

Association between work ability and fatigue in Brazilian nursing workers

Fabio José da Silva^{a,*}, Vanda Elisa Andres Felli^b, Maria Carmen Martinez^c, Vivian Aline Mininel^d and Ana Paula Pelegrini Ratier^e

^a*University Hospital, Nursing Department, Universidade de Sao Paulo, Sao Paulo City, Sao Paulo, Brazil*

^b*Nursing School, Professional Orientation Department, Universidade de Sao Paulo, Sao Paulo City, Sao Paulo, Brazil*

^c*Epidemiology Center, Hospital Samaritano, Sao Paulo City, Sao Paulo, Brazil*

^d*Nursing School, General and Specialized Nursing Department, Universidade de Sao Paulo, Ribeirao Preto City, Sao Paulo, Brazil*

^e*University Hospital, Medical Department, Universidade de Sao Paulo, Sao Paulo City, Sao Paulo, Brazil*

Received 9 August 2013

Accepted 29 June 2015

Abstract.

BACKGROUND: Impaired work ability is associated with work-related illnesses, early retirement and rising pension costs.

OBJECTIVE: To investigate the association between work ability and fatigue in nursing workers.

METHODS: Cross-sectional study conducted with 100 nursing workers from two inpatient units at a public teaching hospital in Sao Paulo, Brazil. The data were collected by means of a socio-demographic profile questionnaire, Work Ability Index (WAI) and Chalder Fatigue Scale. The data were analyzed by means of descriptive and analytical statistical methods, tests of association and multiple linear regression.

RESULTS: The study population was mainly composed of women (88%), exhibited a high educational level (76%), average age 39.4 years old (SD = 9.5) and 15 years of professional experience, on average. The average score on WAI was good (39.4 points, SD = 6.0) but surprisingly, 35% of the participants exhibited moderate to poor work ability. Fatigue was found in 52% of the participants. The score on WAI decreased in association with fatigue ($p < 0.001$) and longer length of work in the same workplace ($p = 0.001$), as well as among nursing technicians compared to nurses ($p = 0.040$).

CONCLUSIONS: Fatigue, longer length of work in the same workplace and work category nursing technician were associated with decreased work ability, which emphasizes the need for investment in health and quality of work life.

Keywords: Occupational health, nursing staff, work organization, work conditions, workload

1. Introduction

The concept of work ability is relevant within the context of productive restructuring and public policies, and the loss of work ability might result in reduced

productivity, leading to early retirement pensions and consequent exacerbation of social security deficits that compromise the national economy in Brazil and worldwide [1, 2].

Work ability is understood as the workers' conditions to meet the physical, mental and social demands of the job [3, 4]. That definition was formulated based on studies conducted by the Finnish Institute of Occupational Health with a cohort of workers that started in 1981. Those studies showed that various factors might affect

*Address for correspondence: Fabio José da Silva, University Hospital, Nursing Department, Universidade de Sao Paulo, Avenida Professor Lineu Prestes, 2565, CEP 05508000, Cidade Universitária, Sao Paulo City, Sao Paulo, Brazil. Tel.: +55 11 996575101; E-mail: fabiojoseph@usp.br.

work ability, like individual characteristics of workers, their lifestyle, age, health profile, social status, and work environment [3–6].

In Brazil, impairment of work ability is investigated in different professional categories [6–8]. Among health care workers, nurses are considered the most prominent group in this regard, as a function of their precarious working conditions that are characterized by intense physical and mental demands, long and irregular work shifts, outsourced workforce and under-employment [5, 9–11]. Those sources of strain result in illness, loss or reduction of work ability and poorer quality of life and well-being [1, 2, 5, 11, 12].

