L00–L99)	716	1.6	3	3.4	396	0.9	3	3.7	320	0.7	3
Diseases of the circulatory system (I00–I99)	631	1.4	2	3.0	468	1.0	2	4.4	163	0.4	2
Diseases of the nervous system (G00–G99)	426	0.9	1	2.0	269	0.6	1	2.5	157	0.3	1
External causes of morbidity and mortality (V01–Y98)	368	0.8	4	1.7	303	0.7	3.5	2.9	65	0.1	4
Diseases of the ear and mastoid process (H60–H95)	205	0.5	2	1.0	134	0.3	2	1.3	71	0.2	3
Endocrine, nutritional, and metabolic diseases (E00–E90)	163	0.4	1	0.8	87	0.2	1	0.8	76	0.2	6
Diagnosis not available	133	0.3	7	0.6	43	0.1	3	0.4	90	0.2	90
Diseases of the blood and blood-forming organs (D50–D89)	24	0.1	5	0.1	23	0.1	5.5	0.1	1	0.0	1
Total	21,250	46.9	2	100	10,591	23.4	2	100	10,659	23.5	2

"Total" shows the accumulated days by cause over the period, "Monthly" is the average accumulated days per 100 worker-months, and "Median" is the median days per SL of that cause

Table 4 Hazard ratios (HR) (crude and adjusted for age, sex, and occupation), their confidence intervals (CI), and the distribution of days per sick leave according to ICD-10 large groups

Prior SL	*n*	%	Crude			Adjusted			Days per SL*			
			HR	95% CI		HR	95% CI		p_{10}	p_{25}	p_{50}	p_{75}
All causes												
0	537	34.8	1			1			1	1	2	3
1	253	16.4	2.02	1.81	2.26	1.97	1.77	2.21	1	1	2	4
2	178	11.5	2.48	2.2	2.79	2.38	2.11	2.68	1	1	2	4
3	115	7.5	3.68	3.21	4.21	3.46	3.02	3.97	1	1	2	3
4	91	5.9	4.40	3.79	5.11	4.15	3.58	4.81	1	1	2	5
5	82	5.3	5.33	4.51	6.3	5.00	4.24	5.91	1	1	2	4
6 or more	286	18.5	9.27	8.10	10.61	8.50	7.45	9.71	1	1	2	5
Infectious and parasitic diseases (A00–B99)												
0	1,192	77.3	1			1			1	1	1	3
1	235	15.2	2.25	1.77	2.85	2.03	1.59	2.6	1	1	1	2
2 or more	115	7.5	5.11	3.81	6.86	4.70	3.6	6.15	1	1	2	3
Mental and behavioral disorders (F00–F99)												
0	1,401	90.9	1			1			1	2	5	10
1	78	5.1	10.52	7.21	15.36	9.52	6.44	14.09	1	2	5	12
2 or more	63	4.1	22.87	15.38	34.00	20.26	13.24	31.00	1	2	7	16.5
Diseases of the nervous system (G00–G99)												
0	1,423	92.3	1			1			1	1	1	2
1 or more	119	7.7	8.81	5.93	13.08	8.20	5.57	12.07	1	1	1	3
Diseases of the eye and adnexa (H00–H59)												
0	1,376	89.2	1			1			1	1	3	5
1 or more	166	10.8	5.54	3.80	8.07	5.30	3.69	7.62	1	1	3	5.25
Diseases of the circulatory system (I00–I99)												
0	1,459	94.6	1			1			1	1	2	7
1 or more	83	5.4	12.82	8.07	20.37	7.92	5.08	12.34	1	1	2	5
Diseases of the respiratory system (J00–J99)												
0	1,023	66.3	1			1			1	1	2	3
1	279	18.1	2.13	1.8	2.53	1.97	1.66	2.35	1	1	2	3
2	102	6.6	3.69	2.99	4.56	3.41	2.76	4.22	1	1	2	3
3 or more	138	8.9	5.10	4.00	6.5	4.63	3.61	5.94	1	1	2	3
Diseases of the digestive system (K00–K93)												
0	1,349	87.5	1			1			1	1	1	3
1 or more	193	12.5	2.37	1.62	3.49	2.16	1.47	3.18	1	1	2	3
Diseases of the skin and subcutaneous tissue (L00–L99)												
0	1,425	92.4	1			1			1	1	3	4
1 or more	80	5.2	10.26	6.27	16.78	9.75	6.03	15.78	1	2	3	7
Diseases of the musculoskeletal system (M00–M99)												
0	1,256	81.5	1			1			1	1	2	4
1	142	9.2	5.01	3.94	6.37	4.78	3.75	6.09	1	1	3	5
2	62	4.0	6.85	4.97	9.43	6.4	4.61	8.9	1	1	3	7
3 or more	82	5.3	13.33	9.82	18.1	12.55	9.27	17.01	1	1	3	9
Diseases of the genitourinary system (N00–N99)												
0	1,368	88.7	1			1			1	1	2	4
1 or more	174	11.3	5.4	3.74	7.8	4.46	3.05	6.51	1	1	2	5
Symptoms, signs, and abnormal clinical and laboratory findings (R00–R99)												
0	1,272	82.5	1			1			1	1	1	2

