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COVID-19 Pandemic Impact on Sickness Absences Among Healthcare Workers: A Cohort Study in a Spanish Hospital (2018-2023)

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Abstract

Background: *Like other European systems, the Spanish national health system (NHS) is reaching a critical point. This article analyses sickness absence (SA) trends, as a direct indicator of this crisis, among healthcare workers (HCWs) in Spain, comparing the pre-pandemic, pandemic, and post-pandemic periods.* **Methods:** *This study was based on a retrospective cohort of HCWs (n=7.918) hired at Hospital del Mar in Barcelona for at least three months during 2018-2023. The primary outcome was incident SA episodes. Incidence rates (IR) per 1,000 persons-day and 95% confidence intervals (95% CI) were calculated by sex, period, and occupational variables. Longitudinal entropy regression models were estimated to identify the factors influencing the frequency of transitions between the different HCWs' employment states (active or on SA).* **Results:** *Increasing trends in IR (95%CI) were observed, rising from 1.77 (1.71; 1.83) episodes of SA per 1,000 workers-day during the pre-pandemic period to 5.04 (4.93; 5.15) during the post-pandemic among women, and from 1.23 (1.14; 1.31) to 3.79 (3.64; 3.95), respectively, among men. Nurses, nurse aides, orderlies/technicians, workers under 30, and those in intensive care units and emergency rooms showed the highest IR during and after the pandemic, with longitudinal entropy analysis revealing increased state changes, primarily affecting these groups.* **Conclusions:** *This study demonstrates a significant rise in SA incidence among HCWs during and after the pandemic and identifies vulnerable groups with higher incidence. Several hypotheses, such as poor working conditions, burnout, and patient complexity, have been suggested to explain these results. Urgent interventions are needed to safeguard HCWs' health, thus maintaining the sustainability and safety of the NHS.*

1. Introduction

The Spanish health system, similar to those in other European countries, is reaching a critical juncture. The ongoing aging of the general population, coupled with the rising prevalence and complexity of various diseases, alongside the austerity measures stemming from the Great Recession of 2008 and, more recently, the COVID-19 pandemic, are posing an unprecedented challenge to the Spanish National

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Health System (NHS). It has been noted that the system has long experienced diminished service quality, resource shortages, and understaffing, which have led to degrading working conditions, increased exposure to occupational hazards, and an overall decline in the health of healthcare workers (HCWs) [1–3]. The pandemic worsened this situation.

In healthcare, hospitals are complex workplaces regarding working conditions, exposing staff to various occupational risks, including ergonomic, safety, hygienic, and psychosocial factors. Employment conditions also play a role, linked to long working hours, variable shifts, workloads, understaffing, and an excessive ratio of patients to professionals [4]. As highlighted, the health sector ranks among the most stressful occupations [5]. Poor working conditions increase HCWs' health problems, such as the high prevalence of mental health disorders [6, 7] and musculoskeletal disorders. [8]

Studies about the effect of the pandemic on working conditions show that not all occupational categories are equally affected. Within HCW, there are several job roles, each with distinct tasks, forming a hierarchical work environment that increases health inequalities. For example, nurses have historically been disadvantaged through more precarious employment conditions [2]. Furthermore, gender imbalance is prevalent, with women occupying 90% of aides' positions but only 25% of high-level positions despite accounting for 70% of the workforce [9]. Female HCWs experience poorer working conditions and health outcomes, underscoring the importance of gender perspective when assessing work conditions [10].

Sickness absence (SA) is considered a global measure of health status and functioning in the working population [11], where poor working conditions are associated with SA [12]. SA is a complex phenomenon that affects quality of life and economics at different structural levels, having a significant impact on both social and economic expenditures. In Spain, the expenditure on SA has shown a growing trend in recent years, accounting for more than €11 billion in 2023 [13]. However, SA research is still modest and there is a need for evidence-based knowledge regarding the causes and consequences of SA [14].

HCWs have been identified as a group with a high incidence of SA, particularly among females, older employees, and those experiencing low control and non-supportive management styles [15]. However, there is a lack of studies examining the impact of this issue during and beyond the pandemic, particularly in comparing the years before and after 2020-2021 based on socio-demographic and employment conditions. The main objective of this article is to describe the trend in the incidence of SA episodes among HCWs from 2018 to 2023 by comparing the pre-pandemic (2018 and 2019), the pandemic (2020 and 2021), and the post-pandemic (2022-2023) periods.

