Work, vol. 63, no 3, pp 457-467 (2019)

Work xx (20xx) x–xx
DOI:10.3233/WOR-182934
IOS Press

DOI scopus = 10.3233/WOR-192934

Exploration of the adverse effects of shift work in a multicultural environment

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Received 1 November 2018
Accepted 28 April 2019

Abstract.
BACKGROUND: Given that shift work spreads across many different business sec-tors, studies of its adverse effects are very topical. Much research has been done on the negative impact of shift work, but many researchers have not focused on its impact in a multicultural environment.
OBJECTIVE: The aim of this study was to map out how shift work is perceived by workers in two different shift regimes and two national groups.
METHODS: The research was carried out on Czech manufacturing workers and Turkish airport ground personnel using a questionnaire. The impact of shift work was studied from physical, mental, social and health aspects with connection to family status and gender. For statistical evaluation, Pearson's chi-squared test of independence was used. The effect of shift work on workers' performance and scrap rate was analysed only on the sample of the manufacturing workers.
RESULTS: Fifty-five Czech male workers, 49 Turkish male workers and 60 Turkish female workers participated in the survey. The dependence between sexes was confirmed for mental aspects and sleeping routines. The main difference between nationalities is in work attitude, social aspects and sleeping routines. According to the family status, the difference was confirmed in all areas except social aspects. The lowest values of productivity and the highest scrap rate were observed on night shifts and the maximum productivity and lowest scrap rates were observed on afternoon shifts.
CONCLUSIONS: Some of the basic assumptions were confirmed which suggests that a multicultural environment has an influence on the perception of shift work by the nations and gende

Keywords: Working schedules, physical and psychological conditions, family status, performance, scrap rate

1. Introduction

Shift work is broadly defined as scheduled work that is completed outside the parameters of the traditional day shift e.g. from 9 a.m. to 5 p.m. [1]. Shift workers are defined as workers who change their working schedule and do not follow the biological rhythm of sleeping during the night [2]. Medical interest in the potential harmfulness of shift work started between the First and Second World Wars and is still relevant. The context of shift work in the early 21st century is changing rapidly, and in comparison with previous centuries, the involvement of personnel required to work shift work is spreading over many different business sectors. At present, approximately one in five workers around Europe and in the United States work on a shift basis [2].

Shift work and especially night work can have a negative impact on the health and well-being of workers. Current ongoing research on shift work typically reports a negative impact in these areas:

A. Physical aspects – Due to disturbance of the normal circadian cycle, shift work negatively influences sleeping routines, eating habits and

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has further consequences in fatigue, digestive problems, obesity and cardiovascular functions.

B. Mental aspects – Disturbance of normal sleeping routine also leads to many neuropsychological problems like anxiety, depression, somatization or exaggerated sensitivity.
C. Social aspects – Difficulties in maintaining usual relationships both at family and social levels, with consequent negative influences on marital relations, care of children and social contacts. This aspect can have a specific adverse effects on females due to their family roles.
D. Performance aspects – Different work performance and efficiency as well as resulting errors and accidents.

In fact, the effects of such stress conditions can vary widely among shift workers in relation to many intervening variables concerning both individual factors (e.g. age, personality traits, physiological characteristics), as well as working situations (e.g. workloads, shift schedules) and social conditions (e.g. number and age of children, housing, commuting) [3]. In the following chapters some studies which focused on specific aspects are mentioned.

