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Abstract

The recent pandemic, along with heavy workloads and staff shortages, has placed significant pressure on healthcare workers. Maintaining adequate work ability is vital for ensuring favorable working conditions, mitigating stress, preventing related illnesses, and safeguarding worker performance and patient safety. This article assesses the work ability and working conditions of healthcare professionals at the University Hospital of Modena through a questionnaire administered between August 1, 2022, and September 30, 2022, to identify vulnerable groups and organizational factors influencing work ability.

Among workers with reduced work ability, the majority are over 45 years old and female, 52% are obese, 64% have 3 or more illnesses, 47% report a poor work-life balance, and 50% have at least one dependent adult. Work characteristics are also highlighted as relevant: supervisor support and cooperation with colleagues, autonomy in decision-making processes, participation in the improvement of work processes, possession of skills appropriate to the tasks required, are associated with high levels of work ability. Finally, nurses and nurses aides are associated with lower work ability. Emergency and medical wards are particularly critical in terms of work ability when gender and age differences are taken into account.

Keywords: Workforce ageing, Work ability index, Nurses, Emergency department, Medical wards

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1.Introduction

Work ability is defined as the balance between an individual's resources and the physical and mental demands of the job (1). The monitoring and measurement of work ability are of particular interest to organizations, especially those in the health sector. This interest arises from the fact that high levels of work ability contribute to the mental and physical well-being of workers (2), as well as to reduced sickness absence, lower turnover rates, delayed retirement (3,4), improved productivity (5), and enhanced quality in the services and products provided (2,6).

In particular, a reduced work ability is correlated with mental health problems such as work-related stress and burnout episodes. This can lead to a deterioration in employee performance and, in the medical field, to an increased risk for patient safety (7).

In order to keep health care organisations healthy, it is therefore essential to protect the work ability and psychophysical health of employees.

To this end, monitoring and measuring work ability and related psycho-physical well-being indicators (e.g. BMI, presence of comorbidities) can have a twofold function: on the one hand, they can help to map 'critical' occupational categories in terms of early deterioration of work ability and health. On the other hand, a constant monitoring of these dimensions, together with a monitoring of the organisational dimensions of the hospitals (e.g. degree of work intensity, organisation of working time, degree of support from superiors and colleagues) can help to understand which are the main determinants of work ability, thus suggesting intervention policies aimed at improving the health of the organisation.

One of the main characteristics associated with a deterioration in work ability is certainly an increase in the age of the worker and the number of years of service. In particular, some studies show that a significant deterioration in work ability occurs after the age of 45 (8,9). However, there are also studies which show that this deterioration depends on the type of work performed, so that in certain occupations the increase in age is not characterised by a strong deterioration in the ability to work (10).

For example, in the healthcare sector, job tasks characterised by heavy physical workload, such as nurses, nursing assistants and midwives, would be subject to an early deterioration in work ability and a high incidence of musculoskeletal diseases (10–12).

In addition to the type of work performed and the worker's age, various studies show that the individual's resources, determined, for example, by the lifestyle adopted, are other relevant elements in influencing a person's ability to work and general health. In particular, a BMI associated with

obesity, a lack of physical activity, little time for personal interests and physical and/or mental stress are associated with low work ability (7,11,13–15).

More recently, organisational studies have also begun to approach the study of work ability, noting, for example, that job characteristics involving physical or mental effort can worsen the ability to work if they are not accompanied by adequate 'job resources', such as support from supervisors and autonomy in the choice of work activities (16,17).

Nonetheless, practical interventions to improve work ability are still scarce and are mainly focused on individual interventions (e.g. counseling, promotion of healthy lifestyles), organisational interventions (e.g. promotion of better support, education and training programmes), and interventions to monitor employees' work ability (18).

The present study focuses on a sample of healthcare professionals from the University Hospital of Modena (Azienda Ospedaliero-universitaria, from here AOU), anonymously interviewed in the period 1 August - 30 September 2022 through a convenience sampling, which allowed us to collect 443 workers, corresponding approximately to the 11% of the target population.

A first contribution of this study is to point out the socio-demographic and organisational characteristics associated with reduced work ability. In particular, organisational studies have only recently turned to the study of work ability (2,19), so we add further insights into the working conditions that influence employees' work ability. Another issue of interest concerns the inclusion of variables related to household composition and work-life balance, which have been identified as relevant but understudied characteristics in relation to work ability (20–22). Finally, another important theme is the exploration of other dimensions of malaise associated with unhealthy lifestyles (e.g. being a smoker, having a poor work-life balance, working night shifts, etc.) in those departments considered particularly critical in terms of the incidence of workers with a scarce work ability.