2. Methods

2.1. Study Design and Population

This study is a retrospective cohort conducted from January 1, 2018, to June 30, 2023, at Barcelona Hospital del Mar (HMar), a healthcare institution in Barcelona, Spain. This facility has 1,902 beds, 33,000 annual discharges, and eight acute and long-term care health centers. Information on (HCW) was obtained from the Human Resources Department databases. For each HCW, we collected sociodemographic and occupational variables, along with all information on sick leave episodes. A participant identification number was created to link all the data and ensure confidentiality. Privacy and data safety were guaranteed, and the study received approval from the HMar Ethical Committee (2020/9379/I).

2.2. Inclusion and Exclusion Criteria

The inclusion criteria were being a HCW engaged either in direct patient care or not, aged 18–70 years, and having been employed for at least 3 months during the whole study period. We included a 3-month employment criterion in the cohort because many have successive employment. Workers must have been affiliated with Social Security for at least 6 months in the past 5 years to qualify for sickness absence benefits. The exclusion criteria were staff working in the hospital through an employment contract with an external company (mainly kitchen, security, maintenance, and cleaning staff).

2.3. Variables Definitions

The main outcome was episodes of SA due to any health problem, excluding work-related injuries or accidents, which represent a minimally significant percentage of the total [13] and are covered under a different social security scheme. Employment status was categorized as either actively working or on sickness absence. Time was organized into months and years, then classified into a new variable called "period," which has three categories: "pre-COVID-19" (2018-2019), "COVID-19" (2020-2021), and "post-COVID-19". (2022-2023).

For each worker, the following information was available: type of contract (permanent, temporary/replacement); occupational category (physicians, nurses, nurse aides, medical and other trainees, lab technicians, and administration and management staff); work unit (inpatient care, intensive care, emergencies, surgery, outpatient care, central services, administration/support); health center or facility (Hospital del Mar and Hospital de l'Esperança (acute care), Centre Fòrum (long-term care and psychiatry), and CAEMIL Center (psychiatry)); work shift (day, night, other); age (18–29, 30–49, and 50–70 years) and sex.

2.4. Statistical Analysis

The study variables for each period were described as sample counts and percentages stratified by sex and period. Incidence rates (IR) per 1,000 worker-days and their 95% Confidence Intervals (95% CI) were calculated for every year, and period, also stratified by sex and based on occupational variables. Subsequently, we conducted a regression analysis specifically focused on the entropy associated with employment status (whether active or on sick leave). This analysis aimed to identify factors influencing the frequency of transitions between these two states [16]. Entropy values represent the frequency of state changes within a group, with higher values indicating more frequent changes between active and sickness absence states. For example, if Group A has an entropy of 0.05 and Group B has an entropy of 0.20, workers in Group B experience state changes more frequently than those in Group A. Two approaches adjusted for age were used: one fitted crude models for each occupational variable (Model 1) and the other fitted a single model including all occupational variables (Model 2). All analyses were conducted with RStudio (2024.04.2+764).

3. Results

During the observation period, a total of 7,918 (HCWs) were employed by HMAR, with 72.7% being female. In both genders, approximately 40% were younger than 30 years old, 80% worked during the day shift, more than half had permanent contracts, around 40% were in inpatient care, and about two-thirds were employed at Hospital del Mar, the primary facility. Among women, roughly 32% were nurses and 27% were nurse aides, while among men, about 22% were physicians and 20% were administrative staff. No significant differences or clear trends were observed by period concerning age or any occupational variables (Table 1).

The IR per 1,000 workers-day and 95%CI of SA showed clear, statistically significant increasing trends across the periods both in women and men, from 1.77 (1.71; 1.83) episodes of SA per 1,000 workers-day in 2018-2019, 3.28 (3.20; 3.35) in 2020-2021, to 5.04 (4.93; 5.15) in 2022-2023 among women; and 1.23 (1.14; 1.31), 2.40 (2.29; 2.50) in 2020-2021, to 3.79 (3.64; 3.95), respectively, among men. When stratifying by age and occupational variables, similar increasing trends were observed for most categories, especially in younger ages under 30 years, nurses and nurse aides, intensive care, emergencies and inpatient care, psychiatric and long-term care facilities (Centre Fòrum and CAEMIL), and the night shift. For female nurses, IR increased from 1.63 (1.54; 1.73) in 2018-2019 to 5.14 (4.95; 5.32) in 2022-2023, and for men from 1.51 (1.28; 1.74) to 5.33 (4.88; 5.79). Nurse aides showed similar increases to nurses, but had overall higher IR, with IR for women rising from 2.63 (2.49; 2.77) to 7.75 (7.48; 8.02) and men from 1.80 (1.53; 2.08) to 6.47 (5.95; 7.00). In contrast, physicians had the lowest increases, with female physicians showing an increase from 1.05 (0.93; 1.17) to 2.50 (2.29; 2.71) and men from 0.56 (0.46; 0.65) to 1.52 (1.33; 1.70).