1.1. Physical aspects

One of the most researched areas in the shift work literature is the impact on the physical health of the shift worker. Cardiovascular disease has been studied more comprehensively than other shift work-related disorders. Much of this research has been undertaken in Scandinavia, where a team of researchers has been examining the potential effects of shift work on the cardiovascular system of shift workers for over two decades. This extensive research programme [4, 5] has come to no definitive conclusions, and neither has the research performed by [6]. Other authors have also looked at the influence of shift work on cardiovascular disease. Researchers from Italy [7] dealt with work related stress, well-being and cardiovascular risk among flight logistics workers. 568 workers (415 fixed daytime workers, 104 12-hour workers, and 49 24-hour shift workers) participated in the study. Their results show the effects of their work schedule on cardiovascular disease risk but no effects on well-being. Other Italian researchers dealt with cardiovascular risk factors in a population of railway shift workers [8]. They calculated the cardiovascular risk with the online score of the CUORE Project for 256 shift workers. Results showed that their scores are higher than those of the Italian males reported in the CUORE project. Meal times are important synchronizers of human life. They have both physiological and social contents: therefore, they represent a crucial point of a shift worker's life. The digestive disorders which are often complained of by shift workers, are certainly exacerbated by the disturbance of normal eating habits, particularly on night shifts. Although the calorie intake remains substantially unaltered, the quality of food eaten by shift workers changes: on night shift they usually have quick meals, consisting of pre-packed food, and increase the intake of 'pep' drinks, such as coffee, wine and tea [3]. Abnormal eating behaviour was positively associated with shift work in a recent study conducted on nurses [9]. Increased body mass index was associated with night and rotating shift nurses, but not with permanent day shift nurses in another study [10]. In another study about the association between shift work and being overweight or obese in health care workers [11], this relationship has not been proven. The prevalence of overweight in this study for shift workers was 40.6% and for day workers 40.4%, the prevalence of obesity was 7.90% for shift workers and 6.10% for day workers.

1.2. Mental aspects

The mental aspects are usually connected with the low amount of sleep or sleep–wake disturbances which result in neurological problems. Such conditions in the long run may not only give rise to permanent and severe disturbances of sleep but may also be implicated in troubles of the nervous system, such as chronic fatigue, changes in behaviour patterns, persistent anxiety or depression. 10. Jamal [12] suggests that characteristics of the shift schedule (e.g. working a rotating or night shift) are associated with a higher likelihood of health problems including trouble getting to sleep and headaches. The study performed by Geiger-Brown et al. [13] explored the relationship between demanding scheduling variables and mental health indicators of depression, anxiety and somatization among 473 US female nursing assistants working in nursing homes. Working two or more double-shifts per month was associated with increased risk for all mental health indicators, and working 6-7 days per week was associated with depression and somatization. Researchers from Sweden [14] conducted a study on the relation between

split-shift work and stress, health and psychosocial work factors among bus drivers. There were found to be no significant differences between the two groups of drivers (146 split shift drivers, 83 non-split shift drivers) in terms of self-rated health, perceived stress, sleep quality, persistent fatigue, general work satisfaction or satisfaction with working hours. When comparing split shift drivers who did not regard split shifts as a problem (64%) and drivers who did, there is a significant difference in all research areas. Other authors [15] have investigated how to improve the quality of sleep for shift workers with melatonin therapy. 50 shift workers with difficulty falling asleep were selected according to the Pittsburgh Sleep Quality Index and Insomnia Severity Index. Workers were divided into two groups of 25 workers, group 1 took melatonin and group 2 took a placebo for 3 days. The results showed that melatonin therapy significantly improved the sleep onset latency and sleep efficiency.

1.3. Social aspects

Several studies have also investigated shift work in regard to social aspects. For instance, Demerouti et al. [16] investigated the impact of shift work characteristics on work-family conflicts, job attitudes, and health perceptions in a sample of military police. Not surprisingly, respondents working non-day or weekend shifts reported significantly greater work-family conflict compared to respondents working day shifts. Other research examining the impact of work schedules and preventative measures at work on work-family conflict was published by [17]. The authors found that different work schedules had a differential impact on work-family conflict.

Women shift workers may face even more stressful conditions in relation to their irregular working schedules and their additional domestic duties, especially if they are married and with children. Domestic circumstances have been primarily examined in terms of their impact on sleep for shift workers.

The addition of children to a shift working household meant more sleepiness and more domestic disruption particularly for the female shift workers [18].

Several studies examined the reactions and feelings of the partners of shift workers. In one study, 53% of participants were unhappy or very unhappy with their partners' shift work, and a third of all respondents had tried to persuade their partners to change their working hours [19].

1.4. Performance aspects

The circadian fall in psycho-physical performance at night, in association with sleep deficit and stronger feelings of fatigue, decreases the work efficiency of night workers and increases the possibility of errors and accidents. However, the studies concerning work accidents among shift workers are quite controversial: some investigations have reported more accidents on night shifts, others on day shifts, while others report accidents are less frequent, but more serious on night shifts [3].

Further field research is then necessary on this important aspect, also in relation to the recent introduction of new technologies which require more alertness and vigilance, and are therefore more vulnerable to errors than are manual work activities.