Fatigue has been described as one of the main complaints among nursing workers [13–15]. Its deleterious effects lead to occupational diseases and manifest as increased absenteeism and presenteeism rates. Presenteeism is the situation in which an employee is affected by some illness, but nonetheless remains at work, with consequent undermining of his/her performance and of the quality of services [16]. Both absenteeism and presenteeism might exert negative impact on institutional management, nursing planning and the quality of care [16, 17]. Work-related musculoskeletal disorders (WMSDs) [18, 19] and mental health strain are the most prevalent health problems among nursing workers; mental health disorders are predominantly characterized by depression arising from the mental workload existing in the workplace [20].

The effects of strain on the nursing workers' health notwithstanding, few Brazilian and international studies have sought to investigate the association between work ability and fatigue, which points to the relevance of the present study. While work ability has been widely studied among nursing professionals [5, 7, 9, 10, 15, 21–24] fatigue has been more scarcely investigated [13, 25, 26]. According to Vasconcelos et al. (2011) [15] there is a relationship between work ability and perception of fatigue among nurses and they found reduced work ability (40.8%) and high levels of severe fatigue (25.7%) in the studied population.

As a function of the role poor working conditions play as a trigger of health problems among nursing workers and the lack of studies on the association between chronic fatigue and the work environment of nursing staff, the aim of the present study was to assess the relationship between work ability and fatigue in the daily working routine of nursing staff in southeastern Brazil.

2. Methods

2.1. Study design

The present epidemiological cross-sectional study was conducted at two medical and surgical inpatient units at a public teaching hospital in the city of Sao Paulo, Brazil. This is a university hospital of average complexity that belongs to University of Sao Paulo (USP), the largest university in Brazil and South America. It is a general hospital which comprises 250 beds and about 2,000 workers, being devoted to the treatment of maternal and pediatric problems, including surgical and clinical conditions.

2.2. Participants

The target population was comprised nursing workers – registered nurses, nursing technicians and assistants – of two medical and surgical inpatient units, totaling 117 individuals. These units have the heaviest workload (due to the performance of complex procedures, admission of highly dependent patients and insufficient manpower) and report more sick leave than the remainder of the hospital inpatient units. From the total number of eligible participants, eight chose not to participate, eight were on sick leave; in addition, the principal investigator, who is a staff member, was excluded. Therefore, the final sample comprised 100 volunteers, corresponding to a participation rate of 85.5%.

2.3. Procedures

The data were collected by means of three outcome measures: socio-demographic profile questionnaire, Work Ability Index (WAI) and Chalder Fatigue Scale.

The socio-demographic and work profile data included age, gender, educational level, marital status, family income, length of work in the same workplace, job title, workshift, commute time, number of current jobs, and working hours per week.

The data on work ability were collected by means of the Brazilian version of WAI [2, 3]. WAI is an instrument formulated in Finland [3] and the Brazilian version has satisfactory psychometric properties regarding construct validity and reliability [2]. The WAI allows workers to evaluate their work ability on seven dimensions: (a) current work ability compared with the lifetime best, (b) work ability in relation to the demands of the job, (c) number of current diagnosed

and self-reported diseases, (d) estimated work impairment due to diseases, (e) sick leave, (f) own prognosis of work ability and (g) mental resources [3]. With scores varying from 7 to 49, work ability is classified as excellent, good, moderate and poor; the latter two being considered as inadequate. The cutoff points to define inadequate work ability were 40 for participants up to 34 years old [27], and 35 for workers aged 35 years old or older [3]. The classification formulated by Kujala et al. [27] was adopted in the case of the youngest employees, because the classification by Tuomi et al. [3] is based on studies conducted with a population aged over 45 years. The use of both classifications was intended to avoid underreporting of impaired work ability among the youngest employees.

Fatigue was assessed by means of the Brazilian version of the Chalder Fatigue Scale [28, 29]. The Brazilian version had good reliability and validity (sensitivity and specificity) [29]. This is an 11-item scale that assesses mental and physical symptoms of fatigue with four possible answers. Likert scoring allocates scores 0, 1, 2 and 3 to answers, while in bimodal scoring the first two are allocated zero and the last two are allocated one, whereby the total score varies from zero to 11 [29].

