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Analysis of the Work Ability Index in workers with previous shoulder injury: An exploratory study

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Abstract

Introduction: Every year in Europe, millions of people are temporarily or permanently unable to work as a result of a work-related injury. [1] To date, the extent to which the latter can change in the worker's "perceived work well-being in the present and for the future in relation to the demands of his or her task and his or her mental and physical resources," in terms of Work Ability, is still little investigated. [2]

Aim: To assess the determinants of improved Work Ability in workers who have suffered a shoulder injury, three months after returning to work.

Methods: The study sample consisted of 55 workers who had suffered a shoulder injury, afferent to the outpatient clinics of INAIL in Pescara. A Work Ability Index (WAI) questionnaire was administered at the time the injury event was defined (T0) and after three months (T3). A descriptive and inferential statistical analysis was performed on the collected data to test the relationship between WAI and worker characteristics.

Results: The sample consisted of 75% male workers. According to INAIL management, 48 were in Industry, 4 in Agriculture and 3 in State Account. The mean WAI value at T0 was 29.97±7.08 vs 32.60±7.13 at T3 (p=0.005). Further differences emerged at T3 for gender (p=0.036), age (p=0.035), presence of comorbidities (p=0.049), and objective examination (p=0.002).

Conclusions: The findings highlight the need to implement post-injury programs that take into account the characteristics of workers in order to reduce the incidence of employment disaffection.

Keywords: Shoulder injury; return to work; work ability.

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INTRODUCTION

The Italian National Institute for Insurance against Work Injuries (INAIL) has recorded, between January and December 2022, a marked increase in occupational injury reports compared to the same period in 2021, and although provisional data for the year 2023 show a decrease in reports (due almost exclusively to the significantly lower weight of COVID-19 cases), the figure still remains high compared to previous years. In 2022, four percent of work injuries were related to shoulder trauma, and this figure was reflected in the Abruzzo region [3]. Work Ability (WA) is defined as "the extent to which an individual is capable of performing his or her work in the present and the near future, relative to the demands of his or her task and his or her mental and physical resources" [4]; this concept is closely related to the compatibility between individual (psycho-physical) characteristics and work demands. In fact, the maintenance of a good WA depends on a satisfactory health and occupational status, supported by suitable working conditions and correct lifestyles. A work injury and any sequelae related to it could change the worker's WA. The concept of WA emerged in Finland in the late 1980s and was the result of pioneering studies conducted by Juhani Ilmarinem [5]. In "Health work capacity and work conditions in municipal occupations", Tuomi et colleagues [5] developed the Work Ability Index (WAI) for the purpose of quantifying the WA of municipal workers. Subsequently, this instrument was validated internationally and widely used in both clinical practice and research spreading across countries and being translated into more than 25 languages [6].

To date, only few studies have investigated WA in relation to return to work after illness [7,8]. A review of the literature identified six categories of factors that influence workers' WA: Physical, psychological, cognitive, social/behavioral, workplace-related, and non-work-related; however, this research lacked agreed definitions and boundaries on the concept of WA [9,10]. In addition, a descriptive study found that although cancer survivors require reduced working hours and have reduced WA, it is possible to facilitate their return to work through appropriate work organization interventions related to their needs [7].

The descriptive study by Ghasempour et al. revealed that WA is the most important predictor of return to work [7]. A poor WAI score in workers has been seen to be associated with lack of vigorous leisure-time physical activity, their poor musculoskeletal capacity, advanced age, obesity, high mental work demands, lack of autonomy and high physical workload [11]. In fact, WAI is associated with individual characteristics, lifestyle, work demands and physical condition of the worker [11]. Of interest in this regard is a court study of 141 women on sick leave for prolonged neck/shoulder and/or back pain that showed a relationship between WA and return to work [12].

Hardly any studies are found in the literature investigating WA through WAI upon return to work after work injury. The aim of the present study was to identify and evaluate what factors are determinants to the change in WAI three months after a work injury involving the shoulder. The results of this study may be useful in promoting and improving customized work rehabilitation programs on the worker after an injury.