1.5. Type of industry

The current research studies can also be divided by the field of industry they are focused on. Shift work is quite common in service industries and manufacturing for economic reasons like increasing productivity and decreasing production costs. Chou and Hsieh [20] for instance focused on the impact of shift work on sleep quality and job performance in a semiconductor manufacturing company. The same type of industry with a focus on childbearing females and birth weight in different work schedules was examined in the study of [21]. A long term 10-year observational study which investigated the risk of mental health among shift and daily workers was performed by [22]. The ability to fall asleep in connection with environmental and somatic factors in the shift workers from manufacturing industry was exploited in [23]. However not much of the research from the manufacturing industry focused on work performance and the scrap rate in shift work.

Some service industries like supermarkets or transport also have activities 24/7 nearly every day of the year. Several studies like [24] focused on air traffic controllers who need to work in rapid shift rotation and are also exposed to huge working stress as they are responsible for people's lives. Not many studies focused also on the airport ground staff as [25]. The previously mentioned studies focused on flight logistics workers [7], bus drivers [14] and railway workers [8].

Several studies were performed on police officers and military police. Rajaratnam et al. [26] estimated that shift-work disorder, defined as excessive

sleepiness and insomnia, was present in 14.5% of police officers who worked night shifts. Other research which resulted in poor sleeping and resting habits by police officers was published by [27]. The previously mentioned study by [16] focused on a sample of military police.

Numerous studies have also been focused on mapping the influence of shift work in healthcare, especially on nurses where the adverse effects may have fatal consequences on patients' health. Just a few examples are [9, 17, 18, 28].

Not many researchers focused on the relative impact of multiple shift work features on outcomes in different national settings like [29, 30].

Based on the previous research studies, the following hypotheses were proposed: H1: There will be a difference in perception of shift work between the sexes. H2: There will be a difference in perception of shift work between nationalities. H3: There will be a difference in perception of shift work according to family status. H4: There will be a difference in worker performance on different shifts.

2. Methodology

2.1. Participants

There were three types of shift worker groups that were monitored and analysed for differences. There were several differences; sex, nationality, type of industry and finally shift regime. The first group consists of 55 Czech male workers from manufacturing industry. The mean age of the participants was 38 years (SD = 10.5) and the age range was 18–51 years. Because few females worked in this factory, only male participants were included. The shift system consists of three shifts; from 06:00 a.m. to 02:00 p.m., from 02:00 p.m. to 10:00 p.m. and from 10:00 p.m. to 06:00 a.m. Each worker works the morning shift from 06:00 a.m. to 02:00 p.m. for one week (five working days). After that they continue with one week of afternoon shifts from 02:00 p.m. to 10:00 p.m. and the last shift is one week on night shift from 10:00 p.m. to 06:00 a.m. The workers are off on Saturdays and Sundays. The state holidays are also days off. This shift system can be described as slowly rotating shift work.

The second and third group consists of 49 Turkish male and 60 Turkish female ground personnel from the airport service sector. The mean age of the Turkish male participants was 28 years (SD = 3.3) and the age range was 23–40 years. The mean age of the Turkish female participants was 29 years (SD = 3.4) and the age range was 24–38 years. The shift system here also consists of three shifts; from 07:00 a.m. to 03:00 p.m., from 03:00 p.m. to 11:00 p.m. and from 11:00 p.m. to 07:00 a.m. Every worker must start an 8-hour shift from 07:00 a.m. and has to work two days in this shift. After that, they continue with two days from 03:00 p.m. and finally two days from 11:00 p.m. to get two days off. This system proceeds 24/7 uninterruptedly on every day of year. This shift system can be described as rapidly rotating shift work.

All participants signed their informed consent to take part in the experiments. The study was approved by the local Ethics Committee of both universities.

2.2. Procedures

The assessment was done using a questionnaire. The survey was conducted from January till March 2017. In order not to discourage the participants, the questionnaire contained only a few questions which were based on previous research and a literature review. The questions focused on the individual perceptions of the following areas:

1. Do you mind working in a changeable shift system?
2. Does the shift work affect making time for yourself and your loved ones?
3. Does the shift work influence you physically? (eating habits, appearance)
4. Does the shift work influence you psychologically and mentally? (anger, hyper-sensitivity, delayed reactions, headaches, etc.)
5. Does the shift work influence your health? (getting sick easily, having a chronic disease, using drugs permanently)
6. Does the shift work influence your sleeping routine?

