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Perception of Effects of Shiftwork Questionnaire (PESQ) among Ambulance Service Staff in Saudi Arabia: An Exploratory Factor Analysis

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Abstract

Objective: Despite efforts in describing the impact of shiftwork on the performance of health care workers, the perception of ambulance service staff is largely unexplored. This study attempted to develop the Perception of Effects of Shiftwork Questionnaire (PESQ) using a factor analysis approach to determine the underlying dimensions. **Methods:** A 16-item Likert scale research instrument, designed to gather information about the perceived effects of shiftwork on the respondents' health, social relationships, and career quality, was floated to 375 ambulance services personnel in Saudi Arabia during March and April 2021. **Results:** Based on factor analysis, the questionnaire has three dimensions with varying reliability, namely "perceived effects on social relationship" ($\alpha = 0.815$), perceived effects on health ($\alpha = 0.787$) and "perceived effects on career quality" ($\alpha = 0.602$). Over-all, the research instrument had an acceptable internal consistency ($\alpha = 0.829$). **Conclusion:** The three-dimension model was analyzed simultaneously using parallel analysis and confirms that the three-factor model is the most ideal for the research instrument. Further research, however, is recommended to improve the internal consistency of the items which measure the perceived effects on career quality.

Keywords

Shiftwork, Ambulance Staff, Ambulance Staff Wellbeing, Staff Performance, Factor Analysis

1. Introduction

Shiftwork is common in industries which require the availability or continuity of various services in 24 hours [1]. Conventionally, shift work involves working

outside daytime working hours or on a schedule other than the standard working week and may involve changes in working time arrangements. In most cases, shiftwork in the workplace involves changes in areas of deployment, rotation patterns and schedule [2] [3] [4] [5]. Due to an increasing demand for healthcare services, healthcare systems have required doctors, nurses and other health care professionals to engage in shiftwork to ensure continuity of medical services in clinical settings, emergency cases and rescue operations [2] [4] [6] [7].

Shiftwork is perceived to be indispensable due to globalization as it ensures continuity of essential services. The implementation of shiftwork has been common predominantly in Western countries [8]. Currently, studies which describe the effects of shiftwork to health professionals have been explored, revealing a negative effect on their over-all well-being [3] [5] [9]. During night shifts, in particular, health care workers need to be awake during a time when behavioral inactivity is expected [10]. Most studies dealt with the effects of night shift on the short-term physical and mental well-being of health care professionals and effects on social relationships. Other studies have reported an increased propensity of individuals to develop chronic conditions such as cancer, cardiovascular diseases and diabetes [2] [4] [10]-[15].

Members of ambulance services experience a unique working environment compared to other healthcare professionals in the clinical setting. Aside from dealing with unpredictable cases which require a diverse skill set to provide prehospital interventions, the cases are usually highly stressful especially during night shift, since precise management of pharmacological interventions and clinical skills need to be ensured [16]. When individuals work at night, exposure to light and physical activity causes a disturbance of circadian rhythms, leading to decreased cognitive functions, stress and anxiety [4] [6] [9] [14] [17]. In addition to shift work, ambulance service staff have to cope with other issues such as trauma, accidents, and death, which makes them susceptible to mental health problems [16].

There have been few efforts to investigate the effects of shiftwork on ambulance service staff and personnel using physiologic parameters in other countries, but the social and psychological components remain unexplored [7] [16]. Previous studies have used single-construct questionnaires to evaluate the psychological effects of shiftwork such as the Standard Shift Work Index which measures self-report impact of work on the health and well-being of individuals and General Health Questionnaire (GHQ-28) which measures general well-being [4]. [18] However, there has been no effort to capture the perceived total effects of shiftwork on the over-all wellbeing of ambulance service staff and personnel in Saudi Arabia or other Middle Eastern countries, which has robust psychometric properties. While other countries present rich information on the various effects of shift work in Western ambulance service staff, the effects of shiftwork to ambulance staff in Saudi Arabia remains unexplored, although efforts have been

done to determine the effects shiftwork on nurses in Saudi Arabian clinical settings [19].

The rules and regulations of occupational health and safety in Saudi Arabia are emerging, and the need for globalization and standardization of policies need to be addressed since there are limited literature which can support the similarities of ambulance services in Western and Middle Eastern contexts [16]. In order to capture the over-all effects of shiftwork to the ambulance service staff in Saudi Arabia, there is a need to construct a research instrument which integrates various aspects which were reported to be affected by shiftwork based on the currently available literature. Hence, this study aimed to develop a research instrument which can measure the effects of shiftwork to various dimensions of well-being among ambulance service staff in Saudi Arabia.