The results are key for understanding the individual and organisational determinants of work ability, crucial elements in the development of future interventions. Furthermore, it is particularly important to identify the most vulnerable categories of workers to whom more attention should be paid in order to propose specific interventions (23).

2. Materials and methods

2.1 Sample and data collection process

443 professionals from the University Hospital of Modena (AOU) participated in the survey, representing 11% of the target population. The data collection involved those employees who underwent a medical examination between 1 August 2022 and 30 September 2022 and who

voluntarily joined this study. Given the way the data were collected (physical presence of participants in the hospital between survey months and voluntary adherence) we obtained a convenience sample that is not statistically representative of the entire population. Nevertheless, the comparison with the population, shows that there is a fair degree of similarity between our sample and the reference population with respect to some of the key socio-demographic characteristics (age, gender, professional role, hospital departments, see Table 1, below, for further details).

The study was conducted according to the tenets of the Declaration of Helsinki and approved by the Ethics Committee of the Greater Emilia North Area (reference number 185/2022/SPER/AOUMO SIRER ID 4136, protocol 0017051/22). Participants were informed in advance about the type of study and the objectives of this research, and they were also aware that the compilation was completely anonymous and based on their voluntary adherence.

Table 1. Socio-demographic and occupational characteristics of the sample and population

	Sample		Population	
	N	%	N	%
Total	443	11%	4217	100%
Gender				
<i>F</i>	363	82%	3118	74%
<i>M</i>	80	18%	1099	26%
Age group				
< 35	86	19%	894	21%
35-45	84	19%	1047	25%
45-55	129	29%	1163	28%
> 60	144	33%	1113	26%
Departments				
<i>Outpatient</i>	46	10%	221	5%
<i>Amministrative</i>	69	16%	573	14%
<i>Surgery</i>	40	9%	864	21%
<i>Medical ward</i>	170	38%	1444	34%
<i>Emergency</i>	40	9%	517	12%
<i>Health Services</i>	78	18%	598	14%
Job role				
<i>Physicians</i>	78	18%	824	20%
<i>Nurses</i>	281	63%	2923	69%
<i>Administratives</i>	84	19%	470	11%

2.2 Questionnaire, work ability index and other variables

The study uses a self-report questionnaire to measure work ability in relation to a number of variables such as age, gender, household composition, job role, hospital departments, work organisation. Specifically, the questionnaire consists of three sections: Section 1 includes socio-demographic questions, the Work Ability Index is measured in Section 2 and is based on the questionnaire proposed in Tuomi et al. 1998 (24), while Section 3 concerns working conditions and is inspired by the European Working Conditions Survey (2017) (25).

Socio-demographic characteristics (Section 1) include gender, age groups (< 35; 35-44; 44-55; > 55), years of service (< 5, 5-15, >15), whether the person has a BMI associated with obesity type I, II, or III (BMI > 30), and the presence of specific pathologies. This section also comprises variables related to the household composition and work-life balance, such as having at least one dependent adult who is not self-sufficient, having at least a child under the age of five, perceiving a good work-life balance, having a partner.

The Work Ability Index (Section 2) is a validated composite indicator that assesses a worker's present and future capacity to fulfill physical and mental job requirements. It yields a final score within the range of 7 to 49 points (15). In the following, we'll evaluate work ability using the Work Ability Index (WAI) in two approaches: a continuous scale from 7 to 49 and categorization into two groups: scarce or moderate (WAI 7-36) and good or excellent (WAI 37-49).

Working conditions characteristics (Section 3) pertain to i) work intensification, i.e. working night shifts, shifts on public holidays, shifts of more than 10 consecutive hours; ii) work support, i.e. having good support from the supervisor and colleagues, working in a team; iii) autonomy in defining work objectives and improving the organization/work processes within one's department or company, iiiii) receiving a match between skills and required tasks.

Employees were categorized based on their departmental affiliation, grouped according to the services offered and the level of risk determined by factors such as work-related stress assessment and other occupational risks (e.g., shift work, night shifts).

In particular, the following areas are defined: outpatient, administrative, surgery, emergency, medical ward and health services. The job tasks considered cover the job role of nurses (including nurses and nurses aides), physicians (including doctors and medical managers) and other HCW (i.e., "*other healthcare workers*", including, e.g., technicians and administratives).

Concerning the aggregation of departments by occupational risks, the emergency department stands out as experiencing the highest risk pressure. It is marked by elevated risks of work-related stress, shift and night work, manual handling of patients, violence, and biological hazards.