In this study the Cronbach's alpha of WAI was 0.73 and the one of the Chalder Fatigue Scale was 0.85; on those grounds, the reliability of both instruments was considered to be satisfactory.

Data collection was performed in June and July 2010 at the participants' workplace. The questionnaires were delivered at the beginning of the work shift and collected at its end, having been completed during work time with the nursing supervisor's authorization.

The data were analyzed by means of descriptive and analytical statistical methods, including absolute and relative frequencies, mean, standard deviation (SD), median and minimum and maximum scores. In analytical statistics, WAI was defined as the dependent variable and the socio-demographic profile (gender, marital status, educational level and family income), work profile (job title), work shift, commute time, number of jobs, length of work in the same workplace and in job role) and Chalder Fatigue Scale as independent variables.

2.4. Statistical analysis

The internal consistency of the scales was evaluated by means of Cronbach's alpha and was considered satisfactory when the value was ≥ 0.70 [30]. To verify the adjustment of the data to the normal distribution, the Kolmogorov-Smirnov test was used. As WAI did

not exhibit normal distribution, the Mann-Whitney and Kruskal-Wallis nonparametric tests were used in the univariate analysis of categorical variables with WAI and the Spearman correlation coefficient for the quantitative ones.

Multiple linear regression analysis was performed with stepwise forward modeling. Fatigue was the first variable to be included in the model, while the remainder of the variables were gradually included to assess whether the association between WAI and fatigue remained independent. In this analysis, only variables with $p < 0.20$ on univariate analysis were selected. Residual analysis of the final model showed adherence to the normal curve. In all analyses, $p < 0.05$ was considered as statistically significant.

2.5. Ethics

The study was approved by the institutional ethics committee and all the participants signed an informed consent form. As the principal investigator was a part of the study population, and thus could unintentionally promote participation, several measures were applied to minimize possible sources of bias: the voluntary nature of participation was emphasized, as well as the confidentiality of individual data, and the fact that individual results would not be communicated to heads of service or hospital managers. In addition, the questionnaires were delivered and collected in individual sealed envelopes with no identification.

3. Results

The data in the tables are described in absolute numbers only, as the total sample comprised exactly 100 participants.

As to the demographic characteristics, the study population was predominantly composed of females (88%) and 56% of the participants were married. The average age of the participants was 39.4 years old (SD = 9.5 years old), ranging from 22 to 63 years old. The family income in 75% of the sample was the equivalent to three to nine times the minimum wage, which was about USD 255.00 per month at the time of data collection.

Regarding the job title, 24% of the participants were registered nurses and 76% were nursing technicians or assistants, nurses more dedicated to the administrative work and the other group, performing the same work activities regarding direct patient care. As to the work shift, 29% worked in the morning, 34% in the afternoon

and 37% at night. About 54% of the participants had worked at the hospital for more than 10 years, and 30% of them had been in the nursing profession for more than 15 years. Most of the sample (79%) reported having one job only and working 36 hours per week. Fifty-seven per cent of the participants said they spent more than one hour commuting to and from work; of these, 23% spent two to six hours commuting.

The average score on WAI was 39.4 points (SD=6.3), ranging from 15.0 to 49.0; the median score was 41.0. The distribution of the participants per work ability category was as follows: poor – 8%, moderate – 27%, good – 40%, and excellent – 25%. Therefore, 35% of the workers, i.e., more than one-third of the sample, were classified as exhibiting inadequate work ability.

Among the self-reported diseases identified through WAI, musculoskeletal diseases (65%) and mild emotional disorders (35%) were the most prevalent; followed by respiratory (19%), gastrointestinal (18%), endocrine (16%), and cardiovascular diseases (14%).

The results of the Chalder Fatigue Scale indicated fatigue in 52% of the participants. Of these 52%, 55.7% of the women presented fatigue, 58.7% were married and 26.8% reported physical and/or mental limitations in the performance of work activities.

