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Investigation of effects of work–related quality of life and some related factor on cognitive failures among nurses

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Title: Investigation of effects of work–related quality of life and some related factor on cognitive failures among nurses

Running title: nurse's quality of working life and cognitive failures

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Abstract:
Objective. Cognitive failure is one of the factors which can be influenced by personal and professional characteristics. Hence, this research was carried out to study the effect of work–related quality of life (WRQoL) and some related factors on cognitive failures (CF) among nurses. *Methods*. This cross–sectional study was conducted among nurses working in ICU (Intensive Care Unit), CCU (Critical Care Unit), and Emergency Units, in 2014. *Results*. In this study, 750 nurses participated. The mean ± SD of the total CFs and WRQoL were obtained as 40.5 ± 12.7 and 75.8 ± 13.7 respectively. The result shows that CF statistically has a significant difference among the age groups, experience groups and working units. Multiple regression tests show that age, income and WRQoL have a significant effect on CF. Based on the results, for a unit increase in WRQoL, we expect a 0.26 unit decrease in CF. Analysis of variance (ANOVA) results show that emergency ward had changed the overall effect of WRQoL on the CF, after the effect of WRQoL was controlled. *Conclusions*. Overall results of the present research indicated that despite the high level of WRQoL among understudied nurses, the rate of CF was not in an appropriate level. Development of supportive and interventional strategies is highly recommended.

1. Introduction

In large medical centres such as hospitals, nurses constitute the biggest proportion of employees. Nurses are exposed to more physical and mental strains as compared to other related professions. Moreover, due to long working hours and its consequent fatigue, this occupational group is prone to various health–related problems [1]. Physical and psycho-motor diseases are very popular among healthcare workers in member states of European Union [2].

The work–related quality of life (WRQoL) is a new concept which refers to the conveniences or inconveniences of the workplace from employees' point of view. There is no consensus on the definition of WRQoL. However, according to Ansari (1997) 'WRQoL is essentially a multidimensional concept and is a way of reasoning about people, work and its organization' [3]. According to Edwards et al., nurses' WRQoL includes the aspects of job satisfaction, job tension, and organizational commitment [4]. Nurses' WRQoL influences quality of patient care as well as other organizational standards [5]. Home–work interface, educational opportunities, job stress, working conditions, job promotion, and nature of nursing profession are other factors which affect nurses' quality of work life [6].

Previous studies have shown that individuals with higher WRQoL also have higher organizational identification, job satisfaction, job performance, and lower rate of turnover [7]. WRQoL improvements will enhance the happiness and satisfaction of nurses and will consequently have beneficial results for employees, hospital, and patients [8]. Moreover, deficiencies related to WRQoL would have adverse effects on nurses' job performance.

On the other hand, cognitive failures (CFs) are defined as errors or failures in completion of a task that a person is normally able to perform it [9] and it includes all types of execution and storage failures, except for failures of ability or knowledge. CFs are known with various names such as slip in the execution, slip in the attention (failure to understand), slip in the memory (failures related to information retrieval), and slip in the motor functions (unintended actions or slips in actions). CFs has negative association with alertness and memory function and they are positively correlated with fatigue, sleep disorders, and attention–related problems [9]. It is believed that CFs are associated with the workplace accidents and incidents which can result in low attention, distraction, mental errors, etc. [10]. Workflow interruptions produced by coworkers, patients and organizational limitations probably can lead to nursing errors and workplace cognitive failure [11].

It can be said that work design can affect work cognitive failure indirectly because according to Elfering et al. work design should specifically decrease unnecessary interruptions [12]. Significant relationships between CFs and symptoms of minor psychiatric problems have been reported among nurses who have worked in high–stress units [13].

Nurses' role includes immediate diagnosis and intervention in clinical decision–making situations. In this sense, nurses do not only need to have the psychomotor and emotional skills, but complex mental processes such as inferring and synthesizing information in order to select an effective action as well[14]. High level of stress can interfere with concentration and information processing, and can lead to incorrect diagnosis and subsequent errors [15].

Medical errors are the eighth leading cause of death in the USA each year and about 44,000 to 98,000 patients lose their lives annually due to these errors [16]. The number of people who die due to medical errors is higher than those who lose their lives due to diseases such as cancer, AIDS, motor vehicle accidents etc. [17]. These rates of errors impose additional cost on patients.