The medical ward also presents notable risks, particularly in biological hazards, shift and night work, and manual handling of patients. Similarly, the surgery department carries a significant risk profile, including high biological risks, shift and night work, manual patient handling, albeit with a lower risk of work-related stress. The health services present a high risk of ionising radiation and a low risk of biological and manual handling of patients. Finally, the administrative area is characterised by a high risk of video terminals, and the outpatient area by a low biological risk. Table 2 offers a comprehensive overview of job roles and occupational risks distribution across hospital departments.

Table 2. Job roles and distribution of occupational risks between departments

	Outpatient	Administrative	Surgery	Medical ward	Emergency	Health Services
Job roles						
<i>Physicians</i>	10 (13%)	1 (1%)	8 (10%)	28 (36%)	8 (10%)	23 (30%)
<i>Nurses</i>	34 (12%)	5 (2%)	31 (11%)	132 (47%)	32 (11%)	47 (17%)
<i>Administrative</i>	2 (2%)	63 (75%)	1 (1%)	10 (12%)	0 (0%)	8 (10%)
<i>Total</i>	46	69	40	170	40	78
Occupational risks						
<i>Biological</i>	Low	-	High	High	High	Low
<i>Work-related stress</i>	-	-	Low	-	High	-
<i>Shift/night work</i>	-	-	Yes	Yes	Yes	-
<i>Manual patient handling</i>	-	-	High	High	High	Low
<i>Violence</i>	-	-	-	-	High	-
<i>Ionizing radiations</i>	-	-	-	-	-	Yes
<i>Video display terminals</i>	-	Yes	-	-	-	-

2.3 Data analysis

SPSS version 25 was used for the data analysis. The data were evaluated by means of descriptive and inferential statistical analysis tests, using continuous and categorical variables. In particular, Pearson's chi-square test, the t-test and the one-way Anova test are used. The level of statistical significance was set at $p < 0.05$.

3.Results

3.1 Sample description

The sample is predominantly composed of women (82%), with nurses comprising the largest job role (63%), followed by administrative staff (19%) and doctors (18%). Age distribution is relatively uniform across groups: 19% are under 35, 19% are aged 35-44, 29% are aged 45-54, and the remaining 33% are over 55. Regarding departments, the majority of workers are in medical wards (38%), followed by health services (18%), administrative (16%), outpatient (10%), surgical (9%), and emergency (9%) departments. Finally, 65% of the sample exhibits good/excellent work ability (WAI between 37 and 49 points). It's worth noting that despite the majority showing good work ability, over a third of the sample demonstrates poor/mediocre work ability. We'll investigate factors linked to low work ability below. Detailed sample and department descriptions are available in Tables 1 and 2.

3.2 Work Ability, individual and organizational factors

In Table 3, higher age and working seniority correlate with a significant decrease in individuals with high work ability. For instance, high work ability declines from 86% in the over-35 age group to 53% in the over-54 age group (p-value=0.000). Moreover, women exhibit lower high work capacity, at 63%, compared to men, at 75% (p-value=0.047).

Table 3 also points that physicians and administrators have a higher incidence of high work ability, respectively, 74% and 76%, than nurses (60%), who, on the other hand, have a significant higher incidence of employees with a low work ability (40% versus 26% for physicians and 24% for administrators, p-value=0,008). Significant differences are also found when employees have a different number of diseases and for employees with a BMI associated with obesity status, who are characterized by a low incidence of high work ability (only 48% of employees with an obesity status have a high work ability, p-value 0,000).

Household workload characteristics significantly impact work ability. Employees with at least one dependent adult or experiencing poor work-life balance exhibit lower instances of high work ability. For instance, 71% of those with a good work-life balance report high work ability, compared to only 53% with poor work ability (p-value = 0.000).

While Table 3 reveals no disparity between departments regarding the occurrence of employees with high or low work ability (p-value = 0.321), we will further explore gender and age variations within these areas, yielding contrasting findings.

Moreover, Table 3 presents the relation between work ability and organizational conditions. The supervisor support and colleagues collaboration are dimensions associated with an increased incidence of high work ability. In fact, in both cases, almost 70% of those with a good supervisor support and colleagues collaboration have a good work ability (p-value=0,000, p-value =0,016). Similarly, a strong incidence of high work ability is found among those who declare having autonomy over the work goals (72%) and in the improvement of the organization and work processes (75%) (p-value=0,043; p-value=0,003). Finally, the presence of skill match is another condition associated with an highest incidence of good levels of work ability (66%) (p-value=0,018).

