

# Assessment of the Chronotypes of Nurses Working in Shifts and the Quality of Their Lives

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## ABSTRACT

**Objective:** This research was conducted to identify the relationship between the chronotypes of nurses working in shifts and the quality of their lives.

**Methods:** The research sample that was designed as a descriptive study comprised 267 nurses working in shifts. The research data were collected with the descriptive survey form, the Morningness–Eveningness Questionnaire, and the Short-Form Health Survey (SF-36).

**Results:** As per the breakdown of the nurses by chronotype, 68.9% of the nurses were intermediate-type (n=184), 15.7% of the nurses were morning-type (n=42), and 15.4% of the nurses were evening-type (n=41). The evening-type nurses had a higher number of night shifts than the morning-type nurses (p<0.05). It was found that the evening-type nurses had a lower quality of life than the morning-type and intermediate-type nurses (p<0.05).

**Conclusion:** In conclusion, it was ascertained that the evening-type nurses working in shifts had a lower quality of life. Nurses' shifts can be organized by taking into consideration their chronotypes.

**Keywords:** Circadian Rhythm, Naps During Night Shifts, Shift Nurse, Night Work, Shift Worker

## 1. INTRODUCTION

Due to the 24-hour services offered uninterruptedly in healthcare facilities, the health staff working in this sector are obliged to work in shifts. Particularly the nurses work alternately in different shift hours. The person's circadian rhythm is affected as a consequence of being assigned to duties performed in shifts that alternate day and night and last long hours, and the degree of this effect can change as per personal characteristics (1–3). The circadian rhythm disorders affect the individuals physically and socially (4,5).

The circadian rhythm refers to the physiological and biological changes occurring in the organism in 24 hours. The circadian rhythm is the main determinant of the sleep-wake cycle in individuals. The chronotype refers to the individual differences in the circadian rhythm. The individuals can be categorized into three different circadian types, namely, morning-type, intermediate-type, and evening-type. The morning-type individuals wake up and go to sleep early and perform better in the early hours of the morning. The evening-type individuals go to sleep late and have difficulty in waking up early and, in general, they perform better physically and mentally in the afternoon (2,4,6). In terms of the sleep-wake patterns and performance, the intermediate-type individuals have traits somewhere in the middle (6).

The employment of an evening-type individual on the morning shift or the employment of a morning-type individual on the night shift gives rise to circadian misalignment (7). In connection with working in shifts, patterns of sleep duration and timing change, and this, in turn, brings about misalignment in social life and work duration. Defined as social jetlag, this situation can lead to the development of chronic health problems and a decrease in the quality of life (8–10).

The quality of life is a multifaceted concept and serves as a crucial factor to understand the individual's well-being that includes the physical, mental, and social aspects of life. Moreover, examining the associated factors is of importance as it accounts for the physical, psychological, and social support needed by human beings while performing daily life activities as per how they perceive their health (11). Particularly, the individuals that are affected by the changes in their work hours and have work patterns misaligned with their circadian rhythms have difficulty sustaining their lives normally and become more physically and psychosocially sensitive groups (5,8,12).

Numerous studies performed up to the present with the participation of nurses analyzed the explicit effect of chronotype

on the sleep pattern, the quality of life (12–14), the physical activities (14), the mood (15), and the shift work disorder.

In the relevant literature, there are studies indicating that working in shifts affected the quality of nurses' lives. However, it was discerned that these studies did not adequately address the effect of nurses' chronotypes on the quality of their lives (16,17). Identifying the factors affecting the nurses working in shifts and their modifiable characteristics is important to improving the quality of their lives and hence, enhancing labour productivity. This research was conducted to find out the relationship between the chronotypes of nurses working in shifts and the quality of their lives.

