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Which socio-demographic characteristics impact on the fatigue conditions in nurses: an Italian investigatory study

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Abstract. *Background and aim:* Fatigue describes a wholeness feeling of tiredness or lack of energy. To assess which sampling nurses relating characteristics could influence the fatigue condition among nurses. *Methods:* From May 2020 to September 2021 a cross sectional, multicenter study was conducted among Italian nursing professional orders. An on-line ad hoc questionnaire was spread including sampling characteristics both on socio-demographic and nursing-relating work characteristics. *Results:* Significant associations were reported between item no.1 and gender (p<0.001) and BMI conditions (p=0.013), as most of the female participants (47%) affirmed to often feel themselves tired when they wake up, despite most of participants were at normal weight (32%). Item no.2 was significantly associated with gender (p=0.009), job role (p=0.039) and shift (p=0.030), as most of females never (31%) or often (31%) were not concentrated in their working tasks and, most of them were registered nurses (never: 41% and often: 35%), despite they were employed also during the night shift (never: 28%; often: 22%). Most of females (p=<0.001) were never slow in their reactions (42%), and they were young nurses (p=0.023). 44% of females declared to make an effort to express clearly themselves (p=0.031). Females reported significant high frequencies (p=0.016) in constant excitant substance assumption, such as caffeine (30%) and high significant percentage of females (p=0.047; 41%) reported the need to sleep during the day. *Conclusions*: The fatigue will have a strong impact on the quality of life of nursing professionals, compromising their functional abilities, social relationships and their work and family roles.

Key words: Condition, fatigue, investigatory study, nurse, sampling characteristic

Introduction

Fatigue is particularly widespread and consequential in the healthcare sector. It has been classified as a "work-related condition which ranges from acute to chronic and can produce an overwhelming sense of tiredness, decreased energy and exhaustion, resulting in impaired physical and cognitive functioning" (1). It was sufficient to observe reality in hospital settings to find that healthcare professionals were prone to experience situations of stress or fatigue with negative consequences (2,3). Repeated exposure to unpredictable challenges in nursing practice could cause symptoms of anxiety, fatigue and stress in professionals, with decreased of job satisfaction and compromised quality of care provided (4). Factors such as physical, psychological, social and emotional stresses might be triggers of high fatigue (5-9). Populations particularly at risk of

fatigue included women, nurses, and those engaged in particular working hours, for example long and consecutive shifts, do shift work, physically demanding workloads (10). The negative consequences of the working environment could make workers feel exhausted and suffer from certain syndromes, such as Obstructive Sleep Apnea Syndrome (OSAS). A study showed an association between fatigue, sleep disturbances and high levels of OSAs and a strong association between OSAs and depression among the general population (11,12). Fatigue has been shown to be associated with obesity, insomnia, and depression (13). From a study conducted in Greece, it was found that the risk of OSA was 20%. 8% of participants were at high risk for OSA. Furthermore, it was found that nurses working the night shift have significant meal instability, which is a risk factor for obesity, which in turn is linked to the development of OSAS (14). With a particular predisposition of the female gender as demonstrated by Alsharari et al. (15) in their study. OSAS should not be underestimated as it is an independent risk factor for cardio and cerebrovascular diseases including: arterial hypertension, acute myocardial infarction, heart failure, arrhythmias and stroke. OSAS-related daytime sleepiness also determined a greater risk of accidents driving motor vehicles and occupational and domestic injuries; for these reasons, OSAS was considered a public health problem. Obstructive Sleep Apnea Syndrome (OSAS) could have repercussions in the workplace, with a loss of productivity attributable to an increase in days absent from work and a reduced work, social and economic performance. There was still little knowledge of these aspects, as demonstrated by an Italian study recently conducted on a population of nurses (16). According to our knowledge, to date there are few studies that have investigated the association between fatigue, OSAs and some characteristics among the Italian nursing population.

Aim

The present study assessed which sampling nursing characteristics influence the fatigue condition among Italian nurses.

Materials and Methods

Study design

From May 2020 to September 2021 a cross-sectional, multicenter study was conducted among Italian Nursing Professional Orders. Firstly, a clear e-mail of presentation was sent to the Nursing Orders from the provinces of Genova, Lecce, Treviso, Gorizia, Nuoro, Varese, Firenze, Trapani, Messina, Pavia e Taranto, Italy. All the Nursing Orders invited, agreed to spread the questionnaire through their enrolled nurses: they send an e-mail containing the link of the questionnaire, to all their belonging nurses by freely inviting them to answer to the anonymous questionnaire.