Table 3. Distribution of work ability among socio-demographic, household, and organizational Characteristics

	high WAI (> 37)	low WAI (7-36)	P-value associated to Pearson's Chi-squared
Socio-demographic characteristics, domestic workload and work-life balance			
Age			
< 35	74 (86%)	12 (14%)	<i>P-value =0,000</i>
35-44	61 (73%)	23 (27%)	
45-54	78 (60%)	51 (40%)	
> 54	77 (53%)	67 (47%)	
Job tenure			
< 5	101 (87%)	15 (13%)	<i>P-value=0,000</i>
5-15	58 (68%)	27 (32%)	
> 15	131 (54%)	111 (46%)	
Gender			
Men	60 (75%)	20 (25%)	<i>P-value=0,047</i>
Woman	230 (63%)	133 (37%)	
Job tasks			
Physicians	58 (74%)	20 (26%)	<i>P-value = 0,008</i>
Nurses and nurses aides	175 (60%)	115 (40%)	
Other ACW	57 (76%)	18 (24%)	
Departments			
Outpatient	26 (57%)	20 (43%)	<i>P-value=0,321</i>
Administrative	53 (77%)	16 (23%)	
Surgery	26 (65%)	14 (35%)	
Medical wards	108 (64%)	62 (36%)	
Emergency	26 (65%)	14 (35%)	
Health services	51 (65%)	17 (35%)	
Diseases			
0	113 (94%)	7 (6%)	<i>P-value=0,000</i>
1-2	108 (82%)	23 (18%)	
> 3	69 (36%)	123 (64%)	
BMI > 30			

<i>Yes</i>	30 (48%)	32 (52%)	<i>P-value=0,000</i>
<i>No</i>	260 (68%)	121 (32%)	
At least one dependent adult			
<i>Yes</i>	55 (50%)	54 (50%)	<i>P-value=0,000</i>
<i>No</i>	228 (71%)	92 (29%)	
At least one child less than 5			
<i>Yes</i>	59 (60%)	39 (40%)	<i>P-value=0,215</i>
<i>No</i>	231 (67%)	114 (33%)	
Work-life balance			
<i>Good work-life balance</i>	218 (71%)	91 (29%)	<i>P-value=0,000</i>
<i>Scarce work-life balance</i>	70 (53%)	62 (47%)	
Partner			
<i>Yes</i>	193 (66%)	106 (34%)	<i>P-value=0,594</i>
<i>No</i>	94 (67%)	46 (33%)	
Work ability and organizational conditions			
Night shifts			
<i>Yes</i>	91 (72%)	36 (28%)	<i>P-value=0,075</i>
<i>No</i>	190(63%)	113 (37%)	
Holiday shifts			
<i>Yes</i>	128(67%)	62 (33%)	<i>P-value value=0,415</i>
<i>No</i>	152(64%)	87 (36%)	
Long hours shifts (> 10 hours)			
<i>Yes</i>	144(73%)	52 (27%)	<i>P-value=0,003</i>
<i>No</i>	136(60%)	92 (40%)	
Supervisor support			
<i>High</i>	213(71%)	88 (29%)	<i>P-value=0,000</i>
<i>Scarce</i>	72 (53%)	64 (47%)	
Colleagues collaboration			
<i>High</i>	243(68%)	115 (32%)	<i>P-value=0,016</i>
<i>Scarce</i>	43 (53%)	37 (47%)	
Teamwork			
<i>Yes</i>	264(67%)	130 (33%)	<i>P-value=0,183</i>
<i>No</i>	22 (56%)	17 (44%)	
Autonomy over work goals			
<i>High</i>	102(72%)	39 (28%)	<i>P-value=0,043</i>
<i>Scarce</i>	185(62%)	111 (38%)	
Autonomy over departmental improvements			
<i>High</i>	114(75%)	38 (25%)	<i>P-value=0,003</i>
<i>Scarce</i>	175(61%)	112 (39%)	
Skill Match			
<i>No</i>	4 (33%)	8 (67%)	<i>P-value=0,018</i>
<i>Yes</i>	283(66%)	144 (34%)	

From Tables 4 and 5 we note that the medical wards and the emergency departments are those in which gender and age differences are statistically significant. Specifically, women have a lower work ability than men in the emergency department, where the average levels of WAI turns from 42 points for men to 36,5 points for women (p-value=0,002) and in the medical wards, where men have an average WAI of 39,8 points that reduces to 37 for women (p-value=0,024). On the other hand, the other departments do not register any significant gender difference, given the 5% threshold of significance selected (Table 4).

Similarly, in terms of age differences, we find that the in the emergency department (p-value=0,04) and in the medical wards (p-value=0,002) at increasing age class the WAI significantly deteriorate. For example, in the medical wards the work ability of employees less than 35 years old is almost 40 points, while this value reduces only to 35 points for the employees of the over 55 age group (Table 5).

These results suggest that the medical wards and the emergency department are those that contain the most vulnerable groups of individuals in terms of age and gender. Therefore, we continue the analysis by focusing on the work and lifestyle characteristics associated with these critical areas.