Beside these questions, information about sex, age and family status was also collected. The five point Likert scale was used for possible answers, ranging from 1 (never affects) to 5 (always affects). The questionnaires were distributed to employees at one joint meeting where the purpose of the study and the form of the questionnaire was explained. The employees were asked to fill in the survey in their leisure time in order to avoid them feeling under pressure or stress and to stop them from consulting with their workmates about the answers. The deadline for completing

the questionnaire was set at five working days. After the five day deadline all the questionnaires were collected from the personnel department for further assessment.

The rate of return in Turkey was almost 100%. The rate of return in Czech Republic was 73%. All the questionnaires were checked for errors and the questionnaires that showed confusion or misstatement with completion have been excluded.

In the case of the Czech Republic (manufacturing company) there was also the possibility of evaluating the effect of shift work on workers' performance. Data on productivity and scrap were collected for this purpose. We dropped the original intention to assess workplace accidents because we had incomplete data. The data were collected for one month, during morning, afternoon and night shifts. In total 3600 reports were received for individual products. In order to prepare the final evaluation, the reports were reduced to twenty reports representing each working day and each shift in the company, which were subsequently multiplied by a coefficient to avoid sensitive data being exploited.

2.3. Statistical evaluation

Contingency tables were constructed for statistical evaluation of hypotheses H1, H2 and H3. They are used for testing two independent discrete variables X and Y. In this paper X means gender (male, female), nationality (Czech, Turkish respondents) or family status (in a relationship, married, single) and Y means answers (five point Likert scale). The contingency table includes the frequency distribution of the variables X, Y denoted by n_{ij}, where $i = 1, \ldots I$, I means the number of values of the variable X (rows of the contingency table) and $j = 1, \ldots J$, J means the number of values of the variable Y (columns of the contingency table).

Contingency tables were used for the Pearson's chi-squared test of independence. For testing independence, it is necessary to create expected frequency $o_{ij} = \frac{n_i \cdot n_j}{n}$, where n_i means sum of values in the i line, $n_{\cdot j}$ means sum of values in the j column and n means sum of all values n_{ij}. Assumptions of the test are values of expected frequency bigger than 5. Then the test statistic is $\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{s} \frac{(n_{ij} - o_{ij})^2}{o_{ij}}$. The null hypothesis of independence is refused on the level of significance α with degrees of freedom $v = (I-1)(J-1)$ if $\chi^2 > \chi^2_{1-\alpha}(v)$ and if the p-value of the test is bigger than the level of significance. If the null hypothesis is not refused, there is no relationship between variables X and Y.

3. Results

The first evaluation was categorization according to family status. There were three groups of family status: in a relationship, married and single. The Czech males' representation was 33% in relationship, 49% married and 18% single. The Turkish males representation was 43% in relationship, 35% married and 22% single and the Turkish females representation was 39% in relationship, 28% married and 33% single. We can say that the proportions in the groups were almost equal, except for the Czech workers where the 'single' group was the smallest.

In the next step, histograms for individual questions and answers were generated. In the following pictures you can see the results (see Figs. 1–3). Before statistical analysis, we can see some major differences just by looking at the graphs. For example, the Turks (males and females) do not mind working in the shift system as much as the Czechs despite the fact that they work in rapidly rotating shift work which is more difficult to adapt to than slowly rotating shift work. Another obvious difference is between males and females, as the sleeping routine is heavily affected for Turkish females. This is probably due to different approaches to sleep by males and females and the fact that females sleep longer in general.

Because of the insufficient number of responses from different age groups, the statistical evaluation was performed only for the gender, nationality and family status variables. Four possible relations were examined: the relationship between family status and answers for each group separately; the relationship between family status and answers for all groups

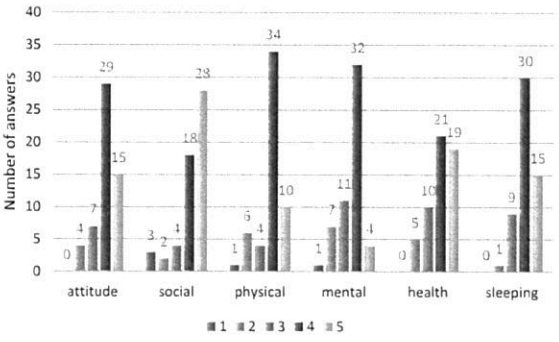

Fig. 1. Histogram of answers for Czech males.