Participants

No eligible criteria were applied to select participants, in fact all Italian nurses who were employed both in public and private healthcare systems, belonging to several wards were considered as potential participants. The minimum statistically significant sample size was assessed through the Cochran formula (17). By considering that in Italy there are a total of about 460,000 nurses employed and by fixing 95% as the confidence level and 5% as the confidence interval, the representative sample size of the Italian nursing population was 384. In the present study a total of 406 Italian nurses, who voluntary agreed to participate.

The questionnaire

Firstly, a clear explanation of the study purpose was proposed and each invited nurses should give the personal consent before to proceed to answer the questionnaire. The questionnaire included items regarding sampling characteristics and work-relating information, and finally psychological and fatigue conditions associated to their work-related activities. Specifically, sampling characteristics included:

- Gender: female and male;
- Age: 21-30 years, 31-40 years, 41-50 years, 51-60 years and over 61 years;
- Body Mass Index: by considering the weight, ex-

pressed in kilograms (Kg), and height, expressed in meters (m); the BMI value was calculated as weight divided by height squared. BMI was classified according to current literature (16), as follows: for BMI values below 18.49, an underweight condition was assigned; values between 18.50 and 24.99 were classified as normal weight conditions; for BMI scores between 25 and 29.99 an overweight condition was identified; finally, for values over 30 an obesity condition was identified (16);

- Smoking habits: yes, no or to be an ex-smoker.
- job role: registered nurse, nursing coordinator and nursing manager;
- educational level: basic degree, master's degree, postgraduate;
- years of work experience: 0-5 years, 6-10 years, 11-15 years, 16-20 years, 21-25 years, 26-30 years and over 31 years;
- Shift work: only during the morning and the afternoon or also during the night shift;
- Ward typology: emergency-urgency critical area, geriatric-rehabilitation medical area, multi-specialty medical area, surgical area, maternal-infant area, prevention and safety, mental health area, management or administrative area, territorial area, training / university area;

In the second part of the questionnaire it was investigated fatigue condition among participants. A total of 12-items were created ad-hoc by considering the current literature (18-20) concerning morphemic apneas which could be particularly influenced the attention, executive and short-term memory functions (Table 1). The alteration of these functions, taken together with other parameters allowed to link problems in family, social, work and legal (snoring, sexual disorders, falling asleep in public, work, driving, low productivity), difficulties in carrying out normal work and social activities, fatigue, difficulty concentrating, subjective feeling of dullness and difficulty remembering, which often motivated patients on their first visit and encouraged them. For each item proposed a Likert scale was associated which varied from 1, as never, to 3, as always with a mid-value, as often, indicating with 2. The items created showed a good reliability (α=0.887).

Table 1. Items concerning the fatigue condition.

Item no.1: Did you wake up feeling tired?
Item no.2: Did you have difficulty concentrating on a task?
Item no.3: Were your reactions in everyday situations slow?
Item no.4: Did you have to try harder than usual to keep track of what you were doing?
Item no.5: Did you have to make an effort to express yourself clearly?
Item no.6: Did you have to use stimulants (coffee, tea, ginseng, etc.) to stay active?
Item no.7: Have you had a hard time paying attention to a task for a long time?
Item no.8: Did you have difficulty paying attention to multiple tasks at the same time (Listening to a radio program while we are driving a car)?
Item no.9: Did you have to work hard to pay attention and not make mistakes?
Item no.10: Did the problems in the previous questions interfere with your ability to work?
Item no.11: Did the problems reported in the previous questions interfere with your social relationships?
Item no.12: Did you feel the need to sleep during the day?

Data analysis

All sampling characteristics were processed thanks to the SPSS, IBM, version 20.

All sampling characteristics were considered as categorical variables and presented as frequencies and percentages. Then, linear regressions were performed for each item of the fatigue investigated condition according to sampling characteristics in order to assess which characteristic significantly influence the fatigue condition among nurses. All p-values less than 0.05 were considered as statistically significant.