2. Materials and Methods

2.1. Research Instrument

The analyzed instrument is the Perception of Effects of Shiftwork Questionnaire (PESQ). The research instrument is a Likert-scale questionnaire, composed of 16 items which are designed to gather information about the perceived effects of night shift to the respondents' health, social relationships, and career quality. One item, **Q14**, determines which shift the respondents will most likely make a wrong decision.

2.2. Validity

To determine the instrument validity, the questionnaire was presented to three experts in the field of research and occupational health. The experts were asked to express their views about relevance, necessity and clarity of the questions. Inputs and feedback received from the experts were included while finalizing the questionnaire.

2.3. Inclusion, Exclusion and Withdrawal Criteria

The inclusion criteria of participants in the present study were as follows: 1) currently employed emergency medical staff, 2) male or female, 3) works in ambulance services, and 4) actively participates in shiftwork. Staff performing administrative work, drivers, volunteers and those working in part-time positions were excluded. All respondents who have withdrawn from answering the questionnaire were excluded from the analysis of data.

2.4. Process

The research instrument was completed by 375 respondents who received an online link to an electronic version of the research instrument via email and social media tools. All research participants were adults who had experience in doing night shift. Participation was voluntary and complied with the rules of informed consent.

2.5. Data Analysis

Exploratory factor analysis was conducted to determine the underlying constructs of the study. Exploratory factor analysis is a statistical method employed to increase the reliability of the scale by identifying inappropriate items that can be removed and the dimensionality of constructs by examining the existence of relationships between items and factors when the information of the dimensionality is limited [20].

To determine the correlations between the items in the identity matrix and determine the suitability of using factor analysis, Bartlett's sphericity test and Kaiser-Meyer-Olkin Test were performed. The degree of deviation from scores from the normal distribution was analyzed by examining asymmetry and kurtosis. Exploratory factor analysis was performed using principal axis factoring with Varimax rotation. This extraction method is more appropriate to determine the underlying constructs in this study. Parallel analysis was also conducted to determine the break in the Scree plot using the syntax [21]. Several random samples based on the actual data are generated, and for each random sample, the parallel analysis procedure calculates eigenvalues [22]. Cronbach's alpha values were used to estimate the reliability of the over-all instrument and of each of the considered dimensions.

3. Results

3.1. Demographic Characteristics

Table 1 shows that out of 357 respondents, more than77% were male professionals. More than half of the respondents are aged between 20 to 30 years old. Most of the respondents (56.0%) had experience ranging from 5 to 10 years and were married (61.6%). Most respondents finished a bachelor's degree or diploma degree (cumulative 82.9%).

3.2. Item Description

Table 2 summarizes the central tendency statistics and the forms of the items that compose the evaluation instrument. Based on the results, the data is platykurtic and has negative skew. Based on Shapiro-Wilk's test, the data is not normally distributed. The highest mean was observed in item **Q3** (*I have more sleeping problems when working night shift compared to when I work day shift*) while the lowest mean was observed in item **Q15** (*Working in shift gives me the opportunity to improve my performance and advance in my career*). Over-all, the standard deviations ranged from 1.25 to 1.43. In item Q14, respondents reported that they are most likely to make wrong decisions during night shift (72.30%, Figure 1).

3.3. Data Suitableness for Factor Analysis

The results for goodness of fit for exploratory factor analysis using principal axis factoring revealed that Kaiser's Measure of Sampling Adequacy value was 0.888

and Bartlett's Test of Sphericity value was 1620.916 (df = 120, $p < 0.001$), indicating that the data were suitable for factor analysis.