Table 1. Sociodemographic and occupational characteristics by sex and period of healthcare workers at Hospital del Mar (2018-2023).

		Women				Men			
		2018-19 n (%)	2020-21 n (%)	2022-23 n (%)	Total n (%)	2018-19 n (%)	2020-22 n (%)	2022-23 n (%)	Total n (%)
Age	18-29	1,134 (29.4)	1,546 (34.1)	1,358 (32.2)	2,381 (41.4)	421 (30.9)	634 (37.9)	545 (34.8)	950 (43.9)
	30-49	1,709 (44.2)	1,942 (42.8)	1,844 (43.7)	2,276 (39.6)	615 (45.1)	695 (41.5)	672 (43.0)	850 (39.3)
	50-70	1,020 (26.4)	1,051 (23.2)	1,016 (24.1)	1,097 (19.1)	328 (24.0)	346 (20.7)	347 (22.2)	362 (16.7)
Occupational Category	Physician	504 (13.0)	546 (12.0)	536 (12.7)	666 (11.6)	378 (27.7)	418 (25.0)	389 (24.9)	490 (22.7)
	Nurse	1,344 (34.8)	1,512 (33.3)	1,421 (33.7)	1,863 (32.4)	209 (15.3)	253 (15.1)	258 (16.5)	343 (15.9)
	Nurse aide	1,004 (26.0)	1,172 (25.8)	1,154 (27.3)	1,531 (26.6)	191 (14.0)	225 (13.4)	238 (15.2)	320 (14.8)
	Medical & other trainees	236 (6.1)	345 (7.6)	236 (5.6)	493 (8.6)	128 (9.4)	146 (8.7)	110 (7.0)	219 (10.1)
	Orderly/technician	277 (7.2)	317 (7.0)	284 (6.7)	411 (7.1)	230 (16.9)	282 (16.8)	263 (16.8)	355 (16.4)
	Administration	498 (12.9)	648 (14.3)	589 (14.0)	792 (13.8)	228 (16.7)	351 (21.0)	306 (19.6)	435 (20.1)
Work unit	Inpatient care	1,699 (44.1)	2,070 (45.7)	1,846 (43.8)	2,711 (47.1)	499 (36.7)	697 (41.7)	562 (35.9)	924 (42.8)
	Critical Care	142 (3.7)	170 (3.8)	153 (3.6)	199 (3.5)	40 (2.9)	47 (2.8)	47 (3.0)	59 (2.7)
	Emergencies	343 (8.9)	387 (8.6)	376 (8.9)	491 (8.5)	158 (11.6)	175 (10.5)	196 (12.5)	241 (11.2)
	Surgery	507 (13.2)	566 (12.5)	573 (13.6)	715 (12.4)	206 (15.1)	232 (13.9)	227 (14.5)	277 (12.8)
	Outpatient care	607 (15.8)	687 (15.2)	639 (15.1)	856 (14.9)	183 (13.4)	211 (12.6)	206 (13.2)	264 (12.2)
	Central services	219 (5.7)	269 (5.9)	263 (6.2)	318 (5.5)	96 (7.1)	104 (6.2)	110 (7.0)	144 (6.7)
	Administration/support	334 (8.7)	376 (8.3)	369 (8.7)	461 (8.0)	179 (13.2)	206 (12.3)	216 (13.8)	252 (11.7)
Health centre	Hospital del Mar	2,468 (64.0)	3,032 (66.8)	2,745 (65.1)	3,778 (65.7)	958 (70.3)	1,216 (72.6)	1,077 (69.0)	1,545 (71.5)
	Hospital de l'Esperança	389 (10.1)	425 (9.4)	469 (11.1)	589 (10.2)	110 (8.1)	128 (7.6)	147 (9.4)	179 (8.3)
	Centre Fòrum	325 (8.4)	346 (7.6)	340 (8.1)	448 (7.8)	75 (5.5)	76 (4.5)	73 (4.7)	96 (4.4)
	CAEMIL	443 (11.5)	450 (9.9)	416 (9.9)	587 (10.2)	149 (10.9)	162 (9.7)	163 (10.4)	222 (10.3)
	Other	233 (6.0)	283 (6.2)	244 (5.8)	345 (6.0)	71 (5.2)	92 (5.5)	102 (6.5)	118 (5.5)
Shift	Day	3,141 (81.3)	3,663 (80.7)	3,424 (81.1)	4,628 (80.4)	1,110 (81.4)	1,367 (81.6)	1,290 (82.5)	1,727 (79.9)
	Night	586 (15.2)	769 (16.9)	713 (16.9)	938 (16.3)	173 (12.7)	242 (14.4)	227 (14.5)	313 (14.5)
	Other	136 (3.5)	108 (2.4)	83 (2.0)	190 (3.3)	81 (5.9)	66 (3.9)	47 (3.0)	122 (5.6)
Contract type	Permanent	2,680 (69.4)	2,878 (63.4)	3,208 (76.0)	3,122 (54.3)	946 (69.4)	1,005 (60)	1,123 (71.9)	1,134 (52.5)
	Temporary	476 (12.3)	825 (18.2)	223 (5.3)	1,160 (20,2)	194 (14.2)	416 (24.8)	152 (9.7)	554 (25.6)
	Replacement	706 (18.3)	836 (18.4)	788 (18.7)	1,472 (25.6)	224 (16.4)	254 (15.2)	287 (18.4)	472 (21.9)
Total		3,863	4,540	4,220	5,756	1,364	1,675	1,564	2,162