METHODS

Study design, sampling and population

The present work is a prospective and observational study conducted at the outpatient clinics of the INAIL office in Pescara in convention with the "G. d'Annunzio" University of Chieti-Pescara.

After obtaining the approval of the Ethics Committee of the Department of Innovative Technologies in Medicine and Dentistry of the "G. d'Annunzio" University, the subjects eligible for the study were identified by convenience. Inclusion criteria were: A documented diagnosis of shoulder injury, age over 18 years, and regularity of the injury both under a medical and administrative profile. Excluded from the study were: workers who were retired at the time of recruitment, cases not pertaining to the INAIL office in Pescara, those who could not be reached at the administration of the questionnaire, and workers who did not provide informed consent to the processing of sensitive data. All the partecipants to the study signed an informed consent form, and in order to standardize the data collection process, information from all workers was collected through interviews in a private room.

Data collection, procedure, and questionnaires

In this study, data collection consisted of three separate phases:

1. Administration of the WAI questionnaire to the worker at the closure of the injury by INAIL (stabilization of the clinical conditions of the worker; time 0, T0) and calculation the WAI score at T0;
2. For each worker recruited collection of the following data:

- **sociodemographic factors** (age and gender).
- **job characteristics**: work sector, INAIL management, type of contract, changes in the type of work at three-months.
- **characteristics of the injury**: type of injury (commuting, work occasion), dynamics, type of pathology, limb involved, days of Absolute Temporary Inability (ATI) to work, sequelae.
- **medical history of the injured person**: comorbidities at T0 and T3, pre-existing conditions.
- **clinical examination** findings;
- instrumental documentation available: ultrasounds, X-ray, MRI, CT, EMG.
- **health interventions undergone:** Surgery, physiatric rehabilitation.

For the purpose of categorizing workers by labor sector we relied on the ATECO 2007 classification of economic activities. In addition, the INAIL Management was considered, which specifies in which sector of activity (Industry, Agriculture and State Account) the event occurred, in fact it represents the insurance grouping of employers governed by rules on compulsory insurance against accidents at work. Each worker was classified whether in self-employed or employed. The clinical examination of the shoulder of the injured workers, performed by INAIL's physicians, was coded into the following categories: "range of movement preserved or reduced by a few degrees or reduced by 1/4", "range of movement reduced by more than 1/3" and "range of movement reduced by 1/2 or more or frozen shoulder". In this regard, the injured shoulder's range of movement (ROM) in the most impaired plane of space during the last clinical examination taken by INAIL was taken into account.

The days of absence from work that the insurance institute assessed as Absolute Temporary Inability (ATI) to perform work were coded into the following categories: "days of incapacity of less than 20 days," "days of incapacity of 21 to 40 days," and "days of incapacity of more than 40 days." Injury sequelae were classified according to the percentage of damage recognized by the Insurance Institution: "zero sequelae", "sequelae from 1% to 5%", and "sequelae greater than and equal to 6%".

The third stage of data collection took place for each individual injury case 3 months (time 3, T3) after the administration of the first questionnaire. Workers were recontacted by telephone to answer the same WAI questionnaire again. Therefore, the WAI score at T3 was calculated.

All the above-mentioned data were extracted from the INAIL's medical records, after receiving specific authorization to process those sensitive health data for research purposes by INAIL's Direction (Agreement between the Institute and the "G. d'Annunzio" University of Chieti-Pescara.

The italian version of the WAI questionnaire (authorized translation by the Finnish Institute of Occupational Health) was administered to all workers eligible for this study [13]. This questionnaire considers seven different dimensions: current state of work ability compared to the best period of life (score 0-10), ability to work in relation to work demands (score 2-10), number of illnesses currently diagnosed by a physician (score 1-7), estimated inability to work due to illness (score 1-6), sick leave used in the last year (score 1-5), personal prediction of work ability in two years' time (1.4 and 7 points), and mental resources (1-4 points). Based on these dimensions, the score obtained for each worker will vary from 7 to 49 [14].