Table 1 shows a statistically significant negative moderate association between WAI and the Fatigue Scale ($r = -0.462$, $p < 0.001$). A weak, negative statistically significant association was also found between WAI and length of work in the same workplace ($r = -0.218$, $p = 0.030$). In addition, Table 2 shows that there was no association between score on WAI and the investigated qualitative variables.

Table 3 describes the linear regression models. In the final multiple model, the variables that exhibited statistically significant associations with the scores on WAI were the score on the fatigue scale, length of employment in the same workplace, and work category. The score on WAI decreased 0.945 points per point of increase in the fatigue score ($p < 0.001$); this association was independent from the remainder of the

variables included in the model. The score on WAI decreased 0.288 points per year of employment in the same workplace ($p = 0.001$). The nursing technicians scored –2.375 points on WAI compared to the nurses ($p = 0.040$).

4. Discussion

In the present study, the prevalence of inadequate work ability (poor or moderate) was high (35%), with the average score on WAI being 39.4/49. Fatigue

Table 1
Association between quantitative independent variables and work ability index (WAI)

Variable	$r^{(SP)*}$	p
Fatigue	–0.462	<0.001
Age	–0.099	0.325
Commute time (minutes)	–0.069	0.499
Length of work in the same workplace (years)	–0.218	0.030
Career working time (years)	–0.177	0.078

* (SP) = Spearman correlation coefficient.

Table 2
Comparison of WAI with personal and professional characteristics

Variable	Category	Mean (SD)	p
Gender	Female	39.1 (6.5)	0.377
	Male	41.0 (4.8)	
Marital status	Without partner	39.7 (6.0)	0.704
	With partner	39.1 (6.6)	
Educational level	High school	38.5 (6.8)	0.179
	College	40.4 (5.6)	
Family income (BRL)	1,500 – 3,000	39.6 (5.5)	0.897
	3,000 – 4,500	39.4 (6.8)	
	>4,500	38.8 (7.1)	
Job title	Nurse	42.1 (5.1)	0.066
	Nursing technician	38.7 (5.9)	
	Nursing assistant	38.0 (7.4)	
Shift	Morning	38.6 (5.8)	0.518
	Afternoon	39.9 (6.5)	
	Night	39.4 (6.7)	

*Mann-Whitney and Kruskal-Wallis tests SD = Standard Deviation.

Table 3
Analysis of the association of work ability with fatigue and other independent variables through the final multiple linear regression model

Variable	Univariate models					Multiple model				
	β	IC _{95%} (β)		p	r^2a	β	IC _{95%} (β)		p	r^2a
		Inf.	Sup.				Inf.	Inf.		
Fatigue	–0.893	–1.237	–0.548	<0.001	0.204	–0.945	–1.274	–0.615	<0.001	0.281
Working time in the same workplace (years)	–0.185	–0.368	–0.002	0.047	0.030	–0.288	–0.456	–0.120	0.001	
Nursing technician compared to nurse	–3.380	–6.462	–0.299	0.032	0.044	–2.375	–4.643	–0.106	0.040	
Nursing assistant compared to nurse	–4.091	–7.480	–0.701	0.019						

exhibited an inverse association with work ability, i.e., the higher the score on the fatigue scale, the greater the work ability impairment. This association proved to be independent of the remainder of the investigated variables.

Showing rather similar WAI scores, in a comparable study with 272 nursing workers from a public hospital in Brazilian Amazonia, the average score on WAI was 38.1 [15].

In a survey of 1,194 nursing workers from two Brazilian hospitals, the average score on WAI was 38.6 and thus similar to the one found in the present study; 38.9% of that sample exhibited inadequate work ability [9].