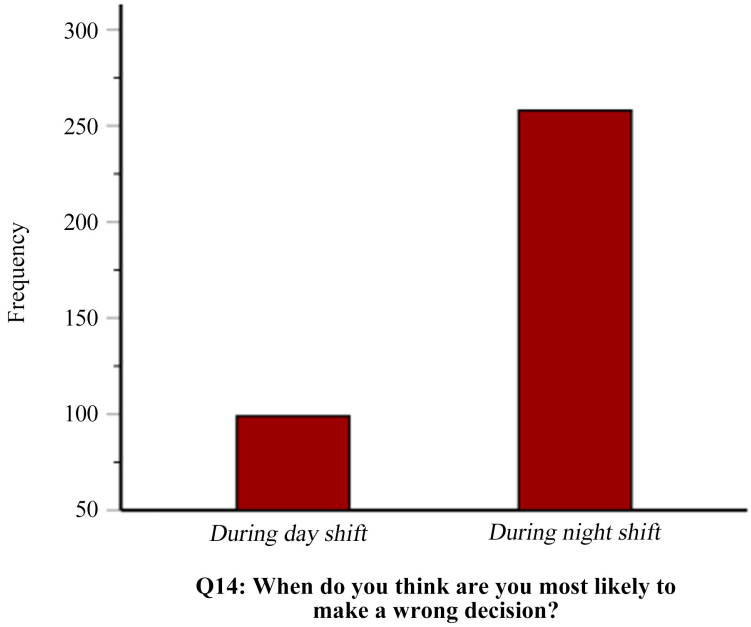

Figure 1. Perceived likelihood of committing wrong decision.

Table 1. Descriptive statistics of demographic variables (n = 357).

Demographic Factors		N	%
Gender	Male	276	77.3%
	Female	81	22.7%
Age	Younger than 20 years old	16	4.5%
	Between 20 and 30 years old	203	56.9%
	Between 31 and 40 years old	122	34.2%
	Above 41 years old	16	4.5%
Duration of Shift Work	Less than 5 years	82	23.0%
	One to five years	161	45.1%
	More than five years	114	31.9%
Marital Status	Not married	137	38.4%
	Married	220	61.6%
Work Experience	Less than one year	75	21.0%
	Between 5 and 10 years	200	56.0%
	Between 10 and 15 years	61	17.1%
	More than 20 years	21	5.9%
Educational Background	Diploma	144	40.3%
	Bachelor	152	42.6%
	Post Graduate Diploma or Master	28	7.8%
	Doctor of Philosophy	33	9.2%

Table 2. Item descriptive statistics of Perception of Effects of Shiftwork Questionnaire (PESQ).

Item Number	Statements	Mean	Standard Deviation	Skewness	Kurtosis
Q01	I experience more health issues when working during night shift.	3.85	1.25	−0.95	−0.36
Q02	I feel more stressed working during a night shift.	3.63	1.32	−0.70	−0.87
Q03	I experience sleeping problems when working during night shift.	3.98	1.30	−1.08	−0.23
Q04	I cannot control my weight because of the shift work system.	3.64	1.42	−0.73	−0.95
Q05	I have poor social relationship because of my shift work.	3.67	1.38	−0.61	−1.15
Q06	Night shift causes conflict with my family.	3.56	1.40	−0.62	−1.07
Q07	Night shift has a negative impact in the relationship with my children	3.62	1.23	−0.50	−0.87
Q08	Due to work shift, I am unable to maintain social relationships.	3.95	1.27	−1.16	0.10
Q09	While working the night shift, I do not have enough social support and services for my family.	3.85	1.38	−0.93	−0.60
Q10	A night shift work causes me to spend less time with my family.	3.87	1.33	−0.91	−0.60
Q11	Because of the night shift work, I feel that I am not fully fulfilling my responsibilities towards my family.	3.94	1.27	−1.04	−0.22
Q12	My quality of work in the night shift does not differ from my quality of work in the day shift.	3.46	1.41	−0.39	−1.36
Q13	I feel tired after midnight while working with patients at night.	3.62	1.37	−0.62	−1.05
Q15	Working during a night shift gives me opportunity to improve my performance and advance my career.	3.07	1.43	−0.04	−1.51
Q16	I feel sleepier after working during my night shift.	3.85	1.27	−1.05	−0.11

3.4. Factor Analysis Results

Principal axis factoring with Varimax rotation was utilized to determine the factor structure of the research instrument. The scree plot in Figure 1 shows that the break point was observed after the third dimension, indicating that that the research instrument has three underlying dimensions. The first factor has an eigenvalue of 5.108, while the second and third factors had 1.538 and 1.217 eigenvalues, respectively Figure 2.