Across all occupational variables, women generally had higher IRs than men (Table 2).

Longitudinal entropy analysis shows that, in the fully adjusted model, both women and men experienced an increase in state changes (active or SA) during and after the pandemic, particularly among nurses, aides, and orderlies/technicians compared to physicians. Female nurses exhibited entropy values rising from 0.07 (in the pre-COVID-19 period) to 0.14 (in the post-COVID-19 period), while nurse aides also surged from 0.11 to 0.25. Male orderlies/technicians, along with male nurse aides, represented the occupational groups with the highest entropy values in the post-COVID-19 period (0.27) (Tables 3 and 4).

Workers with temporary and replacement contracts experienced fewer changes in state compared to those with permanent contracts. While this trend already existed in the pre-COVID-19 period, these differences expanded after the pandemic (e.g., female temporary healthcare workers went from -0.09 state changes to -0.28). In both men and women, workers in inpatient care, intensive care units, and emergency services saw significant increases in state changes compared to administration and support workers. During the pandemic, those in emergency and intensive care roles exhibited significantly higher entropy values (0.24 and 0.21, respectively, among women, and 0.15 and 0.18 among men), with female healthcare workers continuing this trend in the post-COVID-19 period. Health centers and shifts had almost no explanatory power in the adjusted models.

4. Discussion

Our analysis of SA in healthcare workers in a complex healthcare institution shows a significant increasing trend in SA incidence, with post-pandemic rates doubling and even tripling those before the pandemic. An increase in state changes from active to SA can also be observed, primarily affecting nurses, aides, orderlies/technicians, and those working in intensive care units and emergency rooms. Furthermore, SA IRs are always higher among women and, during the post-pandemic period, among workers younger than 30 years old.

While previous studies focused on the SA evolution before and/or during the pandemic [17,18], this study is the first to analyse HCWs' SA trends over a long period comprising before, during, and after the pandemic, shedding light on the HCWs' post-pandemic situation in Spain, and probably in other similar settings. Before the pandemic, SA had been identified as a significant problem among HCWs [19]. Their higher levels of SA have been related to the high exposure to occupational risks and poor employment conditions (such as long working hours, workload and understaffing), the high prevalence of burnout [8, 20] and musculoskeletal disorders which characterize the health sector [4, 5].

It has been shown that, at least during the first months of the pandemic, there has been a substantial increase in sickness absence among HCWs all over Europe [18, 21, 22]. Our findings are coherent with these results, and broadens them, showing how this increase is maintained after the pandemic, even after the decline in COVID infection rates from 2022 onwards in Europe due to vaccination programmes. So, the results obtained show that the COVID-19 pandemic exacerbated an already strained sector [5], that has not returned to normal. In this regard, a significant decline in Spanish HCWs' working conditions was found [3] and several systematic reviews showed that the pandemic caused generalized anxiety and major depression disorders, insomnia, and burnout [6,20], as well as an increasing turnover intention, especially among medical and nursing staff [23]. Also, the increase in SA incidence since the pandemic period could be partly explained by a governmental decision to cover up to 100% of the salary of NHS HCWs during all SA episodes from July 2021 onwards. This could be interpreted as a protective mechanism to support a highly strained health system due to the pandemic. This deserves a specific analysis comparing SA IR before and after July 2021, combined with a qualitative approach to understand the impact of this measure on the incidence of SA since then.

We found that the SA incidence rate was significantly higher among women throughout the entire observation period. This finding aligns with research on SA in Europe [24–26], which indicates that women experience more SA than men [27].