## 2. METHOD

### 2.1. Study design and procedures

This is a descriptive study. The research was conducted on 430 nurses who worked at a training and research hospital in Istanbul province of Turkey in October-December 2020. The sample size was found to be  $[Ntpq/d2(N-1) + t2pq]$  203 with a probability of 50%, 95% confidence interval and 0.05 deviation using the sampling method with a known population. Nurses worked in two shifts, one from 08:00 to 16:00 and the other from 16:00 to 08:00, at the hospital where the research data were collected. However, as 82 nurses who did not work in shifts were not included in the research sample, the research proceeded with 348 nurses. Besides, 22 nurses who did not volunteer to participate in the research, 46 nurses who were on a leave of absence for a variety of reasons (childbirth, sickness, and annual leave), and 13 nurses who submitted forms with missing data were also excluded from the sample. Thus, the analysis was based on data collected from 267 nurses (76.7% of the sample). After the nurses consented to participate in the research upon being informed about the study, the forms were delivered to the nurses, and on the next day, the nurses submitted the forms back.

### 2.2. Measures

In the collection of research data, the descriptive survey form, the Morningness–Eveningness Questionnaire (MEQ), and the Short-Form Health Survey (SF-36) were used.

Designed to gather sociodemographic data, the descriptive form had questions addressing nurse's age, gender, marital status, the service unit where the nurse worked, duration of work, number of night shifts per month (for the last month), state of sleeping before and during the shift, and effects of shift work on the nurse (12–16).

The MEQ is utilized for self-evaluation to identify the morning-type individuals and evening-type individuals as per each individual's circadian rhythm. It examines the individuals' physical and psychological performance within 24 hours and identifies the period when the performance is at its peak. Designed as a four-point Likert-type scale, the MEQ has 19 questions. The minimum and maximum scores to be obtained from the MEQ are successively 16 and 86 points, and the individuals are categorized as evening-types (16-41

points), intermediate-types (42-58 points), and morning-types (59-86 points) based on their scores. As per the reliability and validity study performed in Turkish, Cronbach's Alpha coefficient was found as 0.81 for the MEQ (18). In this study, Cronbach's Alpha coefficient was 0.68.

Designed as a Likert-type scale, the SF-36 evaluates two main components, namely, physical component summary and mental component summary, and comprises 36 questions. The two aforementioned main components have a total of eight sub-scales. The scores to be obtained from the main components and the sub-scales range between 0-100. A high score obtained from the SF-36 refers to high health-related quality of life. As per the reliability and validity study performed in Turkish, Cronbach's Alpha coefficient was found for the physical and mental components summary as 0.87 and 0.89, respectively (19). In this study, the physical component summary of Cronbach's Alpha coefficient was 0.70, and the component summary of Cronbach's Alpha coefficient was 0.73.

### 2.3. Ethical Aspect of the Research

For the research conducted in conformity with the principles of the Helsinki Declaration, the ethical endorsement was obtained from the ethics committee (Endorsement date: 08/10/2020, No: 46418926-050.01.0434981). After the nurses consented in written format to participate in the study upon being verbally informed about the research, the forms were delivered to them to collect the research data.

### 2.4. Statistical analysis

The research data were analyzed with SPSS 25.0 (IBM, Armonk, NY, USA). The measures of Skewness and Kurtosis were utilized to test whether the scores obtained from the measures were normally distributed, and in this regard, the acceptable range was set as (-1, +1). Descriptive statistics, chi-square test, one-way analysis of variance (ANOVA) and Tukey HSD test were used in the statistical analysis. The chi-square test was used to analyze categorical variables, one-way ANOVA was used to compare more than two independent groups and the Tukey HSD test was used to find between-group significance. The statistical significance was identified if the p-value was below 0.05.

## 3. RESULTS

The mean age of the nurses was  $30.08 \pm 6.34$  years. Of the nurses, 85.4% were female, and 62.9% were single. Upon the review of the nurses' education levels, it is discerned that 71.2% held bachelor's degrees, 15% held master's degrees, 9% held associate degrees, and 4.9% were high school graduates (Table 1). Of the nurses, 18% had chronic diseases, 12% regularly used medications, and 23.6% smoked. Of the nurses, 63.3% told that they slept before the night shift, only 14.6% reported that they could nap during the night shift, and 19.9% said that they were late to work once or more for the last month due to falling asleep.