Ethical considerations

The ethical aspects of the study were clearly illustrated in the initial presentation placed at the beginning of the questionnaire, in accordance with the principles of the Italian Data Protection Authority (DPA), emphasizing that participation was voluntary and that any potential participant could reject the protocol at any time. All potential interviewers interested in participating were given an informed consent form with information on confidentiality and anonymity.

Results

A total of 406 Italian nurses agreed to participate in this study. Most of the interviewers were registered nurses (89%) with basic degree (80%), females (76%) and were employed less than 5 years (33%) and employed also during the night shift (58%), belonging to emergency, medical and surgical areas (20%). Additionally, 55% of participants were normal weight, 24% were overweight and 18% were obese. 60% of interviewers were no smokers (Table 2).

By considering all the sampling characteristics according to the items investigating the fatigue condition (Table 3), significant associations were reported between item no.1 and gender (p<0.001) and BMI conditions (p=0.013), as most of the female participants (47%) affirmed to often feel themselves tired when they wake up, despite most of participants were at normal weight (32%) at the enrollment moment, therefore, a linkage between rest and their BMI conditions seemed to be not present (Table 4). Item no.2 was significantly associated with gender (p=0.009), job role (p=0.039) and shift (p=0.030) (Table 3), as most of females never (31%) or often (31%) were not concentrated in their working tasks and, most of them were registered nurses (never: 41% and often: 35%), despite they were employed also during the night shift (never: 28%; often: 22%) (Table 4). Most of females (p=<0.001) were never slow in their reactions (42%), as most of them were also young nurses (p=0.023), as shown in the Table 4. 44% of females declared to make an effort to express clearly themselves (p=0.031). As regards item no.6 (p=0.016), females reported significant high frequencies (p=0.016) in constant excitant substance assumption, such as caffeine (30%) (Table 4). Finally, significant high percentage of females (p=0.047; 41%) reported the need to sleep during the day (Table 3 and Table 4).

Table 2. Sampling characteristics according to gender (n=403)

Sampling characteristic	n(%)
Gender	
Female	310(76)
Male	96(24)
Age	
21-30 years	115(28)
31-40 years	95(23)
41-50 years	104(26)
51-60 years	84(21)
Over 61 years	8(2)
BMI	
Underweight	13(3)
Normal weight	225(55)
Overweight	96(24)
Obese	72(18)
Smoking habit	
Yes	109(29)
No	243(60)
Ex-smoker	54(13)
Job role	
Registered Nurse	362(89)
Coordinator	28(7)
Manager	16(4)
Educational level	
Basic degree	326(80)
Master's degree	44(11)
Postgraduate	36(9)
Shift work	
Daily	170(42)
Night	236(58)
Ward assignment	
Emergency-urgency critical area	81(20)
Geriatric-rehabilitation medical area	78(19)
Multi-specialty medical area	66(16)
Surgical area	59(14)
Maternal-infant area	8(2)
Prevention and safety	20(5)
Mental Health Area	20(5)
Management / administrative area	11(3)
Territorial area	19(5)
Training / university area	44(12)

Discussion

The present study aimed to evaluate which nursing characteristics in the sample influenced the condition of fatigue among Italian nurses. Subjective excessive daytime sleepiness (EDS) and fatigue appeared to be a cardinal symptom in OSA, especially with inadequate sleep hours, induced by behaviors or shift work (21). In a Greek study (22) conducted on a nursing population it emerged that this was at a high risk of OSA for 20%, while 28% for EDS. In the general population, women with OSA, in particular, recorded higher levels of fatigue, tiredness and lack of energy than men (23). The recorded data showed that females get tired more than males, especially when waking up

Table 3. Sampling characteristics influencing fatigue conditions.