Table 2. Incidence rate (IR) of sickness absence/1,000 worker-day and 95% C.I., by sex and period, according to age and occupational variables. Hospital del Mar, 2018-2023.

		Women			Men		
		2018-19 IR (95% CI)	2020-2021 IR (95% CI)	2022-2023 IR (95% CI)	2018-19 IR (95% CI)	2020-2021 IR (95% CI)	2022-2023 IR (95% CI)
Age	18-29	1.43 (1.31; 1.54)	4.07 (3.90; 4.25)	5.81 (5.59; 6.04)	1.15 (0.99; 1.32)	3.65 (3.39; 3.91)	5.05 (4.72; 5.38)
	30-49	1.80 (1.71; 1.89)	3.17 (3.06; 3.28)	4.99 (4.83; 5.15)	1.38 (1.25; 1.50)	2.18 (2.03; 2.34)	3.76 (3.53; 3.99)
	50-70	1.95 (1.84; 2.06)	2.76 (2.63; 2.89)	4.35 (4.16; 4.54)	1.04 (0.90; 1.17)	1.56 (1.40; 1.73)	2.46 (2.22; 2.70)
Occupational Category	Physician	1.05 (0.93; 1.17)	1.52 (1.37; 1.66)	2.50 (2.29; 2.71)	0.56 (0.46; 0.65)	0.98 (0.85; 1.11)	1.52 (1.33; 1.70)
	Nurse	1.63 (1.54; 1.73)	3.48 (3.34; 3.61)	5.14 (4.95; 5.32)	1.51 (1.28; 1.74)	3.65 (3.30; 4.00)	5.33 (4.88; 5.79)
	Nurse aide	2.63 (2.49; 2.77)	4.96 (4.77; 5.15)	7.75 (7.48; 8.02)	1.80 (1.53; 2.08)	4.11 (3.71; 4.5)	6.47 (5.95; 7.00)
	Medical & other trainees	0.75 (0.59; 0.91)	2.39 (2.13; 2.66)	2.47 (2.17; 2.77)	0.71 (0.51; 0.92)	1.90 (1.57; 2.24)	2.12 (1.71; 2.54)
	Orderly/technician	2.08 (1.84; 2.33)	2.98 (2.69; 3.26)	5.55 (5.10; 6.00)	1.95 (1.70; 2.21)	3.36 (3.04; 3.67)	5.67 (5.21; 6.13)
	Administration	1.58 (1.43; 1.72)	2.03 (1.88; 2.19)	3.45 (3.21; 3.68)	1.31 (1.10; 1.52)	1.75 (1.54; 1.97)	2.66 (2.37; 2.96)
Work unit	Inpatient care	1.95 (1.86; 2.05)	3.98 (3.85; 4.12)	5.89 (5.71; 6.08)	1.30 (1.15; 1.45)	3.17 (2.95; 3.39)	4.72 (4.43; 5.02)
	Critical care	1.83 (1.53; 2.14)	4.38 (3.92; 4.83)	6.08 (5.46; 6.70)	1.27 (0.76; 1.78)	3.57 (2.81; 4.33)	5.95 (4.86; 7.04)
	Emergencies	2.05 (1.83; 2.26)	4.35 (4.05; 4.66)	6.83 (6.39; 7.27)	1.70 (1.40; 2.00)	3.19 (2.80; 3.58)	5.51 (4.93; 6.08)
	Surgery	1.40 (1.26; 1.54)	2.71 (2.52; 2.89)	4.43 (4.17; 4.70)	0.88 (0.72; 1.05)	1.60 (1.39; 1.82)	2.98 (2.65; 3.31)
	Outpatient care	1.75 (1.61; 1.89)	2.79 (2.62; 2.96)	4.37 (4.12; 4.62)	1.46 (1.23; 1.69)	2.38 (2.09; 2.66)	3.42 (3.02; 3.81)
	Central services	1.87 (1.63; 2.11)	2.02 (1.78; 2.26)	3.87 (3.50; 4.25)	0.78 (0.53; 1.03)	1.46 (1.14; 1.78)	2.27 (1.83; 2.71)
	Administration/ Support	1.30 (1.14; 1.46)	1.57 (1.40; 1.74)	2.39 (2.15; 2.63)	1.07 (0.87; 1.27)	1.23 (1.02; 1.43)	2.06 (1.77; 2.35)
Health centre	Hospital del Mar	1.65 (1.58; 1.72)	3.18 (3.08; 3.27)	4.89 (4.76; 5.02)	1.09 (1.00; 1.18)	2.24 (2.11; 2.36)	3.68 (3.50; 3.86)
	Hospital Esperança	1.48 (1.31; 1.66)	3.61 (3.35; 3.87)	5.28 (4.94; 5.61)	0.99 (0.74; 1.25)	3.15 (2.70; 3.61)	3.87 (3.36; 4.37)
	Centre Fòrum	2.17 (1.94; 2.39)	4.05 (3.74; 4.35)	5.61 (5.19; 6.02)	2.30 (1.82; 2.78)	3.28 (2.67; 3.89)	4.51 (3.67; 5.35)
	CAEMIL	2.65 (2.42; 2.87)	3.93 (3.66; 4.20)	6.13 (5.74; 6.52)	1.73 (1.42; 2.03)	2.99 (2.61; 3.37)	5.29 (4.72; 5.86)
	Other	1.47 (1.27; 1.68)	1.93 (1.69; 2.16)	3.79 (3.41; 4.17)	1.35 (0.99; 1.72)	1.73 (1.35; 2.10)	2.26 (1.82; 2.71)
Shift	Day	1.64 (1.58; 1.71)	2.98 (2.90; 3.06)	4.63 (4.52; 4.74)	1.18 (1.10; 1.27)	2.18 (2.06; 2.29)	3.41 (3.25; 3.57)
	Night	2.49 (2.31; 2.66)	4.97 (4.74; 5.21)	7.47 (7.13; 7.80)	1.52 (1.27; 1.78)	3.93 (3.54; 4.32)	6.16 (5.64; 6.68)
	Other	1.42 (1.00; 1.84)	2.44 (2.10; 2.77)	2.87 (2.29; 3.46)	1.19 (0.66; 1.73)	2.00 (1.42; 2.58)	3.37 (2.20; 4.54)
Contract type	Permanent	1.78 (1.72; 1.85)	2.95 (2.87; 3.04)	4.76 (4.64; 4.88)	1.18 (1.09; 1.27)	2.00 (1.89; 2.12)	3.50 (3.34; 3.67)
	Temporary	1.81 (1.44; 2.18)	4.07 (3.76; 4.39)	4.69 (4.04; 5.34)	1.16 (0.70; 1.63)	2.93 (2.51; 3.35)	4.60 (3.76; 5.43)
	Replacement	1.70 (1.56; 1.84)	4.39 (4.17; 4.61)	6.51 (6.20; 6.82)	1.49 (1.26; 1.72)	4.00 (3.65; 4.35)	4.85 (4.45; 5.25)
Total		1.77 (1.71; 1.83)	3.28 (3.20; 3.35)	5.04 (4.93; 5.15)	1.23 (1.14; 1.31)	2.40 (2.29; 2.50)	3.79 (3.64; 3.95)