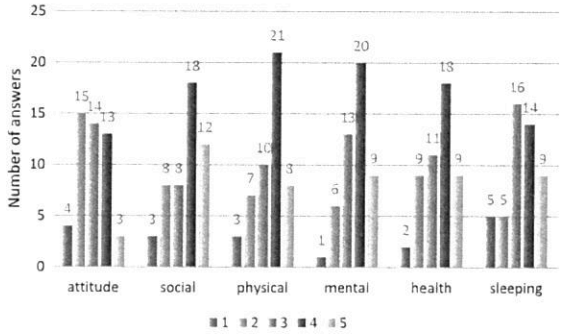

Fig. 2. Histogram of answers for Turkish males.

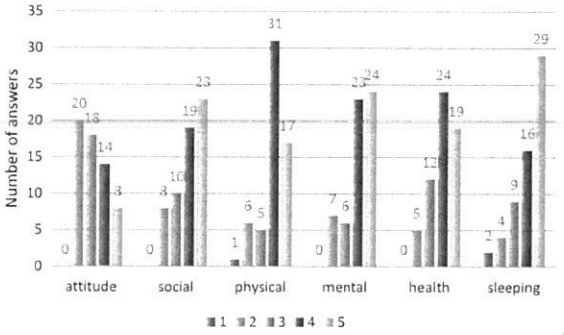

Fig. 3. Histogram of answers for Turkish females.

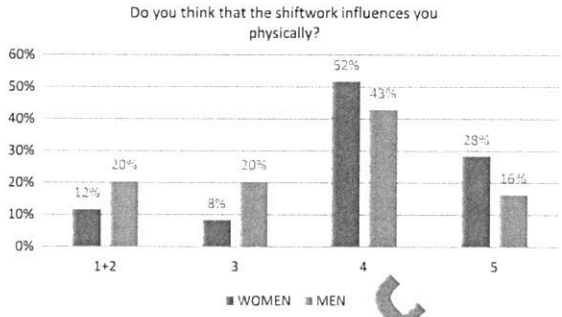

Fig. 4. Histogram of answers for gender versus physical aspects.

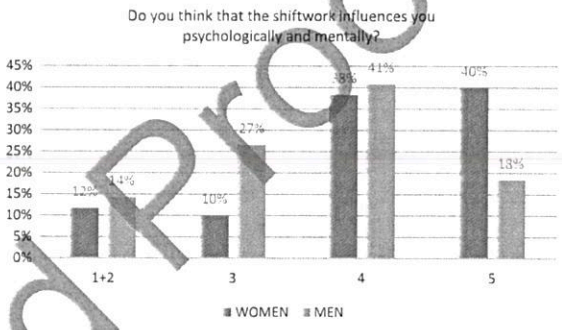

Fig. 5. Histogram of answers for gender versus mental aspects.

together regardless of nationality; the relationship between the sex of the Turkish respondents; and the relationship between the nationalities of male respondents and answers. Pearson's chi-squared test of independence was performed to confirm/reject the hypothesis about whether the two variables are independent/dependent.

3.1. Gender

In the first hypothesis, the question is whether there is a significant relationship between the sexes of the Turkish respondents and the answers. Due to the small number of answers 1 and 2 for all questions and answer 5 for the first question, these answers had to be merged. Then the contingency table for the first question has two rows (man/woman) and three columns (modified Likert scale 1+2, 3, 4+5) and contingency tables for the other question have two rows and four columns (modified Likert scale 1+2, 3, 4, 5). The chi square test of independence was executed and the null hypothesis of independence between answers and gender was tested for level of significance $\alpha = 0.05$.

The results showed that men and women from Turkey have different opinions on the sleeping and mental aspects for a selected level of significance, mainly due to the large differences on the scale 5 (p-value for question 4 is 0.035 and p-value for question 6 is 0.005). Null hypothesis was not rejected for other questions (p-values were: 0.832 for question 1; 0.376 for question 2; 0.097 for question 3; 0.129 for question 5), only for question 3 could be rejected according to level of significance $\alpha = 0.1$.

Hypothesis H1 was only partially confirmed, as the Turkish females were concerned more about the influence of shift work than males but only in the area of sleeping habits, mental and physical aspects. In the following figures (see Figs. 4–6) the results can be seen in histograms (percentage of answers by gender). Women preferred scale 5, while men preferred scale 1, 2 or 3.