Given the above-mentioned statements, nurses' WRQoL is a highly important issue that relates to their performance. CFs can also be considered as an influencing factor. Therefore, this research seeks to study the effect of WRQoL and some related factors on CFs among nurses.

2. Methods and Materials

The present analytical-descriptive and cross-sectional study was carried out among 750 nurses working in hospitals under the auspices of Tehran University of Medical Sciences, in 2014. The participation rate was 83%. Participants' demographic and background characteristics were assessed by a specific self-administered questionnaire. Moreover, the following instruments were used for investigating the CFs and the WRQoL:

2.1. Cognitive Failures Questionnaire (CFQ)

Cognitive failures questionnaire (CFQ) is based on the general cognitive failure questionnaire and was developed by Broadbent et al. (1982) [13]. This instrument assesses CFs and includes four subscales of memory, memory for names, perception, and motor function. The questionnaire consisted of 25 items with a 5-point Likert scale (0 = *never*, 4 = *very often*). The range of scores for cognitive failures is 0–100, the higher the CFQ score, the higher rate of cognitive failures.

2.2. WRQoL Scale

The WRQoL Scale, developed by Van Laar et al. was employed in order to assess quality of working life among understudied nurses [18]. This questionnaire is a multidimensional scale which has been developed for assessing quality of working life of healthcare workers with 6 factors namely: job and career satisfaction (JCS), working conditions (WCS), general well-being (GWB), home–work interface (HWI), stress at work (SAW), and control at work (CAW).The scale consisted of 24 questions with a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*), with a total score, ranging from 0 to 100.

2.3. Statistical analysis

In this research, the questionnaires were analyzed by R software. Furthermore, the means of CFs and WRQoL among the various groups were compared using one-way analysis of variance (ANOVA) and Kruskal–Wallis. The correlation between WRQoL and their sub-scales with total CFs was checked using Pearson and Spearman correlation test. Multiple regression analysis was

used to investigate the effect of WRQoL and other independent variables on CFs among the nurses. Analysis of covariance (ANCOVA) was used to study the effect of interaction between the working units and WRQoL on CF.

3. Results

In this study, 750 nurses filled the questionnaires completely. In all participants, 61.4% were females and 38.6% were males. Findings showed that mean ± *SD* age and work experience of nurses was 33.1 ± 8 and 10.2 ± 7.6 years, respectively. Regarding nurses' working unit, 25.7% were working in emergency unit, 45.7% in ICU (Intensive Care Unit), and 28.6% in CCU (Critical Care Unit). According to the results, mean ± *SD* of CFs and WRQoL for all nurses were 40.5 ± 12.7 and 75.8 ± 13.7, respectively.

Nurses working in emergency and CCU units obtained the highest and lowest values for cognitive failures with mean ± *SD* score of 48.44 ± 10.4 and 33.27 ± 12.65, respectively. Nurses in the age group of 43–49 with mean ± *SD* of 49.87 ± 6.08 had the highest CFs score, while those with the age group of 22–28 had the lowest value of 34.86 ± 10.63. The mean ± SD of CFs for male and female participants was 41.46 ± 12.61 and 39.98 ± 12.81, respectively (Table 1).

Among the understudied working units, the highest mean score of WRQoL belonged to CCU (78.77 ± 12.79) and the lowest value belonged to emergency unit (69.44 ± 13.59). Additionally, individuals with age groups of 29–35 and 43–49 years had the highest and lowest WRQoL scores, respectively. In this study, the average WRQoL of male and female was estimated to be 78.37 ± 12.36 and 74.17 ± 14.28, respectively. Further descriptive information is presented in Table 1.

After checking the normality of variables, Shapiro–Wilk test showed that CFs had normal distribution at a confidence level of 5%. Result of Kruskal–Wallis showed that CF and WRQoL statistically had a significant difference among the age and experience groups at a confidence level of 95%. In other words, higher age and experience could cause more CF.

Also, results of ANOVA showed that CF and WRQoL statistically had a significant difference among the working units at a confidence level of 95%. In other words CF and WRQoL in the emergency department were more than ICU and CCU. The results showed that the WRQoL average was not equal but different in over-time groups. The variance was statistically significant at a confidence level of 95% ($p < 0.05$).