Item/Variables	Gender	Age	BMI	Smoking habit	Work experience	Job role	Educational level	Shift	Ward
Item no.1									
β	-0.205	0.022	0.124	-0.047	-0.014	0.005	0.046	0.001	0.022
t	-4.131	0.209	2.488	-0.963	-0.135	0.093	0.873	0.018	0.434
p-value	>0.001*	0.834	0.013*	0.336	0.893	0.926	0.383	0.986	0.665
Item no.2									
β	-0.132	0.000	0.064	0.008	-0.087	0.106	-0.030	-0.108	0.030
t	-2.632	0.003	1.265	0.158	-0.824	2.070	-0.558	-2.174	0.595
p-value	0.009	0.998	0.206	0.874	0.411	0.039*	0.577	0.030*	0.552
Item no.3									
β	0.150	-0.115	0.158	0.097	0.082	-0.151	0.070	-0.051	-0.029
t	6.738	-2.283	1.511	1.919	1.654	-1.430	1.374	-1.027	-0.560
p-value	>0.001*	0.023*	0.131	0.056	0.099	0.153	0.170	0.305	0.576
Item no.4									
β	-0.091	0.076	0.077	0.000	-0.022	0.043	-0.046	-0.011	-0.038
t	-1.800	0.716	1.503	0.001	-0.203	0.834	-0.852	-0.228	-0.743
p-value	0.073	0.474	0.134	0.999	0.839	0.405	0.395	0.820	0.458
Item no.5									
β	-0.109	0.102	0.019	0.044	-0.098	0.071	0.028	-0.019	-0.033
t	-2.160	0.966	0.379	0.873	-0.920	1.377	0.511	-0.378	-0.650
p-value	0.031*	0.334	0.705	0.383	0.358	0.169	0.610	0.706	0.516
Item no.6									
β	-0.120	0.068	0.062	-0.093	-0.174	0.069	0.100	0.044	-0.036
t	-2.421	0.655	1.235	-1.889	-1.659	1.376	1.873	0.891	-0.707
p-value	0.016*	0.513	0.218	0.060	0.098	0.170	0.062	0.373	0.480
Item no.7									
β	-0.055	0.003	-0.003	0.061	0.019	0.098	0.036	-0.046	0.016
t	-1.082	0.027	-0.063	1.211	0.176	1.909	0.657	-0.928	0.317
p-value	0.280	0.978	0.949	0.227	0.860	0.057	0.512	0.354	0.751
Item no.8									
β	-0.074	0.135	0.042	0.000	-0.140	0.065	0.033	-0.034	0.054
t	-1.472	1.282	0.818	0.009	-1.316	1.273	0.601	-0.679	1.055
p-value	0.142	0.201	0.414	0.993	0.189	0.204	0.548	0.498	0.292
Item no.9									
β	-0.063	0.079	0.030	-0.047	-0.090	0.022	0.032	-0.012	-0.010
t	-1.238	0.744	0.590	-0.944	-0.826	0.416	0.576	-0.260	-0.163
p-value	0.216	0.457	0.555	0.346	0.409	0.678	0.565	0.837	0.870
Item no.10									
β	-0.034	-0.028	-0.025	0.027	0.052	0.016	0.034	-0.099	-0.025
t	-0.666	-0.266	-0.482	0.546	0.482	0.315	0.625	-1.636	-0.424
p-value	0.506	0.790	0.630	0.585	0.630	0.753	0.532	0.103	0.672
Item no.11									
β	-0.016	-0.085	0.023	-0.043	0.036	0.056	0.043	-0.045	-0.012
t	-0.319	-0.795	0.448	-0.862	0.335	1.064	0.782	-0.740	-0.203
p-value	0.750	0.427	0.654	0.389	0.738	0.288	0.435	0.460	0.839
Item no.12									
β	-0.101	-0.146	0.029	0.005	0.010	0.051	-0.079	0.059	0.038
t	-1.994	-1.383	0.569	0.109	0.094	0.988	-1.454	0.980	0.663
p-value	0.047*	0.168	0.570	0.914	0.925	0.324	0.147	0.328	0.508

*$p<0.05$ is statistical significant.

Table 4. How varied significant associations in fatigue conditions according to sampling characteristics.