The final scores were classified into four groups: poor work ability (score 7-27), moderate work ability (score 28-36), good work ability (score 37-43) and excellent work ability (score 44-49).

All the information from INAIL's medical records and the questionnaires were reported in a spreadsheet for subsequent statistical analysis.

Statistical analysis

Descriptive analysis was carried out using mean and standard deviation (SD) or median and interquartile range (IQR) for quantitative variables and with absolute and percentage frequencies for categorical variables. The normality of the distributions of quantitative variables was assessed with the Shapiro-Wilk test. The relationship between quantitative variables has been studied with the Student T test for independent data or ANOVA analysis for comparison between more than 2 groups. For significant trends, the Bonferroni test was used for multiple comparisons.

The difference between the WAI score measured at T0 and T3 was analysed with the Student T test for paired data while the correlation between the WAI score (T0 and T3) and the quantitative variables was determined with the Pearson correlation coefficient. Finally, mixed linear models were implemented to determine differences in the time course of the WAI score (T0 and T3), the effect of factors (gender, comorbidity and objective examination) and their interaction. Statistical significance was taken at the <0.05 level. All analyses were performed using Stata software v18.0 (StataCorp, College Station, Texas 77845 USA).

RESULTS

A sample of seventy-two shoulder-injured workers were recruited; of these, 55 were found to be eligible to participate in the study: 41 (74.55%) were male and 14 (25.45%) were female, and the mean age recorded was 46.78 ± 13.82 years. As many as 81.82% of the injured were in contractual dependency and the remainder were self-employed. The INAIL Management most represented in the sample under study was Industry with 42 cases (76.36%), followed by Self-employed Industry with 6 cases (10.91%), Agriculture with 4 cases (7.27%) and finally State Account 3 (5.45%). Specifically, the most affected business sector was Manufacturing and Trade with 21 injured persons (38.18%), followed by the other sectors as shown in Table 1.

Table 1. Job characteristics of the sample.

INAIL Management, n (%)	
-Industry	42 (76.36%)
-Self-Employed Industry	6 (10.91%)
-State Account	3 (5.45%)
-Agriculture	4 (7.27%)
Business Sector, n (%)	
-Agriculture, forestry and fishing	4 (7.27%)
-Manufacturing and Trade	21 (38.18%)
-Constructions	10 (18.18%)
-Transport and warehousing	9 (16.36%)
-Health	5 (9.09%)
-Instruction	3 (5.45%)
-Public Administration and Services	3 (5.45%)
Type of contract, n (%)	
-Self-employed	10 (18.18%)
-Dependent	45 (81.82%)
Changes in the type of work at 3 months, n (%)	6 (60.00%)
-Unemployment	3 (30.00%)
-Changed task	1 (10.00%)
-Changed company	

Of all the injuries examined, 67.27% occurred at work and only 32.73% in commuting. Six different types of lesions were diagnosed, as shown in Table 2, with contusion affecting the largest number of injured persons (44%). The dominant limb was the most involved, affecting 32 cases (58%). Different injury dynamics were also identified and were appropriately coded into four categories (Table 2), with fall and car accident being predominating over the other events. For 24 injured persons (44%) who participated in the study, INAIL recognized 21 to 40 ATI days and the average ATI days was 44.12 ± 41.96.

Table 2. Characteristics of the injury.