On the other hand, in another study conducted with workers from a pre-hospital mobile emergency service in Brazil, the authors found that the average score on WAI was higher compared to the one found in the present study [7]. The total average score including all work categories was 41.1, while the average scores per category were as follows: nursing professionals, 41.1; physicians, 41.5; drivers, 42.9; telephone operators, 42.5 and other workers in administrative services, 40.3 [7]. In the Amazonian study described above, the prevalence of inadequate work ability was a bit higher – 40.8% [15]. We can then conclude that the results of the present study are consistent with the findings of others that show that as a function of the work conditions and organization, nursing professionals are exposed to risks that undermine their work ability [8, 9, 15, 24, 31].

The prevalence of fatigue found in the present study was 52%, i.e., which represents a high proportion. The results of Brazilian and international studies are consistent with these findings [7, 15, 25], and demonstrate that nursing professionals perform exhausting work, with high expenditure of physical and mental energy.

In addition to fatigue, the variables that remained independently associated with work ability were length of employment in the same workplace and the nursing technician work category. Those variables may reflect the work conditions and the models of job organization to which some nursing professionals are exposed.

According to some studies, employees in public institutions start working at a relatively young age (about 20 years), and remain at the job for long periods of time; usually until retirement. Studies show that workers with longer periods of employment in the same workplace tend to exhibit a higher risk of impaired work ability [11, 21]. The longer workers are exposed to signifi-

cant job demands, the higher the risk for impairment of their physical and mental capacity, with subsequent functional aging [1, 3, 8].

It is worth emphasizing that in Brazil, nursing staff usually include professionals with varied educational levels, with subsequent differences in their levels of knowledge, work skills, competences, responsibilities and work conditions. These characteristics define occupational profiles that may lead to distinct profiles of sickness. While nursing technicians perform tasks directly related with patient care, registered nurses are mainly charged with managing care. Thus, the performance of tasks requiring greater physical effort and less autonomy in patient care might account for the larger work ability impairment exhibited by nursing technicians compared to nurses [10, 32].

The results of the present study are also consistent with the findings of several studies showing that work and its related factors, like work conditions and demands, contentment, organization, work environment, management and supervision, exert the largest impact on work ability [4, 6, 8].

A study conducted with health workers showed that in addition to fatigue, other variables associated with WAI were: physical activity, accidents and incivility in the workplace, sleepiness, stress and satisfaction. Those findings point to the need to pay attention to the maintenance of the physical and mental health of such workers [7]. Decreased work ability also showed strong association with psychosocial factors at work and musculoskeletal disorders among European nursing workers [18].

Both work ability and fatigue are affected by the presence of health problems. Musculoskeletal disorders and mental and emotional disturbances were identified as the main causes of reduced work ability and increased fatigue due to physical and mental overload among nursing workers [31]. Minor emotional disorders, such as mild depression, tension, anxiety and insomnia, are also common among nursing workers. Those conditions might be triggered by workplace conflict arising from stressful situations in the daily relationship with patients, their relatives, and other professionals within the context of hospital work [14, 20]. Inadequate work conditions and organization also account for the high prevalence of musculoskeletal disorders among nursing workers [8–10, 18, 19].

In addition, the association between impaired work ability and fatigue is influenced by the working conditions. One study conducted with 581 Chinese hospital nursing workers found that 54.9% of the

variance in acute fatigue was explained by lack of rest between shifts, work demands, quality of sleep, exposure to risks in the hospital environment and work control [25].

Fatigue, impaired work ability and sleep disorders were also detected in nurses working the night shift, as the levels of alertness decrease parallel to the increase in the working hours, posing risks to the workers' health and the patients' safety [9, 14]. Fatigue and exposure to long working hours with few rest breaks can reduce the job satisfaction and work performance of nursing workers, resulting in risks to the patients' safety [33]. A study on the effects of work hours on nurses' vigilance found that longer work duration increased the rate of errors and near errors [34]. The night shift is considered to pose higher risk to the patients' safety, due to increased fatigue caused by sleep deprivation [13].

Research on nursing workers from various European health care institutions revealed increased fatigue and reduced work ability among those working 12-hour shifts. The authors recommended introducing management changes to limit the nurses' work hours so as to preserve the quality of care [34].