Table 4. Work ability and gender differences among departments

	Men	Woman	Difference	P-value associated to T-Test
<i>Outpatient</i>	40,00 (7,07)	37,83 (6,81)	2,17	<i>P-value=0,662</i>
<i>Administrative</i>	40,52 (5,501)	39,84 (5,757)	2,76	<i>P-value=0,660</i>
<i>Surgery</i>	34,86 (6,094)	38,77 (5,340)	-3,91	<i>P-value=0,096</i>
<i>Medical wards</i>	39,88 (5,044)	37,17 (6,811)	2,71	<i>P-value=0,024</i>
<i>Emergency</i>	42,25 (3,696)	36,50 (6,935)	5,75	<i>P-value=0,002</i>
<i>Health services</i>	40,33 (5,051)	37,42 (5,394)	2,91	<i>P-value=0,088</i>

Notes. T-test are estimated using the WAI in its scale ranging 7-49. Standard deviation is in parenthesis. The significance level is established at 5%.

Table 5. Work ability and age differences among departments

<i>Age</i>	< 35	36-45	46-55	> 55	P-value associated to the Test F (one-way ANOVA)
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<i>Outpatient</i>	45,20 (4,494)	36,50 (7,778)	36,62 (6,117)	37,22 (6,815)	<i>P-value=0,08</i>
<i>Administrative</i>	43,40 (3,406)	43,00 (5,292)	38,88 (6,009)	39,08 (5,415)	<i>P-value=0,06</i>
<i>Surgery</i>	40,00 (6,464)	38,89 (6,051)	37,62 (4,970)	34,50 (4,970)	<i>P-value=0,28</i>
<i>Medical wards</i>	39,97 (5,247)	39,29 (4,854)	36,63 (7,413)	35,11 (7,186)	<i>P-value=0,002</i>
<i>Emergency</i>	39,40 (6,423)	42,71 (5,282)	33,50 (6,279)	37,25 (6,042)	<i>P-value=0,040</i>
<i>Health services</i>	42,75 (2,872)	38,33 (5,821)	38,20 (4,764)	36,84 (5,606)	<i>P-value=0,204</i>

Notes. F-test and one-way anova are estimated using the WAI in its scale ranging 7-49. Standard deviation is in parenthesis. The significance level is established at 5%.

In the following, we focus our attention on the lifestyle and work organisations of the departments considered most critical, i.e. those where we found groups of individuals most vulnerable in terms of gender and age differences (Table 6).

Firstly, the medical wards and emergency departments are those in which there is a high percentage of employees with a scarce work-life balance: in the total sample, 30% of employees declare a poor work-life balance. This percentage significantly increases up to 43% for the emergency department and to 38% for the medical wards. These results are highly significant (p-value=0,001).

The highest difficulties found in balancing work-life in these areas may be linked to the greatest presence of night shifts, shifts on holidays and long shift hours. Indeed, these are dimensions found more frequently in the medical wards and emergency departments. In particular in the emergency department, where we find that 81% of employees work on holiday shifts, against an average of 44% for all the sample, and 76% work on night shifts, against an average of 29% for all the sample. These dimensions of work intensity seem to typically characterized these two departments. (p-value=0,00).

These areas are also characterized by a high presence of teamwork, as in both the departments 95% of employees declare to work in team groups (p-value=0,00). The emergency department is also characterized by a lower supervisor support, in fact, 60% of the workers in this department declare a good support, against an average of 69% in all the sample (p-value=0,00). Finally, we note that the emergency department is also characterized by 43% of smokers, against an average incidence of 19% in the total sample (p-value = 0,00). Also this difference may be an indicator of severe malaise and stress in this area.

Table 6. Individual and organizational characteristics: critical departments

	Medical wards	Emergency	Average of all departments	P-value associated to Pearson's chi-squared
<i>Smoking</i>	13% (21/168)	43% (17/40)	19% (78/436)	<i>p-value=0,000</i>
<i>BMI >30</i>	13% (21/170)	20% (8/40)	14% (62/443)	<i>p-value=0,894</i>
<i>Scarce work-life balance</i>	38% (65/169)	43% (17/40)	30% (132/441)	<i>p-value=0,001</i>
<i>Night shifts</i>	36% (60/166)	76% (29/38)	29% (127/430)	<i>p-value=0,000</i>
<i>Holiday shifts</i>	59% (96/162)	81% (30/37)	44% (190/429)	<i>p-value=0,000</i>
<i>Long hours shifts (> 10H)</i>	45% (73/161)	69% (25/36)	46% (196/424)	<i>p-value=,000</i>
<i>Supervisor support</i>	68% (113/167)	60% (24/40)	69% (301/437)	<i>p-value=0,000</i>
<i>Colleagues collaboration</i>	79% (132/168)	90% (36/40)	82% (358/438)	<i>p-value=0,328</i>
<i>Team work</i>	95% (159/167)	95% (37/39)	91% (394/433)	<i>p-value=0,000</i>
<i>Autonomy to improve the organization</i>	38% (65/170)	31% (12/39)	35% (152/439)	<i>p-value=0,283</i>
<i>Autonomy over job goals</i>	38% (63/168)	23% (9/39)	32% (141/437)	<i>p-value=0,172</i>
<i>Skill match</i>	98% (166/169)	95% (38/40)	99% (427/429)	<i>p-value=0,589</i>