Sampling characteristics/Items			
Item no.1	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	59(14)	190(47)	61(15)
Male	37(9)	50(12)	9(2)
BMI			
Underweight	1(1)	12(3)	0(0)
Normal Weight	59(14)	132(32)	34(8)
Overweight	19(5)	61(15)	16(4)
Obese	17(4)	35(9)	20(5)
Item no.2	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	127(31)	126(31)	57(14)
Male	55(13)	28(7)	13(3)
Job role			
Registered Nurse	166(41)	141(35)	55(13)
Coordinator	11(3)	8(2)	9(2)
Manager	5(1)	5(1)	6(2)
Shift			
Daily	69(17)	63(15)	38(9)
Night	113(28)	91(22)	32(8)
Item no.3	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	171(42)	122(30)	17(4)
Male	64(16)	29(7)	3(1)
Age			
21-30 years	72(18)	43(11)	0(0)
31-40 years	51(13)	40(10)	4(1)
41-50 years	54(13)	41(10)	9(2)
51-60 years	52(13)	26(6)	6(2)
Over 61 years	6(1)	1(1)	1(1)
Item no.5	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	178(44)	116(29)	16(4)
Male	67(16)	25(6)	4(1)
Item no.6	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	121(30)	87(21)	102(25)
Male	44(11)	31(8)	21(5)
Item no.12	**Never n(%)**	**Often n(%)**	**Always n(%)**
Gender			
Female	61(15)	165(41)	84(21)
Male	27(7)	49(12)	20(5)

(47%). The data were in agreement with the literature, in the study Alshammari et al. (24), nurses registered a higher fatigue index than their male peers, as in the study Zhang et al. (25), in which 70% of female nurses reported sleep disturbances, and more than half take stimulants such as caffeine during the work shift, as well as in the study Jarrad et al. (26) in which 69% of nurses assumed more coffee. The consumption of stimulating substances, such as coffee, was also highlighted in our study in which 30% of women assumed them. It has been demonstrated that coffee consumption acted on adenosine A(2A) receptors (A(2A)Rs) in the brain, promoting wakefulness (27), reducing melatonin secretion (28,29), the main hormone that regulated sleep, and interfered with the normal concentration of the stress hormone cortisol (30), leading to a prolonged activation of stress with failure to recover after a working day, decreased quality of sleep and daily tiredness (31,32), daytime sleepiness, insomnia. Sleep latency was also longer in patients with insomnia after rest, with a further increase following physical activity. In fact, within the study, a significant percentage of women (p=0.047; 41%) reported the need to sleep during the day (Table 3 and Table 4) and to make an effort to express themselves clearly (44%). OSA patients presented with daytime sleepiness and severe mental fatigue (33). Sleep deprivation had a number of effects on cognitive functions, leading to cognitive and psychomotor slowing of commands, impairment of working memory as well as response to solutions and errors (34). In a recent review of 22 studies published between 2000 and 2020 it emerged that fatigue in nurses lead to problems regarding safety and health with a negative effect on the attitude of nurses towards work, performance of tasks, in the quality of care and in the relationship with the patient (35). As also highlighted by an Israeli study in which a reduced cognitive performance was found on a population of nurses during the middle of the night shift and its increased at the end of the shift, given by an increasing in drowsiness, prolonged waking time and advanced age (36). In our study, however, 42% felt they were never slow in their reactions, as most of them were also young nurses (p=0.023). 31% of the sample was often decentralized in their work duties. There was a correlation between fatigue and clarity of role in the

workplace, the greater the clarity of one's role the less confusion and duplication of effort will be (24). Fatigue was present despite the majority of participants being of normal weight (32%). In fact, although patients with OSA present with fatigue as a symptom, a South Korean study showed that the severity of fatigue is associated with the severity of insomnia, increased daytime sleepiness (37).

Conclusion

The fatigue associated with OSAs will have a strong impact on the quality of life of nursing professionals, compromising their functional abilities, social relationships and their work and family roles. The present research had several limitations: sample size, lack of actual disease diagnosis for most subjects, lack of disease follow-up and long-term effect investigations for subjects reporting OSA. Finally, the possible reluctance of respondents to faithfully declared their state of health as nurses. Furthermore, our survey group did not fully represent the general population. There were numerous risk factors associated with a high risk of having OSA in a nursing population. Given the high percentage of people still underdiagnosed for OSA and the lack of knowledge of this disease, the paucity of studies in the literature, our study helps to highlight important results by associating fatigue and the onset of OSA. The results of our study could only represent the tip of the iceberg among a population of nurses, increasingly essential to the Italian national health service and increasingly in need of care.

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Ethic Committee: The Ethical Committee of the General Hospital of Policlinic of Bari, Italy, expressed the opinion of "not within its competence", for the study focused on nurses and not directly referring to patients. Therefore, it suggested that it was necessary to guarantee compliance with European regulations on privacy.

Conflict of Interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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