The data collected in the present study suggest that many employees keep on working under conditions of fatigue, having musculoskeletal symptoms and presenting emotional disorders, which are the features characteristic of presenteeism. The fact that people remain working under unfavorable health conditions strongly points to the need for programs focusing on the prevention of presenteeism in order to improve the performance of employees with impaired work ability, while avoiding absenteeism [24].

The cross-sectional design of the present study did not allow for the detection of causal relationships, and because it was not possible to measure the long-term consequences on the workers' health, some results might have been under-estimated. The response rate was 85.5% which is considered to be adequate [35]. Also, we observed other items to ensure internal validity. To minimize outcome measure bias, outcome measures used were already validated for use in Brazil, with which we performed a pre-test and instructed the research participants regarding its completion, and we checked the reliability of used outcome measures. Furthermore, we proceeded to the analysis of the reliability of the outcome measures using the Cronbach's alpha, obtaining satisfactory results. Last, to evaluate a possible selection bias resulting from data collection (conducted

with volunteers), response rates already mentioned were analyzed.

Although there are about 1,500,000 nursing professionals currently in Brazil, the external validity of the present study can only be extended to the employees of hospitals with similar demographic characteristics, working conditions and organizational features.

Strategies to promote health at work for workers with inadequate work ability should be implemented to improve, or even restore their work ability, including eating a balanced diet, exercise, improved quality of sleep, rest and social interaction, as well as medical rehabilitation when needed [3]. From the managerial point of view, environmental risks and working conditions that might jeopardize the health of workers should be identified and corrected [3]. Individual ergonomics training, equipment changes, and reorganization of the work process are relevant measures to improve the occupational health of nursing workers with work-related musculoskeletal disorders.

For the purpose of prevention, the literature suggests introducing changes in the work process and rest breaks attuned to the workplace, while taking the demands proper to the various work shifts and hospital units into consideration [36, 37]. In addition, it recommends providing rest facilities with appropriate accommodations to improve the working conditions of nursing workers, thus reducing their levels of fatigue, and consequently also the rates of occupational accidents and adverse events [13, 38]. Investments made to improve and maintain work ability reflect on the workers' quality of life and prevent losses in work ability, early retirement and the occurrence of occupational diseases [11, 18, 28].

Good health means better work ability, which points to the relevance of workers' health surveillance, so that alterations might be detected early and individual and collective measures be applied. Such types of monitoring also allows for improving the job organization and the psychosocial work environment, thus promoting the workers' physical and mental health [1–4, 9].

5. Conclusion

The results of the present study demonstrated high rates of inadequate work ability and prevalence of fatigue in the investigated population of nursing workers from two hospital inpatient units. Increased fatigue, longer time in the same job and work category (i.e. nurse

technician) were associated with reduced work ability. The negative association between fatigue and work ability was independent from other variables. Therefore, the need to invest in the quality of work life is evident, including improvement of the working conditions and monitoring the nursing workers' health, so that they might maintain satisfactory work ability levels. This will promote prevention of illness, and reduced sick leave and early retirement, all of which compromise the country's economy and the quality of the care provided to its population.