Commuting, n (%)	
- Yes	18 (32.73%)
- No	37 (67.27%)
Lesion, n (%)	
- Contusion	24 (43.64%)
- Distortion/distraction	16 (29.09%)
- Fracture/luxation	14 (25.45%)
- Wound	1 (1.82%)
Limb involved, n (%)	
- Dominant	32 (58.18%)
- Non-dominant	22 (40.00%)
- Bilateral	1 (1.82%)
Dynamics of the injury, n (%)	
- Fall	20 (36.36%)
- Car accident	19 (34.55%)
- Trauma as a result of body movement	14 (25.45%)
- Trauma caused by a machine or other means of work	2 (3.64%)
Days of Inability to Work, n (%)	
- < 20 days	14 (25.45%)
- 21-40 days	24 (43.64%)
- > 40 gg	17 (30.91%)
Average days of Inability to Work, means ± SD	44.12 41.96
Sequelae, n (%)	
- *None*	42 (80.77%)
- 1%-5%	6 (11.54%)
- ≥ 6 %	4 (7.69%)

Eighty-one percent of the workers reported zero sequelae, and only 7 percent were assessed as having a percentage of damage greater than or equal to 6%, resulting in the payment of compensation by the insurance company. Table 3 shows the results obtained related to the characteristics of the injured person, the clinical findings, the instrumental examinations performed, and the medical interventions undergone by the injured persons. 63.64% of the injured had previous cases of injuries (pre-existing) and 58.18% had medical conditions in addition to the one investigated. The most frequently used instrumental examination was radiography with 25.45% cases, followed by 20.00% cases of MRIs.

Table 3. Characteristics of the injured worker.

Previous damages, n (%)	
- Yes	35 (63.64%)
- No	20 (36.36%)
Previous damages, means ± SD	2,54 ±3.60
Comorbidities, n (%)	
- Yes	32 (58.18%)
- No	23 (41.82%)
Comorbidities at 3 months, n (%)	
- Yes	3 (5.45%)
- No	52 (94.55%)
Comorbidities at 3 months (diseases) n (%)	1 (33.3%)
- Musculoskeletal disease of the back, limbs, or other parts of the body (chronic joint pain, muscle pain, sciatica, rheumatism, arthritis)	1 (33.3%)
- Respiratory disease (repeated infections of the respiratory tract, emphysema, …)	1 (33.3%)
- Gastrointestinal disease (gastritis, gallstones, haepatic or pancreatic disease, constipation…)	
Physical examination	
Clinical Examination, n (%)	
- ROM preserved or reduced by a few degrees or reduced by 1/4	36 (65.45%)
- ROM reduced by more than 1/3	6 (10.91%)
- ROM reduced by 1/2 or more or frozen shoulder	13 (23.64%)
Instrumental exams	
Ultrasound, n (%)	
- Yes	9 (16.36%)
- No	46 (83.64%)
X-RAY, n (%)	
- Yes	14 (25.45%)
- No	41 (74.55%)
MRI, n (%)	
- Yes	11 (20.00%)
- No	44 (80.00%)
CT scan, n (%)	
- Yes	1 (1.82%)

- No	54 (98.18%)
EMG, n (%)	
- Yes	3 (5.45%)
- No	52 (94.55%)
Medical Intervention	
Physiatric Rehabilitation, n (%)	
- Yes	13 (23.64%)
- No	42 (76.36%)
Surgery	
- Yes	3 (5.45%)
- No	52 (95.55%)
Questionnaire	
WAI at time 0, means ± SD	29.9 ± 7.08
WAI at 3 months, means ± SD	32.6 ± 7.13

The results also reveal that some workers at T3 had changes regarding type of work and diagnosis of new diseases (see Table 3). The mean WAI score at T0 was 29.9 ± 7.08 and at T3 was 32.6 ± 7.13. Notably, 5% of the suspects developed additional diseases at 3 months after the injury event.