4. Discussion and practical implications

The analysis in Table 3 focuses on the socio-demographic characteristics associated with work ability. It emerges that the group of employees with a BMI related to an obesity status is characterized by a lower incidence of high work ability, therefore companies should promote a healthy lifestyle and facilitate opportunities for employees to exercise, either within the organisation or through external agreements with sports centres and gyms (18).

Age, gender and seniority at work are other characteristics that determine a differentiated distribution of work ability. Specifically, women, increasing seniority at work and age, are all categories in which the percentage of workers with a good or excellent work ability is significantly lower. We will elaborate further on the gender and age differences between the different hospital departments.

An essential concern involves balancing family responsibilities and domestic duties. Specifically, a poor work-life balance and having at least one dependent adult are linked to lower instances of high

work ability. Promoting flexible working hours and providing supervisor support can alleviate workload burdens, enhance work-life balance, and accommodate caregiving responsibilities. Recent research on work ability emphasizes the significance of social and family environments, highlighting dimensions like work-family conflict and work-life balance alongside personal and organizational factors (21,22,26,27).

Nurses are the job roles with the lowest work ability, this may be due to the type of work activity required by this profession and the workload, which may involve considerable physical effort and emotional strain. For instance, a recent meta-analysis claims that almost one in four nurses have inadequate work ability (29). It is therefore necessary to target preventive measures and interventions at this profession, which appears to be more critical than others (28,29). For example, regular checks on the psycho-physical health status of workers and counselling interventions are valuable tools to protect the mental well-being of nurses. Furthermore, in the case of work activities that involve physical strain and thus increase the risk of illnesses such as musculoskeletal disorders, providing adequate support in terms of work equipment and postural or physical activities would be important preventive tools.

There are also organizational interventions that can influence work ability. In particular, having good supervisor support, working in a friendly environment with collaborative colleagues, having autonomy in setting goals, participating in the improvement of the organisation, and the presence of skill matches are all characteristics associated with an high incidence of good work ability.

For these reasons, managers and supervisors should try to provide adequate support to their teams, e.g. by ensuring that they provide clear and timely feedback. Also, supervisors should try to assess critical areas where there is a lack of cooperation between colleagues or where there is a mismatch of competencies, and then intervene with training courses or other tools as a further element that improves work ability.

It is also important to promote autonomy over the definition of work objectives and in the improvement of the organization and work processes, as these elements lead to a greater work ability. In fact, as found by previous works, autonomy and supervisor support are important job resources that help in dealing with work challenges (2,16,30).

Another interesting element of this study concerns the identification of certain fragile employee groups. In particular, women have lower levels of work ability than men, and older individuals have lower work ability than younger ones. A novel element of this work is that, although these differences have also been noted by other works in the literature (10,21,22), we attempt to explore them in more detail between specific departments. The analysis leads us to argue that, although these gender and age differences emerge in most hospital areas, they are only statistically significant in some of them.

In relation to this point, it is argued that decreasing levels of work ability according to age group may depend on the type of profession and the workload required. In fact, work ability may remain fairly stable over the years for those professions characterised by high autonomy and low physical workload, such as physicians and biologists, while it may decrease more in professions characterised by heavy workload and low work autonomy, such as nurses (10). These different effects depending on workload and work activities may vary in the hospital departments considered, thus helping to explain why these disparities are more critical in some areas than in others.

Finally, it is important to note that the departments in which we depict gender differences, at disadvantage of women, are also those in which we find significant age differences. At this point, we focus our attention on those departments characterized by these differences, that we defined as “critical”, that are the emergency and medical wards.

These departments also have common characteristics that differ significantly from the other areas: in both we note a particular incidence of employees with a scarce work-life balance, that is a characteristic significantly associated with a low work ability (Table 3 and in (21,22)). The greatest difficulty in balancing work-life may be associated with the presence of night shifts, long hours shifts, holidays shifts. These are all work characteristics found with the highest incidence in these departments. Also, the emergency department registers a lower supervisor support than the other areas (Table 6), that is an element associated with a lower work ability (Table 3 and in (2,16)).