References

- [1] Ilmarinen J. Towards a longer work life. Ageing and the quality of work life in the European Union. In: Maintaining work ability. Helsinki: Finnish Institute of Occupational Health. Ministry of Social Affairs and Health 2006:132-48.
- [2] Martinez MC, Latorre MRDO, Fischer MF. Validity and reliability of the Brazilian version of the Work Ability Index questionnaire. *Rev Saude Publica* 2009;43(3):525-32.
- [3] Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. Work Ability Index: Translated and adapted for Brazilian Portuguese. In: Frida FM et al, 2005. Sao Carlos: Finnish Institute of Occupational Health. EdUFSCAR.
- [4] Ilmarinen J, Gould R, Järviskoski A, Järvisalo J. Diversity of Work Ability. In: Gould R, Ilmarinen J, Järvisalo J, Koskinen S (editors). Dimensions of Work Ability. Helsinki: Finnish Centre for Pensions 2008, pp. 13-24.
- [5] Fischer FM, Martinez MC. Individual features, working conditions and work injuries are associated with work ability among nursing professionals. *Work* 2013;45(4):509-517.
- [6] Alcântara MA, Sampaio RF, Assunção AA, Silva FCM. Work Ability: Using structural equation modeling to assess the effects of aging, health and work on the population of Brazilian municipal employees. *Work* 2014;49(3):465-72.
- [7] Vegian CFL. Work ability and fatigue among professionals working in a Service Pre-Hospital Mobile Emergency [master]. Campinas: College of Medical Sciences, State University of Campinas 2010.
- [8] Fischer FM, Martinez MC. Work ability among hospital food service professionals: Multiple associated variables require comprehensive intervention. *Work* 2012;41(Suppl. 1):3746-52.
- [9] Rotenberg L, Griep RH, Fischer FM, Fonseca MJM, Landsbergis P. Working at night and work ability among nursing personnel: When precarious employment makes the difference. *Int Arch Occup Environ Health* 2009;82:877-85.
- [10] Magnago TSBS, Lima ACS, Prochnow A, Ceron MDS, Tavares JP, Urbanetto JS. Intensity of musculoskeletal pain and (in) ability to work in nursing. *Rev. Lat Am Enfermagem*. 2012;20(6):1125-1133. Link: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-11692012000600015&lng=en.
- [11] Hilleshein EF, Lautert L. Work capacity, sociodemographic and work characteristics of nurses at an university hospital. *Rev Lat Am Enfermagem*. 2012;20(3):520-7. Link: <http://www.scielo.br/pdf/rlae/v20n3/pt.a13v20n3.pdf>.
- [12] Felli VEA, Baptista PCP, Martins AC, Silva FEC, Karino ME. Working conditions and sickness of nursing workers in Brazil (A1456). In: 30th International Congress on Occupational Health, 2012, Cancún – México, 18 a 23/03. ANAIS. Cancún – México, 2012.
- [13] Rogers AR. The effects of fatigue and sleepness on nurse performance and patient safety. In: Hughes RG, editor. Patient safety and quality: An evidence-based handbook for nurses. Rockville (MD): Agency for health care research and quality (US); 2008.
- [14] Maynardes DCD, Sarquis LMM, Kirchhof ALC. Nocturne job and nursing workers morbidity. *Cogitare Enferm* 2009;14(4):703-8.
- [15] Vasconcelos SP, Fisher FM, Reis AOA, Moreno CRC. Factors associated with work ability and perception of fatigue among nursing personnel from Amazonia. *Rev Bras Epidemiol*. 2011;14(4):688-97. Link: http://www.scielo.org/pdf/rbepid/v14n4/en_15.pdf
- [16] Hemp P. Presenteeism: At work – but out of it. *Harvard Business Review* 2004;82(10):49-58.
- [17] Felli, VEA, Baptista PCP, Carvalho MB, Guimarães AL, Penteado PE. The impact of illness among nursing staff in Public Hospitals in Brazil according to working days lost. 2012. In: XIII Pan American Nursing Research Colloquium, 2012, Miami. Anais do XIII Pan American Nursing Research Colloquium. Miami, 2012.
- [18] Simon M, Tackenberg P, Nienhaus A, Estryn-Behar M, Conway PM, Hasselhorn H-M. Back or neck-pain-related disability of nursing staff in hospitals, nursing homes and home care in seven countries – results from the European NEXT-Study. *Int J Nursing Studies* 2008;45:24-34.
- [19] Lelis CM, Battaus MRB, Freitas FCT, Rocha FLR, Marziale MHP, Robazzi MLCC. Work-related musculoskeletal disorders in nursing professionals: An integrative literature review. *Acta Paul Enferm*. 2012;25(3):477-82. Link: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S010321002012000300025&lng=en.
- [20] Mininel VA, Baptista PCP, Felli VEA. Psychic Workloads and Strain Processes in Nursing Workers of Brazilian University Hospitals. *Rev Lat Am Enfermagem*. 2011;19(2):340-7. Link: <http://www.scielo.br/pdf/rlae/v19n2/pt.16.pdf>.
- [21] Hilleshein EF, Souza LM, Lautert L, Paz AA, Catalan VM, Teixeira MG et al. Work capacity of nurses in a university hospital. *Rev Gaucha Enferm* 2011;32(3):509-15.
- [22] Golubic R, Milosevic M, Knezevic B, Mustajbegovic J. Work-related stress, education and work ability among hospital nurses. *J Advanced Nursing* 2009;65(10):2056-66.
- [23] Chiu MC, Wang MJ, Lu CW, Pan SM, Kumashiro M, Ilmarinen J. Evaluating work ability and quality of life for clinical nurses in Taiwan. *Nursing Outlook* 2007;55:318-26.
- [24] Vries HJ, Reneman MF, Groothoff JW, Geertzen JHB, Brouwer S. Self-reported work ability and work performance in workers with chronic and nonspecific musculoskeletal pain. *J Occup Rehabil* 2013;23:1-10.
- [25] Fang J, Kunaviktikul W, Olson K, Chontawan R, Kaewthummanukul T. Factors influencing fatigue in Chinese nurses. *Nurs Health Sci* 2008;10:291-99.
- [26] Barker LM, Nussbaum MA. Fatigue, performance and work environment: A survey of registered nurses. *J Advanced Nursing* 2011;67(6):1370-86.
- [27] Kujala V, Remes J, Ek H, Tammelin T, Laitinen J. Classification of work ability index among young employees. *Occup Medicine* 2005;55:399-401.