**Table 1.** Demographic variables of nurses

Demographic variables	N	%
Age (year)*	30.08±6.34 (21-49)	
<b>Gender</b>		
Female	228	85.4
Male	39	14.6
<b>Marital status</b>		
Married	99	37.1
Single (or divorced)	168	62.9
<b>Education</b>		
College	13	4.9
Vocational school	24	9.0
Undergraduate	190	71.2
Postgraduate/PhD	40	15.0
<b>Chronic diseases</b>		
Yes	48	18.0
No	219	82.0
<b>Smoking</b>		
Yes	63	23.6
No	204	76.4

\*(Mean ± standard deviation; min-max)

Of the nurses, 68.9% were intermediate-type (n=184), 15.7% were morning-type (n=42), and 15.4% were evening-type (n=41). It was found that the morning-type nurses had a higher mean age than intermediate-type and evening-type nurses ( $p<0.05$ ). It was ascertained that there was a statistically significant relationship between marital status and nurses' chronotypes ( $p<0.05$ ) (Table 2).

**Table 2.** Relationship between socio-demographic characteristics and chronotypes

Demographic variables	Chronotype			Statistic	p
	M-types n (%)	I-types n (%)	E-types n (%)		
Age (year)*	32.79±7.07 <sup>a</sup>	29.98±6.22 <sup>b</sup>	27.73±5.10 <sup>c</sup>	F:6.950	<b>0.001*</b>
<b>Gender</b>					
Female	36 (15.8)	162 (71.1)	30 (13.2)	$\chi^2$ :5.950	0.051
Male	6 (15.4)	22 (56.4)	11 (28.2)		
<b>Marital status</b>					
Married	23 (23.2)	61 (61.6)	15 (15.2)	$\chi^2$ :6.849	<b>0.033</b>
Single (or divorced)	19 (11.3)	123 (73.2)	26 (15.5)		
<b>Education</b>					
College	1 (7.7)	7 (53.8)	5 (38.5)	$\chi^2$ :9.666	0.139
Vocational school	3 (12.5)	19 (79.2)	2 (8.3)		
Undergraduate	28 (14.7)	134 (70.5)	28 (14.7)		
Postgraduate/PhD	10 (25.0)	24 (60.0)	6 (15.0)		
<b>Chronic diseases</b>					
Yes	6 (12.5)	33 (68.8)	9 (18.8)	$\chi^2$ :0.827	0.661
No	36 (16.4)	151 (68.9)	32 (14.6)		

\* Significance between a – b; a – c (Tukey HSD test)  
F: One-way ANOVA;  $\chi^2$ : Chi-squared test

It was discerned that the morning-type nurses had a higher mean of total work duration in years than evening-type and intermediate-type nurses, and this difference was statistically significant ( $p<0.05$ ). Besides, there was a statistically significant difference in the number of evening-type and morning-type nurses' monthly night shifts, and the evening-type nurses had a larger number of night shifts per month than morning-type nurses ( $p<0.05$ ). Furthermore, there was a statistically significant relationship between the state of sleeping during the day before the night shift and nurses' chronotypes ( $p<0.05$ ) (Table 3).

**Table 3.** The relationship between nurses' weekly working hours, number of night shifts, sleeping before and during night shifts and chronotype

	Chronotype			Statistic	p
	M-types Mean±SD	I-types Mean±SD	E-types Mean±SD		
Experience as a nurse (years)	10.79±7.68 <sup>a</sup>	7.77±6.89 <sup>b</sup>	5.41±5.09 <sup>c</sup>	F:6.598	<b>0.002*</b>
Working hours per week	45.07±5.00	45.65±5.27	45.24±5.50 <sup>c</sup>	F:0.264	0768
Night shifts per month (days)	5.95±3.07 <sup>a</sup>	6.84±2.90 <sup>b</sup>	7.59±3.04 <sup>c</sup>	F:3.185	<b>0.043**</b>
	n (%)	n (%)	n (%)		
<b>Department</b>					
Services	27 (20.6)	87 (66.4)	17 (13.0)	$\chi^2$ :5.075	0.079
Intensive care unit	15 (11.0)	97 (71.3)	24 (17.6)		
<b>Sleep before night shift</b>					
Yes	22 (13.0)	114 (67.5)	33 (19.5)	$\chi^2$ :7.512	0.023
No	20 (20.4)	70 (71.4)	8 (8.2)		
<b>Nap during night shift</b>					
Yes	6 (13.3)	35 (77.8)	4 (8.9)	$\chi^2$ :2.289	0.318
No	36 (16.2)	149 (67.1)	37 (16.7)		
<b>Being late to work due to falling asleep</b>					
Yes	9 (17.0)	37 (69.8)	7 (13.2)	$\chi^2$ :0.272	0.873
No	33 (15.4)	147 (68.7)	34 (15.9)		