When comparing the mean WAI score at T0 and T3, there was a significant difference (T0 29.9 ± 7.08 vs 32.6 ± 7.13 T3, p=0.005). Analyzing the relationship between the WAI score at T0 with the detected characteristics showed no significant differences while between the latter and the WAI score at T3 there was a correlation with age (r=-0.283, p=0.035) and differences with gender (Females 29.17±6.78 vs 33.78±6.95 Males, p=0. 036), comorbidity (NO 34.82 ±7.19 vs 31.01 ± 6.76 YES, p=0.049) and clinical examination (ROM preserved or reduced by a few degrees or reduced by 1/4 34.45 ± 6.67 vs 33.75 ± 6.49 ROM reduced by more than 1/3 vs 26.96 ± 6.0 ROM reduced by 1/2 or more or frozen shoulder, p=0.003). Specifically, among the categories "ROM reduced by 1/2 or more or frozen shoulder" vs "ROM preserved or reduced by a few degrees or reduced by 1/4", p=0.002.

Finally, for gender and objective examination, mixed linear models showed a significant relationship between factors and the WAI score (Table 4). Males reported a higher WAI score increase between T0 and T3 than females, while for the objective examination, the 1/3 upper motility reduction in movement showed a higher increase in the WAI score between T0 and T3 than for the other categories. The statistically significant difference for comorbidity was found only in the temporal trend, and we did not observe any significant interactions.

Table 4. Data is expressed as mean and standard deviation (SD). Statistically significant values are given in bold type.

			P-value		
Gender	**WAI T0**	**WAI T3**	**Gender** [a]	**Time**	**Interaction**[c]
Female	27.62 (5.20)	29.17 (6.78)	**0.045**	**0.034**	0.483
Male	30.76 (7.50)	33.78 (6.95)			
Comorbidity	**WAI T0**	**WAI T3**	**Comorbidity**	**Time**	**Interaction**
No	30.91 (7.73)	34.82 (7.19)	0.114	**0.003**	0.235
Yes	29.29 (6.61)	31.01 (6.76)			
Objective examination	**WAI T0**	**WAI T3**	**Objective examination**	**Time**	**Interaction**
ROM preserved or reduced by a few degrees or reduced by ¼	31.12 (7.07)	34.45 (6.67)	**0.030**	**0.009**	0.266
ROM reduced by more than 1/3	26.91 (7.43)	33.75 (6.49)			
ROM reduced by 1/2 or more or frozen shoulder	28.19 (6.67)	26.96 (6.01)			

Note: [a]For each factor, differences have been tested between the latter in time [b]Time, for each factor, differences were tested between T0 and T3 [c]Probability that the effects of work ability are greater in a single factor (time*factor interaction)

DISCUSSION

The aim of the present study was to evaluate the determinants of improved WA in workers who have sustained a shoulder injury, three months after returning to work. Based on a review of the literature, this study is one of the few studies that has addressed this issue. The results of the aforementioned research showed that in the sample under review, shoulder injuries clearly predominantly affect the male gender (74.55%), compared to the female gender (25.45%), with an average age around 46.7 years. These data are justified by the national prominence recorded by the European Agency for Safety and Health at Work, which shows a male employment rate (72.4%) significantly higher than the female rate (53.2%), and Italy with the average age of the general population of 46.7 years stands as the "oldest" country in Europe, and by the fact that men are more prone to injuries due to physical exertion than females [15].

Similarly, the results that emerged on the labor sector and INAIL management reflect the national picture, where the industry sector excels [16]. Furthermore, the data collected showed that only 25.45% of the injured had an ATI of less than 20 days, despite the fact that most of the diagnosed conditions are contusions and thus injuries for which a recovery time of a few days is assumed. What's more, from a clinical standpoint, 65.45% of the injured had an almost silent objective examination at INAIL's last clinical examination. In this regard, however, it should be considered

that the workers under consideration may have had other injury-related pathologies besides shoulder, which were not considered in the present study. The sharp increase in the mean WAI recorded at the definition of injury cases compared with that noted after three months after the latter is in line with the results of a research paper by A. van Schaaijk et al. [17] that highlighted improvements in WA upon return to work after absences due to illness or maternity leave. Research work by Tamene et colleagueas, investigating the time to return to work after a work injury showed faster post-injury recovery times for the female gender [18]. From the present research work, however, it was inferred that the female gender recovers their "perceived work well-being" after the accident event with difficulty compared to their male counterparts. Several studies have shown that women devote more hours to family care than men, but at the same time the working hours are the same in both [19-21].