Table 3. Longitudinal entropy analysis. Relationship of employment state transitions (from active to sickness absence), and age and occupational variables among women, by period. Hospital del Mar 2018-2023.

		Model 1			Model 2		
		2018-19	**2020-21**	**2022-23**	**2018-19**	**2020-21**	**2022-23**
Occupational Category	Physician (ref)	0	0	0	0	0	0
	Nurse	0.07 ***	0.19***	0.17***	0.07***	0.16***	0.14***
	Nurse aide	0.10***	0.25***	0.26***	0.11***	0.26***	0.25***
	Medical & other trainees	0.06***	0.09***	0.03	0	0.01	-0.07**
	Orderly/technician	0.06***	0.08***	0.15***	0.07***	0.11***	0.17***
	Administration	0.02	0.05**	0.07***	0.06***	0.12***	0.17***
Work unit	Administration/ Support (ref)	0	0	0	0	0	0
	Inpatient Care	0.07***	0.17***	0.17***	0.05***	0.17***	0.17***
	Critical Care	0.08***	0.20***	0.20***	0.06***	0.21***	0.21***
	Emergencies	0.05***	0.17***	0.17***	0.06***	0.24***	0.24***
	Surgery	0.05***	0.13***	0.13***	0.05***	0.15***	0.15***
	Outpatient Care	0.05***	0.10***	0.10***	0.06**	0.13***	0.13***
	Central Services	0.06***	0.09***	0.09***	0.06***	0.10**	0.10***
Health center	Hospital del Mar (ref)	0	0	0	0	0	0
	Hospital Esperança	0	0	0	0	-0.01	-0
	Centre Fòrum	0.04***	0.04*	0.04*	0	0.01	0
	CAEMIL	0.05***	0	0.06***	0.04***	-0.03	0.01
	Other	-0.04***	-0.12***	-0.08***	-0.02	-0.05*	-0.02
Shift	Day (ref)	0	0	0	0	0	0
	Night	0.03***	0.10***	0.05***	0.02**	0.03**	0
	Other	-0.06***	-0.28***	-0.33***	0.01	-0.21***	-0.18***
Type of contract	Permanent (ref)	0	0	0	0	0	0
	Temporary	-0.10***	-0.13***	-0.28***	-0.09***	-0.09***	-0.28***
	Replacement	-0.08***	-0.10***	-0.10***	-0.12***	-0.20***	-0.20***