The correlation between WRQoL and their sub-scales with total CFs was checked using Pearson and Spearman correlation test. The results showed that all variables had a negative significant correlation with CF (Figure 1). It is noteworthy that in order to analyze the relationship between WRQoL and CF (because WRQoL is an ordinal variable), Spearman correlation was used and other correlations were investigated using Pearson correlation test. The highest correlation was between job satisfaction and control at work with CF (correlation coefficient was equal to 0.32). WRQoL with CF had a negative relationship and correlation coefficient between them was determined to be 0.27.

Multiple regression analysis was used to study the effect of background and demographic variable and WRQoL on CF. Results of this test showed that age, income and WRQoL had a significant effect on CF at a confidence level of 95%. The R^2 was 0.32 which means that about 56% (R = 0.56) of the CF variance was accounted for by the model. According to results the coefficient for WRQoL which was –0.26, for one unit increase in WRQoL, we would expect a 0.26 unit decrease in CF. Also, for every age, CF level is expected to rise by 0.76. β is used when there is more than one independent variable in the model. In this case, the amount of β helps to compare the relative contribution of each variable in predicting the dependent variable. In other

words, we can determine which variables have the greatest impact on the dependent variable. The results showed that although age, income and quality of working life affected cognitive failure, the effect of age (β = 0.48) was higher than the other two factors. Gender, marital status and number of shifts in a month at the confidence level of 95% had no significant effect on CF (Table 2).

As presented in Table 1, CF was significantly different in the working units. Also, the results of Pearson correlation test (Figure 1) and regression model (Table 2) showed that WRQoL was one of the factors influencing CFs. The analysis of covariance (ANCOVA) was used to study the effect of interaction between the working units and WRQoL on CFs. ANCOVA separates an overall correlation into different layers to understand how this correlation is in each layer. In this study, ANCOVA investigated the effects of the units on CF, after the effects of WRQoL were controlled. The result showed that overall correlation between WRQoL and CF and correlation between the two variables in separation of the working units was negative (table 3). In addition, emergency ward had changed the overall effect of WRQoL on the cognitive failure.

4. Discussion

According to the results, mean CFs obtained was high (40.5) and this can be attributed to the nature of nursing jobs [19]. Pereira et al. showed that workflow interruptions and supervisor-induced social stressors at work can directly lead to attention failure in surgery personnel [20]. According to the results presented in Table 1, the mean value of CFs was not the same in various working units; the highest CFs belonged to nurses in the emergency unit. High speed of work, acute care of patients and low WRQoL justify the high value of CFs in nurses working at emergency units. Also, Elfering et al. said that individual differences in conscientiousness were part of the factors affecting the cognitive failure among theater nurses and physicians [21]. High levels of workload imposed on the nurses during emergencies is amongst factors influencing fatigue [22] and consequently the fatigue can cause higher rate of CFs [9].

Moreover, the mean value of CFs reached the highest value among older nurses. A considerable number of CFQ surveys have found a paradoxically negative correlation between age and the cognitive failure. Rast et al. conducted a study to investigate the impact of age on cognitive failure (among people 24–83 years age) and showed that self-reported forgetfulness rose with age [23]. Another study conducted by Begum et al showed that the number of self-reported incidences of forgetfulness rose from 6.3% to 15.6% for young people (aged 16–24 years) and elderly people (older than 75 years) respectively [24]. Some mental processes that are vital for many occupations seem to have been influenced by age. Level of cognitive functions also appeared to have decreased with age, even if experience had increased performance in people of all ages. It was previously noted that increasing one's age, increases sleep disorders and could result in drowsiness [6]. The drowsiness was also positively correlated with level of CFs [9]. Results of this study are in contrast with that of Schmalzried and Winter [25–26]. Schmalzried showed that elderly people stated more complications in relation to memory and naming items, but those stated by younger individuals were more [25]. Also, Winter et al were of the opinion that older people had almost equal or even less CFs than younger ones [26]. The decrease (or non-increase) in cognitive failure with age can be attributed to the multidimensionality of CFs, an age-related increase in some of its dimensions (e.g., memory failures) as a confounding factor, self-reported decrease in distraction.