5. Conclusion

The contributions of this study are manifold. Firstly, the results suggest that certain individual characteristics are associated with poor work ability, such as increasing worker age and job tenure, the presence of specific diseases (e.g. musculoskeletal, cardiovascular, endocrine disorders), being female or having a BMI associated with obesity status.

Secondly, we shed light on a number of work resources that can contribute to improving and preventing the deterioration of WAI, including autonomy over work goals and over the departmental improvement, supervisor support and co-operation of colleagues. Furthermore, the tasks of nurses and nursing assistants are associated with lower levels of work ability.

Although the organizational conditions that influence WAI have already been assessed by the human resources discipline, the results on this topic are still at an early stage, so it is important to continue

to pay attention to the more nuanced aspects related to working conditions that can improve or worsen work ability (2,19).

This study also focuses on aspects of the worker's social environment, in particular family composition and work-life balance. Evidence on the role of family and social networks is very scarce and recent studies suggest the need to focus more on these aspects as potential determinants of WAI (22,26,27).

Finally, this study analyses the presence of gender and age differences in work ability, comparing them across departments. In particular, emergency and medical departments are the areas where these differences are most pronounced. Preliminary analyses of these areas show that they are characterized by a poor work-life balance, as well as a greater presence of night shifts, holiday shifts, shifts with long hours and, in the case of the emergency department, less support from supervisors. In particular, the organizational characteristics mentioned could play a role in the worsening of work-life balance, which in turn could worsen work ability.

6. Limits and Future developments

These initial findings offer valuable insights for guiding future research in this field. Subsequent studies could delve deeper into the influence of socio-demographic and organizational factors on work ability. Additionally, understanding the processes by which these variables impact work ability, such as investigating mediating or moderating effects, is of interest. Of particular note is exploring indirect mechanisms through which organizational dimensions like autonomy, support, or long working hours may affect work ability by influencing employees' work-life balance. Hence, an interesting aspect to explore further in this work is the role of work-life balance as a potential mediator between job characteristics and work ability, especially for vulnerable groups like women and older employees.

This work has several limitations, including the use of non-standardized questionnaires for sections on working conditions and socio-demographics, reliance on physical presence and voluntary participation of hospital workers for data collection, and relatively small sample sizes for certain departments, potentially impacting the statistical significance of our analyses across hospital departments. A critical aspect of this work is the limited focus on occupational risks associated with specific hospital departments. Future studies should address this gap by exploring the relationship between these occupational risks and work ability in more detail

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References

1. Ilmarinen J. Work ability—a comprehensive concept for occupational health research and prevention. *Scand J Work Environ Health*. 2009 Jan;35(1):1–5.
2. Brady GM, Truxillo DM, Cadiz DM, Rineer JR, Caughlin DE, Bodner T. Opening the black box: Examining the nomological network of work ability and its role in organizational research. *J Appl Psychol*. 2020 Jun;105(6):637–70.
3. Tisch A. Health, work ability and work motivation: determinants of labour market exit among German employees born in 1959 and 1965. *J Labour Mark Res*. 2015 Oct;48(3):233–45.
4. Sell L. Predicting long-term sickness absence and early retirement pension from self-reported work ability. *Int Arch Occup Environ Health*. 2009 Oct;82(9):1133–8.
5. Van Den Berg TI, Robroek SJ, Plat JF, Koopmanschap MA, Burdorf A. The importance of job control for workers with decreased work ability to remain productive at work. *Int Arch Occup Environ Health*. 2011 Aug;84(6):705–12.
6. Tuomi K. Promotion of work ability, the quality of work and retirement. *Occup Med*. 2001 Aug 1;51(5):318–24.
7. Ruitenburg MM, Frings-Dresen MH, Sluiter JK. The prevalence of common mental disorders among hospital physicians and their association with self-reported work ability: a cross-sectional study. *BMC Health Serv Res*. 2012 Dec;12(1):292.
8. Camerino D, Conway PM, Van Der Heijden BIJM, Estryng-Behar M, Consonni D, Gould D, et al. Low-perceived work ability, ageing and intention to leave nursing: a comparison among 10 European countries. *J Adv Nurs*. 2006 Dec;56(5):542–52.
9. Tomietto M, Zanini A, Sgrazzutti S, Palese A. L'abilità lavorativa percepita dagli infermieri: studio descrittivo.
10. Costa G, Sartori S. Ageing, working hours and work ability. *Ergonomics*. 2007 Nov;50(11):1914–30.
11. Amirmahani M, Hasheminejad N, Tahernejad S, Reza Tohidi Nik H. Evaluation of work ability index and its association with job stress and musculoskeletal disorders among midwives during the Covid-19 pandemic. *Med Lav Work Environ Health*. 2022 Aug 25;113(4):e2022031.