3.2. Nationalities

In the second hypothesis we asked if there is a significant relationship between the nationalities of the male respondents and the answers. Due to the small number of answers 1 and 2, mostly from Czech respondents, these answers had to be merged

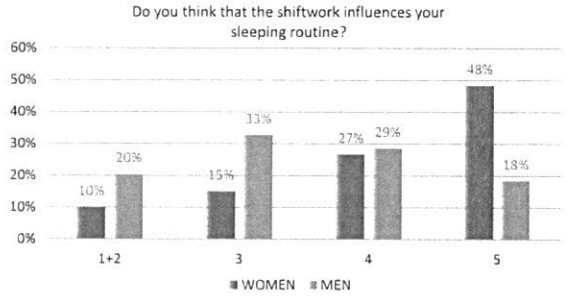

Fig. 6. Histogram of answers for gender versus sleeping routine.

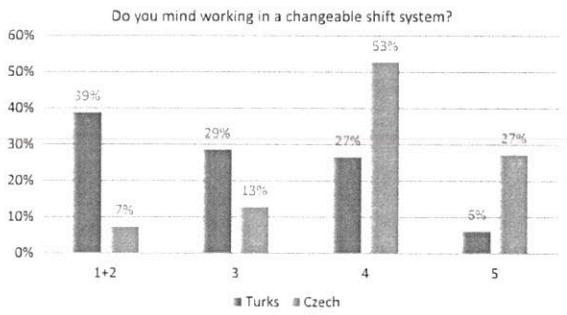

Fig. 7. Histogram of answers for nationality versus work attitude.

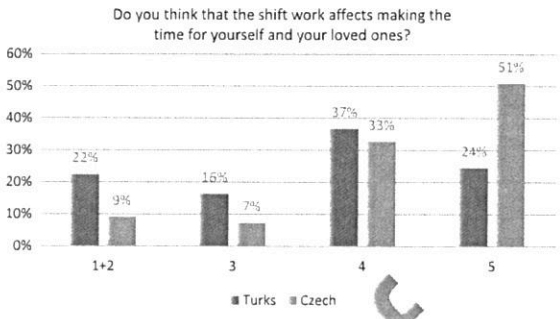

Fig. 8. Histogram of answers for nationality versus social aspects.

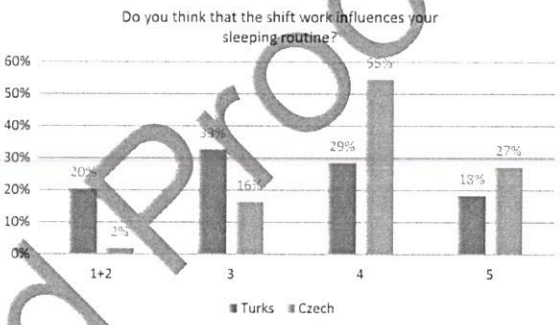

Fig. 9. Histogram of answers for nationality versus sleeping routine.

again. Then the contingency tables have two rows (Czech/Turkish respondent) and four columns (modified Likert scale 1+2, 3, 4, 5). The chi square test of independence was executed and the null hypothesis of independence between answers and nationalities was tested for level of significance $\alpha = 0.05$.

Pearson's chi-squared test showed that there is a significant relationship between nationalities of respondents and answers to questions 1, 2 and 6 (p-values were for: 1st question 0.00001, 2nd question 0.02, 6th question 0.00096). Null hypothesis was not rejected for other questions (p-values were: 3rd question 0.11, 4th question 0.22, 5th question 0.12).

Hypothesis H2 was confirmed only in the area of attitudes to working in a changeable shift system, social aspects and sleeping routine. The results can be seen in the histograms in the following figures (see Figs. 7–9) (percentage of answers by gender). It seems that Czech respondents preferred the scale 4 or 5, while Turkish respondents preferred scale 1, 2 or 3. There is no difference between Czech and Turkish respondents in the area of physical, mental and health aspects.

3.3. Family status

The last hypothesis for statistical evaluation was if there is a significant relationship between answers and family status. The first case of this relationship was for each group separately. In order to use the test, answers 1 and 2 had to be merged because of their small number. Still, the condition about an expected frequency bigger than 5 was violated in most of the columns, so we could not use the test and safely say whether there is a statistically significant dependence between these variables for lack of data (there are only five 'singles' in the Czech nationality and assumptions of the test are violated).