Table 4 continued

Prior SL	*n*	%	Crude			Adjusted			Days per SL*			
			HR	95% CI		HR	95% CI		p_{10}	p_{25}	p_{50}	p_{75}
1	170	11.0	3.56	2.77	4.58	3.27	2.53	4.24	1	1	1	2
2 or more	100	6.5	6.61	4.89	8.94	5.68	4.15	7.76	1	1	1	2
Injury, poisoning, and consequences of external causes (S00–T98)												
0	1,345	87.2	1			1			1	2	4	7
1 or more	197	12.8	4.39	3.20	6.02	3.91	2.89	5.28	1	3	4	7
Factors influencing health status and contact with health services (Z00–Z99)												
0	1,322	85.7	1			1			1	1	2	8
1 or more	220	14.3	2.5	1.82	3.44	2.37	1.71	3.27	1	1	2	7

* p_{10}, p_{25}, p_{50}, p_{75}, and p_{90} are the percentiles of 10, 25, 50, 75, and 90

the distribution of workers in terms of the number of SL during the period, the hazard of experiencing a subsequent SL depending on the number of prior occurrences and the distribution of duration of absence. The results are presented both overall and by the cause of the SL. In general, we can see a trend whereby the higher the number of prior SL, the greater is the hazard of presenting a new one. This is particularly the case for SL due to mental and behavioral disorders, diseases of the skin and subcutaneous tissue, and diseases related to the nervous system. A similar trend can be observed for duration of SL. In this case, however, this pattern is only statistically significant for SL due to problems with the musculoskeletal system and connective tissue ($p < 0.001$) and for those related to the skin and subcutaneous tissue ($p = 0.005$). For all the causes, episode duration also presents an association with the recurrences ($p = 0.032$).

Table 5 shows the same results as Table 3 but for more specific diagnostic groups. In this table, we see the same pattern. The hazard of experiencing an SL episode is increased when the worker has one or more previous SL. This effect is strong in the majority of the pathological groups studied. For example, in the SL due to mood disorders, the hazard of having a new SL in workers who have had one previously is more than 21 times the hazard in workers without any SL for this cause. Regarding the duration of the SL, we found statistical significance only in the absences related to the acute upper respiratory infections ($p = 0.033$), dorsopathies ($p = 0.032$), soft tissue disorders ($p = 0.038$), and signs and symptoms involving the digestive system and abdomen ($p = 0.005$).

Discussion

SL is a commonly used outcome in occupational health cohort studies. Although it is a recurrent phenomenon, there is little literature about the role that it plays in the occurrence of new spells. This paper quantifies the effect of prior SL episodes on the hazard of presenting a new one in several diagnostic groups. Although this effect varies depending on the diagnostic group, it is significant in all cases.

We have seen different patterns in the densities and duration of SL by type of SL: first or recurrence. Since the recurrence density is clearly higher than the incidence density, it means that when the worker has presented some SL, the risk of suffering a new one will be higher. We observe that this happens for all diagnoses.

Some diseases, such as migraine, herpes simplex or bronchial asthma, are characteristically recurrent phenomena. In other cases, depending on the disease, specific medical aspects contribute to the recurrence of SL. Patients with chronic diseases will certainly be prone to relapse, which can lead to repeated periods of illness. This may be observed, for example, for diabetes mellitus, psychiatric illnesses, and respiratory diseases (Roskes et al. 2005). However, other important factors are probably also involved, such as working conditions, especially the component of work organization, which is related to short SL. For example, increased stress-related illnesses and psychosocial problems in the workplace are possible explanations for the increase in SL (Hensing and Wahlstrom 2004).