\* Significance between a – b (Tukey HSD test)  
\*\* Significance between a – c (Tukey HSD test)  
F: One-way ANOVA;  $\chi^2$ : Chi-squared test

It was identified that the evening-type nurses obtained lower means of scores from the SF-36 mental component and SF-36 social functioning sub-scale than the morning-type

nurses; also, they obtained lower means of scores from the SF-36 physical main component, physical functioning, physical role functioning, and vitality sub-scales than both morning-type and intermediate-type nurses, all these differences were statistically significant (Table 4).

**Table 4.** Comparison of nurses' chronotypes and quality of life

	Chronotype			Statistics	p
	M-types Mean±SD	I-types Mean±SD	E-types Mean±SD		
<b>Physical component</b>	67.51±13.10 <sup>a</sup>	62.41±14.37 <sup>b</sup>	55.39±18.22 <sup>c</sup>	F:7.029	<b>0.001*</b>
<b>Mental component</b>	64.53±16.29 <sup>a</sup>	58.44±14.41 <sup>b</sup>	55.63±18.15 <sup>c</sup>	F:3.848	<b>0.023**</b>
Physical functioning	85.48±19.34 <sup>a</sup>	80.97±19.90 <sup>b</sup>	66.46±20.25 <sup>c</sup>	F:0.654	<b>0.000*</b>
Physical role functioning	83.33±27.35 <sup>a</sup>	74.32±35.11 <sup>b</sup>	57.92±30.84 <sup>c</sup>	F:1.925	<b>0.001*</b>
Bodily pain	55.05±24.92	53.60±20.76	54.02±28.39	F:0.071	0.931
Vitality	55.47±17.90 <sup>a</sup>	48.17±16.76 <sup>b</sup>	40.12±24.17 <sup>c</sup>	F:0.918	<b>0.001*</b>
General health perception	58.21±18.17	55.00±16.77	58.41±20.80	F:1.008	0.366
Social functioning	64.88±22.29 <sup>a</sup>	57.47±20.29 <sup>b</sup>	49.69±23.46 <sup>c</sup>	F:1.769	<b>0.005**</b>
Emotional role functioning	83.33±31.45	75.72±33.82	74.79±33.14	F:0.975	0.379
Mental health	60.76±18.89	55.82±15.11	55.12±18.55	F:1.737	0.178

\* Significance between a – c; b – c (Tukey HSD test)

\*\* Significance between a – c (Tukey HSD test)

F: One-way ANOVA

#### 4. DISCUSSION

In general, nurses working in shifts are awake and work actively in the period when they are supposed to sleep as per their circadian rhythms (1,2). This study was performed to identify the relationship between the chronotypes of nurses working in shifts and the quality of their lives.

It is set forth that age was a significant factor associated with chronotype and had effects on the chronotype categorization and the wake-up time (20). As adults age increases, they become more inclined to be the morning-type (21–23). Likewise, as per the results of this current study, it was found that the morning-type nurses had a higher mean age than evening-type and intermediate-type nurses.

In the current study, it was ascertained that there was a statistically significant relationship between marital status and chronotype. Moreover, it was discerned that a larger percentage of married and a smaller percentage of single nurses were morning-type. In a study performed in a different culture, no statistically significant difference was identified in nurses' chronotypes as per marital status. In this respect, it is considered that the relationship found between marital status and chronotype in this current study may have been linked with married nurses' family roles and responsibilities

and the fact that the married nurses had a more regular life (8).

Upon the review of the relationship between work duration in years and the chronotype in the current study, it was identified that the participants who worked for long years as nurses were morning-type. It was put forward that the senior nurses could tolerate the morning shift better than the junior nurses, and senior nurses' sleep patterns were affected less by the morning shift (24,25). Alongside this result, it is predicted that, as the inclination to be morning-type moves in tandem with age, these nurses tend to be morning-type (26,27).