*Model 1: age adjusted; Model 2: fully adjusted; *p<0.1, **p<0.05, ***p<0.01.*

This pattern has been linked to the gendered division of paid labor and family responsibilities, and the related women's double presence [24]. Additionally, it relates to their higher exposure to precarious employment and adverse working conditions in the segmented European labor markets [28, 29].

In terms of age, since the pandemic, there has been an unexpected shift in the age distribution of SA IR, with individuals under 30 now showing the highest incidence. This change may be attributed to their limited experience (many are residents) and the increased risk of poor working conditions faced by younger workers after the pandemic began [30]. These conditions may expose younger workers to heightened physical and psychological stress. Beyond occupational factors, rates of depression and anxiety among young adults in Catalonia rose by 144% and 133% from 2008 to 2022 [31]. Paradoxically, older adults reported less psychological distress despite being at a higher risk for COVID-19, likely due to better emotional regulation with age [32].

Table 4. Longitudinal entropy analysis. Relationship of employment state transitions (from active to sickness absence), and age and occupational variables among men, by period. Hospital del Mar, 2018-2023.

		Model 1			Model 2		
		2018-19	**2020-21**	**2022-23**	**2018-19**	**2020-21**	**2022-23**
Occupational Category	Physician (ref)	0	0	0	0	0	0
	Nurse	0.07***	0.18***	0.22***	0.08***	0.15***	0.20***
	Nurse aide	0.07***	0.22***	0.26***	0.08***	0.24***	0.27***
	Medical & other trainees	0.06***	0.10***	0.07*	0.03	0.02	-0.01
	Orderly/technician	0.11***	0.21***	0.26***	0.13***	0.22***	0.27***
	Administration	0.04***	0.08***	0.08***	0.08***	0.13***	0.14***
Work unit	Administration/ Support (ref)	0	0	0	0	0	0
	Inpatient Care	0.03*	0.08***	0.10***	0.04*	0.08**	0.10**
	Critical Care	0	0.17***	0.06	0.02	0.18***	0.07
	Emergencies	0.03*	0.11***	0.07*	0.05**	0.15***	0.11**
	Surgery	0.02	0.04	0.07*	0.06**	0.07*	0.11**
	Outpatient Care	0.04**	0.08**	0.06*	0.05**	0.09**	0.08*
	Central Services	0.02	-0.03	-0.01	0.02	-0.03	-0.02
Health center	Hospital del Mar (ref)	0	0	0	0	0	0
	Hospital Esperança	0	0.02	0.01	-0.02	0	-0.05
	Centre Fòrum	0.01	0.06	0.04	0.01	0.02	-0.03
	CAEMIL	0.05***	0.04	0.07**	0.04*	-0.02	-0.01
	Other	-0.01	-0.05	-0.03	-0.01	-0.02	0
Shift	Day (ref)	0	0	0	0	0	0
	Night	0.02*	0.08***	0.07***	0.01	0.02	0
	Other	-0.04*	-0.18***	-0.26***	0.03	-0.07	-0.09*
Contract type	Permanent (ref)	0	0	0	0	0	0
	Temporary	-0.06***	-0.15***	-0.20***	-0.07***	-0.16***	-0.19***
	Replacement	-0.04***	-0.07***	-0.03	-0.07***	-0.17***	-0.13***

*Model 1: age adjusted; Model 2: fully adjusted; *p<0.1, **p<0.05, ***p<0.01.*

Moreover, this finding could signify a paradigm shift in the relationship between younger workers and employment, indicating a need for further research to fully understand this phenomenon.

Furthermore, our investigation revealed significant differences among occupational categories, with nurses, aides, and orderlies/technicians exhibiting the highest SA incidence, alongside increasing trends over the study periods and transitions from active employment to SA across all three phases. These results appear to confirm that, beyond underlying health issues, SA can be influenced by poor working conditions. Nurses and nurse aides inherently face a higher risk of occupational health problems due to the nature of their work, which is why our study, as well as previous research [33], indicated that they already had the highest levels of SA IR even before the pandemic. Recent scientific literature has further corroborated that nurses experience the most significant negative impacts

from poor working conditions stemming from the pandemic [2, 34], potentially explaining the substantial increases in SA observed during the entire period. Additionally, nurses and nurse aides were at the frontline of COVID-19 patient care and dealt with the suffering of their patients throughout their shifts, which may have contributed to mental health challenges due to traumatic work-related experiences. The longitudinal entropy analysis indicated that these occupational categories exhibited more transitions from active employment to SA, suggesting these transitions were associated with short and frequent SA spells rather than long-term episodes. There is an urgent need for further research regarding the duration of SA spells.