Mood disorders or neurotic and stress-related disorders present the highest adjusted hazard ratios. High workload, poor quality of leadership, professional conflicts and emotional demands of caring are associated with these disorders in nursing (McVicar 2003), and they probably have a similar influence on other hospital staff. More generally, other authors (Roelen et al. 2009) have observed that rewards in terms of job esteem and job perspectives were negatively related to the absence frequency, in men, and satisfaction with income, in women. Decision latitude

Table 5 Hazard ratios (HR) (crude and adjusted for age, sex, and occupation), their confidence intervals (CI), and the distribution of days per sick leave according to three-character ICD-10 categories

Prior SL	*n*	%	Crude			Adjusted			Days per SL*			
			HR	CI (95%)		HR	CI (95%)		p_{10}	p_{25}	p_{50}	p_{75}
Intestinal infectious diseases (A00–A09)												
0	1,292	83.8	1			1			1	1	1	2
1	186	12.1	2.25	1.65	3.07	2.07	1.51	2.85	1	1	1	2
2 or more	64	4.2	5.61	3.59	8.78	5.07	3.32	7.73	1	1	1	2
Viral infections characterized by skin and mucous membrane lesions (B00–B09)												
0	1,471	95.4	1			1			1	1	3.5	7
1 or more	71	4.6	16.64	10.26	26.98	13.72	8.70	21.63	1	1	3	10
Mood [affective] disorders (F30–F39)												
0	1,460	94.7	1			1			1	3	7.5	14.25
1 or more	82	5.3	23.79	15.91	35.58	20.53	13.52	31.18	1	4	8.5	17
Neurotic, stress-related and somatoform disorders (F40–F48)												
0	1,462	94.8	1			1			1	1	3.5	7
1 or more	80	5.2	14.82	8.67	25.30	13.38	7.73	23.17	1	1	3	10
Episodic and paroxysmal disorders (G40–G47)												
0	1,433	92.9	1			1			1	1	1	2
1 or more	109	7.1	8.86	5.77	13.59	8.03	5.29	12.19	1	1	1	2
Disorders of conjunctiva (H10–H13)												
0	1,420	92.1	1			1			1	1	4	7
1 or more	122	7.9	5.29	3.57	7.85	4.99	3.32	7.48	1	1	3	10
Acute upper respiratory infections (J00–J06)												
0	1,108	71.9	1			1			1	1	2	2
1	248	16.1	2.30	1.91	2.79	2.15	1.77	2.60	1	1	2	3
2	93	6.0	4.00	3.09	5.18	3.63	2.80	4.72	1	1	2	3
3 or more	96	6.2	4.73	3.38	6.61	4.22	3.01	5.93	1	1	2	2
Influenza and pneumonia (J09–J18)												
0	1,397	90.6	1			1			1	1	2	3
1 or more	145	9.4	1.64	1.01	2.65	1.47	0.90	2.42	1	1	1	2
Diseases of oral cavity, salivary glands, and jaws (K00–K14)												
0	1,427	92.5	1			1			2	2	3	5
1 or more	115	7.5	4.32	2.58	7.21	3.77	2.21	6.43	1	2	3	5
Dorsopathies (M40–M54)												
0	1,352	87.7	1						1	1	2	3
1	115	7.5	5.14	3.73	7.08	4.75	3.44	6.57	1	1	2	4
2 or more	75	4.9	13.54	9.06	20.21	12.40	8.37	18.36	1	1	3	7
Soft tissue disorders (M60–M79)												
0	1,419	92.0	1			1			1	1	2	5
1 or more	123	8.0	6.96	4.70	10.32	6.52	4.36	9.75	1	1	3	9.25
Symptoms and signs involving the digestive system and abdomen (R10–R19)												
0	1,411	91.5	1			1			1	1	1	2
1 or more	131	8.5	5.94	4.13	8.55	5.01	3.44	7.29	1	1	1	3
Injuries to the ankle and foot (S90–S99)												
0	1,470	95.3	1			1			1	1	2	3
1 or more	72	4.7	6.27	3.26	12.05	5.64	2.93	10.85	1	1	1	3
Persons encountering health services for specific procedures and health care (Z40–Z54)												
0	1,399	90.7	1			1			1	1	4	14

Table 5 continued

Prior SL	*n*	%	Crude			Adjusted			Days per SL*			
			HR	CI (95%)		HR	CI (95%)		p_{10}	p_{25}	p_{50}	p_{75}
1 or more	143	9.3	2.82	1.84	4.32	2.55	1.64	3.95	1	1.25	3.5	9

* p_{10}, p_{25}, p_{50}, p_{75}, and p_{90} are the percentiles of 10, 25, 50, 75, and 90

was also seen as a strong predictor for long-term SL (Andrea et al. 2003).