In the current research, it was found that the evening-type nurses had a higher mean number of night shifts. Likewise, the study by Vedaa et al. demonstrated that the evening-type nurses had more night shifts for the last two years (28). The morning-types prefer waking up early and being awake during the early hours of the day. While the evening-types prefer going to sleep late, they have a better work performance in the afternoon and evening (13). Therefore, it can be said that the evening-types were less well-aligned with morning shifts and better aligned with night shifts (15,29).

As the nurses are supposed to stay awake for a long time during the night shift, they try to compensate for this period of sleeplessness by sleeping during the day. While the morning-types prefer going to bed early to have enough sleep before the morning shift, the intermediate-types and evening-types have difficulty in going to sleep before morning shifts as they are more inclined to go to sleep late at night (4). In general, the evening-type individuals go to sleep late at night and wake up late in the morning (5) whereas the morning-type individuals have difficulty in going to sleep during the day (4). In the current study, it was ascertained that a higher percentage of evening-type nurses working in shifts slept during the day before the night shift. Likewise, in a study conducted on intensive care nurses, it was discerned that the morning-type nurses slept for a shorter period before the night shift than the evening-type nurses (8). It is considered that a higher percentage of evening-type nurses working in shifts slept during the day before the night shift in this current study because the duration of the night shift was long (16:00-8:00) at the hospital where the research data were collected and evening-type nurses had more night shifts.

In the current study, it was identified that there was no statistically significant relationship between napping during the night shift and the nurses' chronotypes. In a similar vein to this current study, a previous study did not find a relationship between napping at night shift and chronotype (8) whereas another study emphasized that napping at night shift would contribute to the sustainability of the circadian rhythms of nurses having rapid-rotation shift work (30). However, it can be considered that a large part of the nurses participating in this current study did not nap during the night shift due to the institutional policies and the high volume of workload.

In general, the individual's physical and mental performance varies throughout the day depending on their chronotypes. As the nurses work in shifts, they have irregular sleep and wake patterns. By sleeping before the night shift, the nurses want not to suffer from sleeplessness at night shift, and after the night shift, they want to sleep and rest. Working in shifts and the long work hours affect the nurses' daily lives and the quality of their lives together with their circadian rhythms. The current study found that the morning-type nurses obtained higher means of scores from the SF-36 and its physical and mental main components. Urban et al. ascertained that the evening-type nurses obtained a lower mean of scores from the SF-36 physical functioning sub-scale, and the morning-type nurses obtained a higher mean of scores from the SF-36 physical functioning and social functioning sub-scales (5). There are also studies indicating that working in shifts negatively affected the quality of nurses' lives. Besides, certain studies assert that the evening-type nurses were more sensitive to emotional disturbances (12), their physical activities decreased, and the nurses working in shifts that were misaligned with their chronotypes were more affected by the social jetlag (4,8). In the current study, it is considered that, as the nurses worked for long hours and in shifts that were misaligned with their chronotypes, the quality of their lives was negatively affected.

The limitations of the current study were that the study was performed only in one center, a high number of nurses were on leave of absence for various reasons, and the number of female nurses was relatively high in the research sample. Also, since the study is a survey study, the results of the research are based on the reports of the individual.

## 5. CONCLUSION

In the study, it was found that as the age and work duration in years went up, there was a higher inclination to be morning-type, and a higher percentage of evening-type nurses working in shifts slept during the day before the night shift. They had a lower quality of life.

In this context, making an assessment of individuals' chronotypes can be identified their circadian alignment with shift work, particularly the night shifts. Thus, employing nurses in appropriate shifts may contribute to their ability to maintain their quality of life at an optimal level by increasing their adaptation to shifts. Moreover, performing further studies with more participants working in shifts is recommended.

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## Author Contribution:

*Research idea: EB, SÇ*

*Design of the study: EB, SÇ*

*Acquisition of data for the study: AO, GA*

*Analysis of data for the study: EB*

*Interpretation of data for the study: EB*

*Drafting the manuscript: EB, SÇ*

*Revising it critically for important intellectual content: EB, SÇ*

*Final approval of the version to be published: EB, SÇ*

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