Injury in a woman could more easily compromise this delicate balance between work and family by affecting her WA. Moreover, there are several studies that have shown a reduction in WAI with advancing age, and this study also reaffirms this relationship [11,22-25]. Comorbidity showed a negative influence on WA, the latter appearing to worsen at three months after the definition of the injury in workers who had at least one pathology in addition to the shoulder pathology under consideration. Not surprisingly, workers with clinical relief of near-complete shoulder motility recorded better WAI scores at T3 as physical ability has an important influence on WA [6,26].

It is of interest to note that workers with greater than 1/3 motility impairment, thus intermediate impairment, improved more than the other categories. In contrast, workers who were more physically impaired showed no improvement in their WA.

In addition, neither management nor work area showed a relationship with the worker's perceived WA. Besides, already Ilmarinem & Tuomi reiterated the importance of focusing on working conditions (human relations, workload...) rather than on the task itself performed by the worker [22].

Thus, it is clear from the analysis conducted how the WAI score changes not only over time but also and especially in relation to the factors of age, gender, comorbidities, and objective relief. The present study, like many others had limitations that should be taken into consideration when interpreting the results. Firstly, the data used in this research work are self-reported and this may have introduced a social desirability bias and secondly, the results are based on a convenience sample of participants who participated voluntarily and anonymously, which allowed only a percentage of the target population to be reached. So further investigation is desirable with the expansion of the tested sample that could provide additional data and channel to further interesting results.

CONCLUSIONS

The results obtained highlight the need to implement pre- and post-injury programs that take into account the characteristics of workers in order to reduce the incidence of disaffection from employment and enable personalized reintegration on the worker who has suffered a work injury. In this regard, organizational interventions could be implemented to improve the WA of all workers. È, therefore, it is desirable to monitor WA with validated tests such as the WAI to be administered by the competent physician first at preventive examinations and then at subsequent (so-called periodic) examinations particularly for older workers (55 years and older) and women with pre-

school children. We also propose targeted interventions for groups with poor WAI scores in order to safeguard worker well-being.

Possible interventions include organizational ones, such as plans to reduce physical labor (staff shifts), introducing short breaks between work processes, and improving the ergonomics of machinery. Personal-level measures are also desirable specifically the distribution of work performance taking into account age, gender, and possible comorbidities. The interventions will promote the maintenance of good WA for each individual worker, with a view to enhancing human resources that will pave the way for the productivity and market competitiveness of any enterprise.