We have observed that other frequent causes of SL were the musculoskeletal disorders and, specifically, dorsopathies. Both show high levels of recurrence and their effects on the risk of presenting a new SL for one of these causes is remarkable (adjusted HR = 4.95 and 13.51 for the second and third or subsequent dorsopathy-related SL episode). Among nursing personnel, high physical demands can lead to musculoskeletal diseases, especially injuries in the dorsal region mainly due to transferring patients (Engkvist et al. 2000).

Another cause where the effect of recurrence was high is infection by skin or mucous membrane lesions (adjusted HR = 14.58). In general, they are herpetic lesions, which can be considered as a chronic problem and, consequently, it is to be expected that they present strong effects.

Regarding the duration of the absences, the pattern is not as clear as that of the hazard. In some cases, the median of days per SL is higher in recurrent SL than in the first SL. Some cases are statistically significant, although they are not particularly intense, and some tests are probably not significant due to low statistical power. On the other hand, this finding is consistent with another study showing that the duration of the episodes is not associated with factors that, in turn, are related to the frequency of SL (Roelen et al. 2009).

SL is a recurrent event, i.e., it may occur more than once in a given individual. Classical statistical models may not be appropriate for analyzing variables of this type (Christensen et al. 2007; Navarro et al. 2009), as they tend to assume that the risk of experiencing one SL is independent of the number of prior SL presented by the worker. When this is not true, the application of these models would lead to an underestimation of the variance and could result in a biased estimation of the effect of the studied factors. Therefore, SL needs to be analyzed by proper statistical techniques given the change on the hazard depending on the previous episodes.

The results obtained provide evidence that having suffered a previous SL episode implies a significant increase in the risk of experiencing a subsequent one. Therefore, in order to obtain accurate estimates of the factors associated with the occurrence of SL, it is essential to incorporate the effects of recurrence into the analysis.

A possible limitation of this study is the classification of the diagnoses. We used both the ICD-10 large groups, and a classification based on the first three characters, since we needed to work with a minimum number of records in each sample in order to ensure the consistency of the results. This fact obviously affects the substantive interpretation of the findings of our paper. However, it is important to note that if we found these associations, using these classifications, probably a more homogeneous classification would show stronger associations. The only published study we found with similar characteristics to ours (Roelen et al. 2010) used only the large groups of the ICD-10.

We are aware that the estimated effects describe a particular situation, and therefore their generalization should be made with caution. First, our study has been conducted in a hospital and our subjects are mostly nursing personnel: health professionals are known to have high rates of absenteeism (dos Reis et al. 2003; Lopez Cuenca et al. 2006). Second, the granting of sick leave depends on the legislation in each country. Even so, our paper presents a previously unreported pattern in the effect of recurrences on the risk of presenting a subsequent SL episode.

Strength of our study is the fact that the sample is only composed of new workers, people whose first contract with the hospital began during the studied period. This means we can determine the exact number of SL from the start of the contract relation, and their order. Consequently, we can estimate the effect of the prior SL in a fairly accurate way. However, it must be borne in mind that the fact of having only studied recently hired workers may imply that the cohort analyzed is composed of younger workers than other occupational cohorts. One would expect that with an older cohort, chronic diseases would be more common and thus the incidence of recurrence would be higher. It is also logical to think that this could affect the duration of episodes, i.e., more longer episodes, whereas in our study, they are mostly short.

Briefly, given the considerable burden of recurrent SL, prevention of relapse, whenever possible, should be part of any treatment program or intervention aimed at facilitating return to work (Roelen et al. 2010) and high recurrence density of certain diagnoses should be interpreted as a general indication that something is wrong in the occupational setting.

Acknowledgments This study was partially funded by the Fondo de Investigación Sanitaria, Instituto de Salud Carlos III, Ministerio de Ciencia e Innovación, Gobierno de España (PI080703 project).

Conflict of interest None.

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