- [28] Chalder T, Berflowitz G, Pawlikowaska T, Watts L, Wessely S, Wrigh D, Wallage EP. Development of fatigue scale. *J Psychosom Res* 1993;37(2):147-53.
- [29] Cho HJ, Costa, Menezes PR, Chalder T, Bhugra D, Wesley S. Cross-cultural validation of the Chalder Fatigue Questionnaire Brazilian primary care. *J Psychosom Res* 2007;62(3):301-4.
- [30] Bland JB, Altman DG. Cronbach's alpha. *BMJ* 1997;314:572.
- [31] Raffone AM, Hennington EA. Functional capacity evaluation of nursing professionals. *Rev Saude Publica* 2005;39(4):669-76.
- [32] Magnago, TSBS, Lisboa MTL, Griep RH, Zeitoune RCG, Tavares JP. Working conditions of nurses: Evaluation based on the demand-control model. *Acta Paul Enferm* 2010;23(6):811-7.
- [33] Scott LD, Rogers AE, Hwang W, Zhang Y. Effects of critical care nurses' work hours on vigilance and patients' safety. *Am J Crit Care* 2006;15:30-7.
- [34] Estryn-Béhar M, Van der Heijden BIJM. Effects of extended work shifts on employee fatigue, health, satisfaction, work/family balance, and patient safety. *Work* 2012;41:4283-90.
- [35] Fowler Jr DJ. (1990) Nonresponse: Implementing a sample design, in: *Survey research methods*. California: Sage Publications; 1990, pp. 45-60.
- [36] Szeto GPY, LawKY, Lee E, Chan SY, Law S. Multifaceted ergonomic intervention programme for community nurses: Pilot study. *J Advanced Nursing* 2010;66(5):1022-34.
- [37] Gonçalves MBL, Fischer FM. Working conditions of practical nurses in an orthopedics and trauma institute of a public hospital in Sao Paulo, Brazil. *Cad Psicol Soc Trab* 2004;7:51-65.
- [38] Barboza J, Moraes EL, Pereira EA, Reimão RNAA. Evaluation of the sleep pattern in Nursing professionals working night shifts at the Intensive Care Units. *Einstein* 2008;6(3):296-301.