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References

1. Tabelle infortuni sul lavoro (ESAW) dal 2008. INAIL. [Online] 8 febbraio 2024. https://www.inail.it/cs/internet/attivita/dati-e-statistiche/statistiche-europee/tabelle.html.
2. Tengland PA. The concept of work ability. J Occup Rehabil. 2011;21(2): 275–285.
3. INAIL. Flussi Informativi. Intranet INAIL. [Online]
4. Ilmarinem J. Work Ability a comprehensive concept for occupational health research and prevention. Scandinavian Journal of Work, Environment and Health. 2009, 35 (1): 1-5.
5. Tuomi K, Ilmarinen J, Martikainen R, et al. Aging, work, life-style and work ability among Finnish municipal workers in 1981-1992. Scand J Work Environ Health. 1997;23 Suppl 1:58-65.
6. Ilmarinem J. From Work Ability Research to Implementation. Int J Environ Res Public Health. 2019; 16(16):2882.
7. Ghasempour M, Purabdollah M, Rahmani A, et al. The Relation of Work Ability and Return to Work Among Iranian Cancer Survivors. Asian Pac J Cancer Prev. 2022;23(10):3339–3346.
8. Cabeceira HDS, Souza DMST, Juliano Y, et al. Work ability and productivity in patients with diabetic foot. Clinics (Sao Paulo). 2019 Mar 25;74:e421. doi: 10.6061/clinics/2019/e421.
9. Fadyl JK, McPherson KM, Schlüter PJ, et al. Factors contributing to work-ability for injured workers: literature review and comparison with available measures. Disabil Rehabil. 2010;32(14):1173-83. doi: 10.3109/09638281003653302. Erratum in: Disabil Rehabil. 2010;32(19):1619.
10. Christopherson RM, Fadyl JK, Lewis GN. Return-to-work expectations and workplace supports in New Zealand: injured workers' perspectives. Disabil Rehabil. 2022 Mar;44(5):702-709. doi: 10.1080/09638288.2020.1776775.
11. van den Berg TI, Elders LA, de Zwart BC, Burdorf A. The effects of work-related and individual factors on the Work Ability Index: a systematic review. Occup Environ Med. 2009 Apr;66(4):211-20. doi: 10.1136/oem.2008.039883.
12. Rashid M, Heiden M, Nilsson A, et al. Do work ability and life satisfaction matter for return to work? Predictive ability of the work ability index and life satisfaction questionnaire among women with long-term musculoskeletal pain. BMC Public Health. 2021;21:584.
13. Questionario del WAI. Consulta Interassociativa Italiana per la Prevenzione. [Online]

https://www.ciip-consulta.it/index.php?option=com_phocadownload&view=file&id=8:questionario-wai&Itemid=609.

14. Ilmarinem J. The Work Ability Index (WAI). Occup Med. 2007;57:16.
15. Official website of the European Union. https://visualisation.osha.europa.eu/osh-barometer/osh-context/workforce-profile/median-age/ageing-workers.
16. Censimento Popolazione Abitazioni. ISTAT. http://dati-censimentopopolazione.istat.it/Index.aspx?DataSetCode=DICA_CARATT_ATTL_COM#.
17. van Schaaijk A, Nieuwenhuijsen K, Frings-Dresen MHW, et al. Work ability and work functioning: measuring change in individuals recently returned to work. Int Arch Occup Environ Health. 2019 Apr;92(3):423-433. doi: 10.1007/s00420-019-01400-z. Epub 2019 Jan 17.
18. Tamene A, Habte A, Derilo HT, et al. Time to Return to Work After an Occupational Injury and Its Prognostic factors Among Employees of Large-Scale Metal Manufacturing Facilities in Ethiopia: A Retrospective Cohort. Environ Health Insights. 2022 Jun 27;16:11786302221109372. doi: 10.1177/11786302221109372.
19. Pace F, Sciotto G. Gender Differences in the Relationship between Work–Life. Balance, Career Opportunities and General Health Perception. Sustainability. 2022; 14:357.
20. Eby LT, Casper WJ, Lockwood A, et al. Work and family research in IO/OB: Content analysis and review of the literature 1980–200. J Vocat Behav. 2005;66:124–197.
21. Frone MR. Work–family conflict and employee psychiatric disorders: The national comorbidity survey. J Appl Psychol. 2000;85.
22. Ilmarinem J, Tuotni K. Past, present and future of work ability. People Work Res Reports. 2004;65:1-25.
23. von Bonsdorff MB, Seitsamo J, Ilmarinen J, et al. Work ability in midlife as a predictor of mortality and disability in later life: a 28-year prospective follow-up study. CMAJ. 2011 Mar 8;183(4):E235-42. doi: 10.1503/cmaj.100713. Epub 2011 Jan 31.
24. Ilmarinen, J. Aging and Work: An international perspective. The Johns Hopkins University Press; 2009:51–73.
25. Ross D. Ageing and work: an overview. Occup Med. 2010;60(3):169–171.
26. Ilmarinen J. Arbeitsfähig in die Zukunft. Arbeitsfähig in die Zukunft. Willkommen im Haus der Arbeitsfähigkeit; 2011.