Kruskal–Wallis test showed that the mean CFs was different among nurses in various work experience groups. In this way, individuals with higher levels of work experience had higher rates of CFs. By increasing age and work experience, the physical work ability decreases. Moreover, with continuous exposure to job risk factors, the burnout increases and these can be taken to be

background variable in the occurrence of CFs [22]. Level of cognitive functions also appeared to have decreased with age, even if experience had increased performance in people of all ages.

Regarding gender variables, it was found that female nurses had higher CFs, compared to their male counterparts. There is consistency in our results as compared to that of Mecacci et al. [27]. It is interesting to note that in this study, no significant relationship was found between hours of over-time and CFs. However, in the study conducted by Nirel et al., which was carried out among healthcare staff, it was reported that over-time exposure of a high level of strain on participants can consequently increase burnout and decrease employees' mental health [28]. Mental health and burnout have inverse relationships with CFs [22–29]. Although the relationships between over-time and CFs seem to be logical, no relationships were found in the present research and this shows the need for more research.

CFs had a significant inverse relationship with home–work interface. Increase in job strain can interfere with home–work interface relationships. This would lead to dissatisfaction in life. On the other hand, dissatisfaction with life and job is one of the leading variables in increasing the likelihood of CFs [8].

In the present research, a significant converse association was also observed between CFs and satisfaction at work. This can be explained by the fact that job stressors subsequently increased mental workload and CFs [19]. A study by Bartram et al. [30] and Sirgy et al. [8] also confirmed a significant positive correlation between job satisfaction and stress among nurses and other healthcare workers [30–8]. Considering the fact that in this research, nurses have experienced a high level of job stress, it can be concluded that high stress resulted in low job satisfaction and consequently high CFs. Moreover, findings of this project confirmed the inverse correlation between CFs and control at work in a way that led to an increase in control at work, CFs would decrease and this is in accordance with results of Elfeing et al. [19]. Control at work can have an impact on prevention or reduction of job stressors. Frequent work interruptions among nurses were positively associated with CFs. In this study, stress at work was inversely associated with CF which opposes results of Elfering et al's study. In this regard, the constructive role of stress can be pointed out since stress (apart from its detrimental effects) has positive effects on performance.

The results demonstrated that CF had a significant inverse relationship with working conditions. It can be said that the nurse–patient ratio is one of the factors associated with nursing burnout. Burnout has a negative relationship with CFs, as well [22]. Considering the above-mentioned issues, it can be stated that the working conditions were inversely associated with CFs. Also, a significant negative correlation exists between the rate of CFs and WRQoL. Low job satisfaction is an underlying factor for increased CFs [30]. Individuals with low job satisfaction have less WRQoL [31]. Therefore, it can be concluded that there is a significant inverse relationship between CFs and WRQoL.

The results showed that although age, income and WRQoL affected cognitive failure, the effect of age (β = 0.48) was higher than the other two factors. With regards to age which is one of the factors affecting the WRQoL, it can be said that, age covered part of the WRQoL effects. Therefore, it is convenient to state that by excluding the effect of age, WRQoL among other variables would have the greatest influence on CFs.

Results of ANOVA showed that the emergency ward had changed the overall effect of WRQoL on the CF, and that was after the effect of WRQoL was controlled. Although the other two units had no impact on the effect of WRQoL on the CF, given that this effect was affected by the interaction between emergency ward and WRQoL, it can be said that working unit was also a factor affecting

the CFs. Due to increased speed of work and tension such as acute care patients, low WRQoL in this unit, WRQoL on CFs was affected by the working units.

Limitations:

There are several limitations in our study. The study ignored conscientiousness, as personality characteristics might also justify staff differences in CF. Also, we used subjective tools for assessment. This is a cause for concern because subjective methods are inherently susceptible to bias.