12. Garzaro G, Clari M, Ciocan C, Albanesi B, Guidetti G, Dimonte V, et al. Physical Health and Work Ability among Healthcare Workers. A Cross-Sectional Study. *Nurs Rep.* 2022 Apr 5;12(2):259–69.
13. Van Den Berg TIJ, Elders LAM, De Zwart BCH, Burdorf A. The effects of work-related and individual factors on the Work Ability Index: a systematic review. *Occup Environ Med.* 2008 Nov 18;66(4):211–20.
14. El Fassi M, Bocquet V, Majery N, Lair ML, Couffignal S, Mairiaux P. Work ability assessment in a worker population: comparison and determinants of Work Ability Index and Work Ability score. *BMC Public Health.* 2013 Dec;13(1):305.
15. Rieker JA, Gajewski PD, Reales JM, Ballesteros S, Golka K, Hengstler JG, et al. The impact of physical fitness, social life, and cognitive functions on work ability in middle-aged and older adults. *Int Arch Occup Environ Health.* 2023 May;96(4):507–20.
16. McGonagle AK, Fisher GG, Barnes-Farrell JL, Grosch JW. Individual and work factors related to perceived work ability and labor force outcomes. *J Appl Psychol.* 2015;100(2):376–98.
17. McGonagle AK, Barnes-Farrell JL, Di Milia L, Fischer FM, Hobbs BBB, Iskra-Golec I, et al. Demands, resources, and work ability: A cross-national examination of health care workers. *Eur J Work Organ Psychol.* 2014 Nov 2;23(6):830–46.
18. Söderbacka T, Nyholm L, Fagerström L. Workplace interventions that support older employees' health and work ability - a scoping review. *BMC Health Serv Res.* 2020 Dec;20(1):472.
19. Cadiz DM, Brady G, Rineer JR, Truxillo DM. A Review and Synthesis of the Work Ability Literature. Wang M, editor. *Work Aging Retire.* 2019 Jan 18;5(1):114–38.
20. Ilmarinen J. The Work Ability Index (WAI). *Occup Med.* 2006 Oct 17;57(2):160–160.
21. Smyth J, Pit SW, Hansen V. Can the work ability model provide a useful explanatory framework to understand sustainable employability amongst general practitioners: a qualitative study. *Hum Resour Health.* 2018 Dec;16(1):32.
22. La Torre G, Grima D, Romano F, Polimeni A. Perceived work ability and work-family conflict in healthcare workers: An observational study in a teaching hospital in Italy. *J Occup Health [Internet].* 2021 Jan [cited 2023 Jun 16];63(1). Available from: <https://onlinelibrary.wiley.com/doi/10.1002/1348-9585.12271>
23. Burr H, Lange S, Freyer M, Formazin M, Rose U, Nielsen ML, et al. Physical and psychosocial working conditions as predictors of 5-year changes in work ability among 2078 employees in Germany. *Int Arch Occup Environ Health.* 2022 Jan;95(1):153–68.
24. Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. Work ability index. Vol. 19. Finnish Institute of Occupational Health Helsinki; 1998.
25. Parent-Thirion A, Biletta I, Cabrita J, Llave Vargas O, Vermeylen G, Wilczynska A, et al. 6th European Working Conditions Survey: overview report. 2017 update. Luxembourg: Publications Office of the European Union; 2017. 160 p. (EF).

26. McGonagle AK, Bardwell T, Flinchum J, Kavanagh K. Perceived Work Ability: A Constant Comparative Analysis of Workers' Perspectives. *Occup Health Sci.* 2022 Jun;6(2):207–46.
27. Ilmarinen. From Work Ability Research to Implementation. *Int J Environ Res Public Health.* 2019 Aug 12;16(16):2882.
28. Rostamabadi A, Zamanian Z, Sedaghat Z. Factors associated with work ability index (WAI) among intensive care units' (ICUs') nurses. *J Occup Health.* 2017 Mar;59(2):147–55.
29. Romero-Sánchez JM, Porcel-Gálvez AM, Paloma-Castro O, García-Jiménez J, González-Domínguez ME, Palomar-Aumatell X, et al. Worldwide prevalence of inadequate work ability among hospital nursing personnel: A systematic review and meta-analysis. *J Nurs Scholarsh.* 2022 Jul;54(4):513–28.
30. Kunz C, Millhoff C. A longitudinal perspective on the interplay of job demands and destructive leadership on employees' work ability in Germany. *Int Arch Occup Environ Health.* 2023 Jul;96(5):735–45.