Factor 1 (*perceived effects on social relationship*) explained 34.05% of the variance. On the other hand, Factor 2 (*perceived effects on health*) and Factor 3 (*perceived effects on career quality*) explained 10.256% and 8.117% of the variance, respectively. Over-all, the three factors explained 52.423% of the observed variance. Based on Cronbach alpha results, internal consistency for Factor 1 ($\alpha = 0.815$) and Factor 2 ($\alpha = 0.787$) were adequate, but the internal consistency for Factor 3 ($\alpha = 0.602$) was considered questionable. Over-all, the research instrument had an acceptable internal consistency ($\alpha = 0.829$).

3.5. Factor Loading

Table 3 shows the factor loadings for each item of the Perception of Effects of Shiftwork Questionnaire (PESQ). Using a cut point of |0.40|, seven items (**Q5, Q6, Q7, Q8, Q9, Q10, Q11**) loaded into Factor 1, another six items loaded into Factor 2 (**Q01, Q02, Q03, Q04, Q13, Q16**), while only two items loaded into

Factor 3 (**Q12, Q15**). No items loaded onto more than two factors. In Factor 1, the range of loading factors was 0.448 to 0.675, while in Factor 2, the range of factor loading was between 0.430 to 0.682. The range of factor loading in Factor 3 was 0.544 to 0.771.

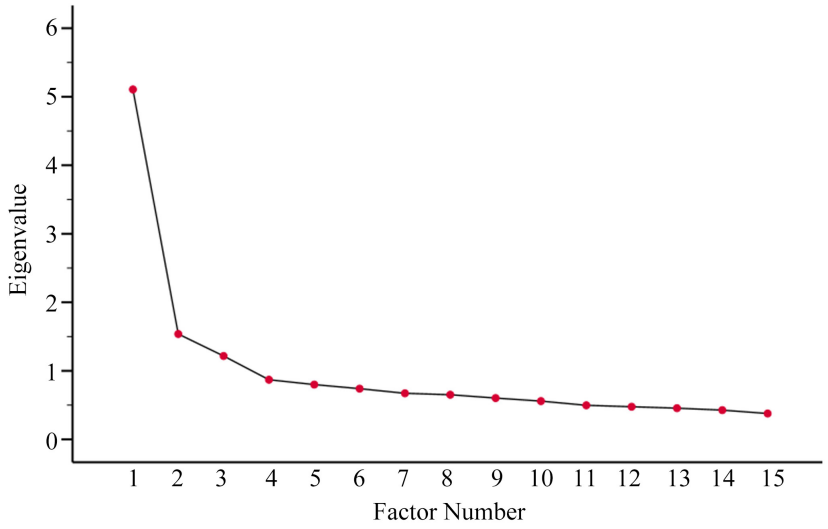

Figure 2. Scree plot showing distribution of factors by their eigenvalues.

Table 3. Factor loading of items in PESQ (Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization Rotation converged in 5 iterations).

Item	Factor		
	1	2	3
Q10	0.675		
Q08	0.666		
Q09	0.629		
Q11	0.580		
Q07	0.480		
Q05	0.466		
Q06	0.448		
Q02		0.682	
Q03		0.587	
Q01		0.585	
Q13		0.558	
Q04		0.506	
Q16		0.430	
Q15			0.771
Q12			0.544

4. Discussion

The primary objective of this study is to determine the factor structure of the PESQ in light of the perceived effects of a night shift to the ambulance services staff in Saudi Arabia. The present results reveal a three-factor solution for the research instrument, which generally presented a good fit to the data. The three-factor structure of the research instrument included the perceived effects on health, social relationship and career quality. With regards to the over-all internal consistency, PESQ has a satisfactory Cronbach alpha, but the dimension pertaining to "*perceived effects on career quality*" needs to be re-evaluated. To the author's knowledge, this is the first attempt to develop a questionnaire which addresses the perceived effects of night shift to the over-all health, social relationship and career quality among emergency medical service staff in Saudi Arabia.

An extensive body of literature has explored the effects of a night shift to sleep quality (Farias *et al.*; Khan *et al.*; Vetter *et al.*), physical health (Ferri *et al.*; Nea *et al.*), mental health and psychological well-being (Ferri *et al.*; Khan *et al.*; Suminska *et al.*), social relationship (Grzywacz; Iskra-Golec *et al.*; Tai *et al.*), work performance (Costa; Dehring *et al.*; Recio-Saucedo *et al.*), cognitive function (Suminska *et al.*), and predisposition to unhealthy lifestyle (Shan *et al.*), certain types of cancer (Szkiela *et al.*; Yuan *et al.*), diabetes, and cardiovascular diseases (Strohmaier *et al.*) [2] [4] [7] [8] [10] [12] [13] [15] [16] [17] [23] [24]. Furthermore, health professionals who worked during night shifts were reported to exhibit more mental health problems such as irritability, somatization, obsessive-compulsive disorder, interpersonal sensitivity, anxiety, altered mood, and paranoid disorders. While such issues have been assessed in clinical settings, there a dearth of literature on the assessment of the perception of ambulance medical services staff in Saudi Arabia [4].