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Table 1. Demographic and background characteristics of study participants

Variable	Frequency (%)	*M (SD)* WRQoL	*p*	*M (SD)* CF	*p*
Gender			0.070		0.510
Male	289 (38.6)	78.37 (12.36)		41.46 (12.61)	
Female	461 (61.4)	74.17 (14.28)		39.98 (12.81)	
Age			0.015		0.001
22–28	273 (36.4)	77.21 (13.44)		34.86 (10.63)	
29–35	203 (27.1)	79.92 (12.87)		39.5 (14.46)	
36–42	160 (21.4)	73.86 (14.56)		45.13 (12.03)	
43–49	86 (11.5)	67.5 (9.53)		49.87 (6.08)	
50–56	28 (3.6)	68 (16.46)		49.4 (6.98)	
Work experience			0.050		0.001
1–6	284 (37.8)	78.11 (13.61)		35.47 (11.08)	
7–12	187 (25)	78.51 (12.51)		37.11 (13.51)	
13–18	139 (18.6)	73.92 (14.01)		46.46 (11.44)	
19–24	101 (13.6)	68.63 (14.40)		48.94 (9.28)	
25–30	38 (5)	71 (10.42)		51.57 (5.12)	
Working unit			0.004		0.001
Emergency	193 (25.7)	69.44 (13.59)		48.44 (10.4)	
ICU	342 (45.7)	77.5 (13.32)		40.67 (11.31)	
CCU	215 (28.6)	78.77 (12.79)		33.27 (12.65)	
Over-time in a month (h)			0.022		0.460
<30	364 (48.5)	74.89 (14.1)		40.32 (12.99)	
30–60	236 (31.5)	80.04 (12.86)		39.29 (13.19)	
>60	150 (20)	71.28 (12.44)		43.1 (11.23)	
Number of shifts in a month			0.880		0.270
10–17	252 (33.6)	74.11 (14.36)		71.7 (14.14)	
18–25	262 (35)	77.08 (13.13)		76.57 (13.55)	
26–33	171 (22.8)	76.09 (13.54)		80.44 (10.55)	
>33	65 (8.6)	76.33 (14.67)		76.25 (16.68)	
Income (million IRR)			0.460		0.070
<12	220 (29.4)	74.39 (15.95)		41.09 (12.66)	
13–16	252 (33.6)	77.96 (13.04)		37.25 (14.04)	
>16	278 (37)	74.94 (12.27)		43.11 (10.94)	
Marital status			0.750		0.400
Single	391 (52.2)	75.52 (13.6)		39.68 (11.6)	
Married	359 (47.8)	76.08 (13.87)		41.51 (13.84)	

Note: CCU = critical care unit; CF = cognitive failure; ICU = intensive care unit; WRQoL = work-related quality of life.

Table 2. Effect of age, work experience, gender, marital status, income, number of shifts in a month and WRQoL on CF.

Variable	Model coefficients***				
	UnStd. regression coefficient (B)	*SE*	*β*	*t*	*p*
Constant	40.57	7.28	–	5.57**	0.001
Age	0.76	0.14	0.48	5.44**	0.001
Gender	1.22	2.06	0.05	0.59	0.55
Marital status	–1.11	2.02	–0.04	–0.55	0.58
Income	–6.05	2.84	–0.21	–2.16*	0.03
Number of shifts in a month	1.86	1.03	0.15	1.81	0.07
WRQoL	–0.26	0.07	–0.28	–3.75**	0.001

* Significant at $P < 0.05$ ** Significant at $P < 0.01$ *** $R^2 = 0.32$

Note: CF = cognitive failure; UnStd = instandardized; WRQoL = work-related quality of life

Table 3. Analysis of covariance to study the effect of working units and WRQoL on CF
Dependent Variable: CF

Parameter	*β*	*SE*	*p*
Intercept	57.858	10.983	0.001
Emergency	2.089	14.636	0.887
ICU	6.911	13.691	0.615
CCU	0[a]	–	–
WRQoL	–0.312	0.138	0.025
Emergency × WRQoL	0.146	0.194	0.452
ICU × WRQoL	0.001	0.173	0.995
CCU × WRQoL	0[a]	–	–

[a] This parameter is set to zero because it is redundant.

Note: CCU = critical care unit; CF = cognitive failure; ICU = intensive care unit; WRQoL = work-related quality of life.

Fig 1. Relationship between CF_{total} and WRQoL and its subscales
Note: CF_{total} = total score of cognitive failure; $WRQoL_{total}$ = total score of work-related quality of life.