A key finding of this study is that certain work units have experienced disproportionately greater increases, thereby exacerbating workplace health inequalities. Several reports indicate that following the COVID-19 pandemic, healthcare workers in critical care or emergency settings are among the most at-risk populations for developing mental health problems or burnout [35, 36]. In fact, the incidence rates and the increases in incidence, as well as the transitions from active employment to SA among workers in these two medical departments, and those in inpatient care, were the highest during and after the pandemic, with post-pandemic rates nearly tripling those prior to the pandemic. This aligns with the hypothesis that burnout and mental health issues are driving this sudden increase [37]. Despite these differences, it is important to note that all work units have experienced significant increases that require attention. Factors such as higher patient intake, increased workload, and a chronic lack of resources within healthcare systems may have placed additional burdens not only on direct patient-care workers but also created ripple effects throughout all occupational categories. Administrative and central services workers, while not directly involved in patient care, have likely faced heightened stress associated with coordinating resources, adapting to rapidly changing protocols, and managing logistical and operational challenges. The pressure to swiftly adapt to evolving protocols while providing administrative and logistical support during the pandemic likely contributed to psychological stress and burnout.

Finally, workers in long-term care and psychiatry (CAEMIL and Centre Fòrum) experienced the highest SA IR throughout the period. While no scientific publications have investigated explicitly whether workers in long-term and psychiatric care are more vulnerable to SA, the results are not surprising given that mental health workers report alarmingly high levels of burnout prevalence [38] and have been recognized as a risk group for workplace violence [39].

4.1. Limitations and Strengths

The primary limitation of this study is the lack of information regarding the underlying health issues related to SA spells, due to data protection regulations. Additionally, by classifying state transitions in the regression model as a dichotomous variable, the model may oversimplify SA dynamics and potentially obscure complex patterns. Nevertheless, SA remains a well-validated and comprehensive indicator for monitoring the health of working individuals. We also lack additional data on potential confounders, such as pre-existing medical conditions or domestic workloads. Finally, the study relies on retrospective data from a single institution, which may limit the external validity of the findings to other settings or regions with different healthcare systems and employment conditions. A significant strength of the study is the use of a large sample followed over almost six years, allowing us to analyze the evolution of the SA trend before and after the pandemic. The data sources were reliable administrative and health records, previously collected, to provide relevant information on the health of HCWs. Furthermore, the data is not self-reported, as all sickness absence spells are validated by physicians. To our knowledge, this is the first study that compares the incidence of SA among HCWs before, during, and after the pandemic, considering occupational characteristics as well as contextual factors.

5. Conclusion

Sickness absence is a complex social measure of health status and functioning in the working population [11, 14], with significant consequences

for individuals, workplaces, and society. The observed upward trend in sickness absences among (HCWs) is influenced by the occupational context, job characteristics, and poor working conditions, along with the pandemic's impact on an already strained healthcare system. Furthermore, individual health and the social determinants of health are key elements [11], highlighting the necessity of a comprehensive approach that considers the interplay of these factors to develop effective interventions aimed at alleviating the inequity in health outcomes faced by specific vulnerable groups such as nurses, aides, orderlies/technicians, and those working in intensive care units and emergency rooms.

It is essential to support healthcare workers by ensuring their safety, providing optimal working and employment conditions, and promoting their mental and physical health. Recommendations to address these challenges include ensuring adequate staffing, guaranteeing professional development opportunities, and enhancing autonomy and participation in the workplace, among other organizational aspects [41, 42]. The findings of this study indicate the need to account for the vulnerability of certain occupational groups in any proposed interventions. Rather than viewing this issue solely as a human resources challenge, these urgent measures must be implemented to maintain the sustainability of the NHS safety.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the HMar Ethical Committee (2020/9379/I).

Informed Consent Statement: Patient consent was waived because there is no recruitment: information on HCWs was available from the Human Resources Department databases. A participant identification number for the study was created to link all the information and ensure confidentiality and anonimity. The analysed databases were fully anonymized and aggregated, so that no one can be identified individually.

Declaration of Interest: None.

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