In addition, the nature of work of ambulance service staff differs from health care professionals in clinical settings as the former deal with pre-hospital or post-hospital environments [25]. Furthermore, the cases dealt with ambulance services may be life-threatening and require an extensive use of available equipment inside the ambulance van prior to the provision of medical services in hospitals. Hence, being in a night shift providing ambulance services demand high proficiency, resourcefulness, and high cognitive function to make important decisions which ensure patient safety prior to the arrival to well-equipped hospitals.

Emergency services during night shift, however, induces high levels of physical and mental stress which may be caused by traumatic experiences or failure to address distresses during work [8]. Aside from the mental effects, shift works impairs eating patterns circadian rhythms which were often attributed as causes of work-related pathologies [9] [14] [17]. The development of a questionnaire which addresses the need for determining the perception of ambulance medical services has been fueled with this gap in literature.

The exploratory factorial validity using the factor extraction strategy used in

this study, pertaining to principal axis factoring with Varimax rotation has satisfactorily identified the three dimensions which can be measured simultaneously in the Perception of Effects of Shiftwork Questionnaire (PESQ), which is contextualized to the ambulance service staff of Saudi Arabia. It has been observed that the dimension "*perceived effects on social relationship*" has the greatest contribution to the observed variance in the study. This implies that the effects of shiftwork to social relationship such as relationship to family members, lack of time to perform social tasks and strengthen social relationships is the greatest advocacy of PESQ. This validates other studies that social relationship is a commonly affected component of a health care worker's well-being [10] [21].

The second greatest source of variance was contributed by the dimension "*perceived effects on health*". Compared to other studies, the items in the research instrument describes generic issues related to over-all health. Apparently, issues on sleeping problems, weight gain, fatigue and feelings of tiredness belong to one factor, indicating a high correlation of the identified sub-components. This supports the effect of shiftwork to previously identified components of over-all wellbeing such as sleep quality (Farias *et al.*; Khan *et al.*; Vetter *et al.*) and physical health (Ferri *et al.*; Nea *et al.*) [2] [4] [8] [16] [17]. One limitation of the items in this dimension, however, is the lack of support for describing the effects to mental health and psychological well-being as reported by Ferri *et al.*, Khan *et al.* and Suminska *et al.* [4] [7] [16].

One novel finding in this study is the inclusion of the perceived effects on quality of work (Q12) and career advancement (Q15). These two items are unique as no studies so far has explored the effects of shift work in the career trajectory of ambulance service staff. However, the third dimension (*perceived effects on career quality*) needs to be improved due to its low internal consistency. Nevertheless, this dimension contributes to the over-all internal consistency of the PESQ, which might further necessitate future investigation.

This study has several implications to the development of policies which will protect the over-all wellbeing of ambulance service staff and address the perceived effects to over-all health, social relationship and career quality among emergency medical service staff in Saudi Arabia. Other countries can also adapt the questionnaire for cross-cultural comparisons among Middle Eastern contexts.

5. Conclusion

This study contributes to the present work related to the exploration of the effects of shiftwork on the over-all wellbeing of ambulance service staff in Saudi Arabia. The research instrument developed in this study, Perception of Effects of Shiftwork Questionnaire (PESQ), has adequate reliability to measure the perception of effects of shiftwork on over-all health, social relationship, and career trajectory. Hence, the research instrument has the potential to be used to generate policies in improving the work schedule and improve the coping mechanisms of ambulance service staff in Saudi Arabia and in other Middle Eastern countries.

Ethics Approval and Consent to Participate

The research protocol was approved by the Institutional Review Board at King Abdullah Medical City, Saudi Arabia, (ethics certificate number IRB Number 21-778). Informed consent was obtained from all participants and anonymity was ensured by assigning a code for each respondent.

Availability of Data and Materials

The data used in this study are available and can be provided on a reasonable request by the corresponding author.

Authors' Contributions

All authors involved in data collection, data interpretation, and manuscript drafting and approval.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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