Based on this result, another test was performed where the dependence between family status and responses of all three groups together was examined. It was necessary to merge answers 1 and 2 again due to the small number of them. Then the contingency tables have three rows (respondents in a relationship/married/single) and four columns (modified Likert scale 1+2, 3, 4, 5). The chi square test of independence was executed and the null hypothesis of independence between answers and family status was tested for level of significance $\alpha = 0.05$.

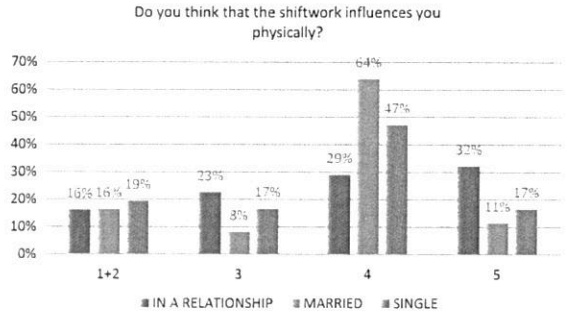

Fig. 10. Histogram of answers for family status versus physical aspects.

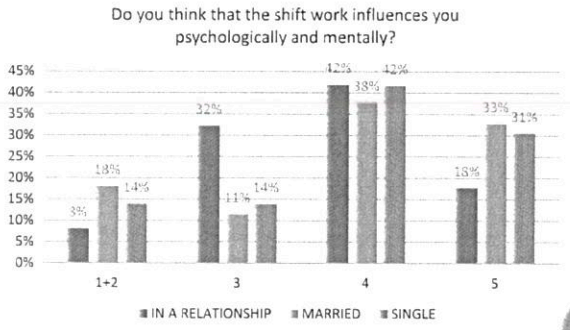

Fig. 11. Histogram of answers for family status versus mental aspects.

In this case the test confirmed that it depends on the family status and the zero hypothesis was rejected of independence on a selected level of significance for answers to the 3rd and 4th questions (p-values were 0.004 for 3rd question and 0.044 for 4th question). The results can be seen in histograms in the following figures (see Figs. 10 and 11) (percentage of answers by gender). In the case of the level of significance $\alpha = 0.1$, we rejected the zero hypothesis for all questions except the 2nd (p-values were for: 1st question 0.064, 5th question 0.099, 6th question 0.095), which means that family status and responses from all groups (Turkish men/women and Czech men) were dependent in 5/6 questions.

There is no difference between single, married and respondents in a relationship in the 2nd question about the social aspects of shift work. (p-value was 0.34). As you can see in the following figure (see Fig. 12), all categories (in a relationship, married, single) preferred the scale 4 or 5 in this question (more than 60 % respondents). Thus the H3 hypothesis was partially confirmed.

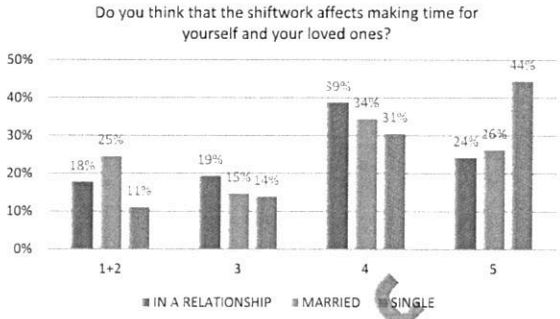

Fig. 12. Histogram of answers for family status versus social aspects.

4. Discussion

According to several authors, about 20% of all workers have to quit shift work after a very short time because of serious problems; on the other hand, only 10% of all workers do not complain about shift work during their working life, while the remaining 70% cope with shift work with different levels of intolerance [3]. There has also been some evidence presented suggesting that the impact of shift characteristics on some aspects of worker well-being may differ by nation [30]. On the other hand, evaluation of data in [29] did not provide evidence of cross-national differences in the magnitude or direction of relationships between shift characteristics and indicators of off-shift quality of life.

After careful evaluation we have been able to confirm in our study national differences regarding attitudes to shift work, social aspects and sleeping routines between Turkish and Czech males. The Turkish males were rather more open towards the acceptance of shift work. They do not mind the influence on their sleeping routines, unlike Czech males, and also stated that shift work is not interfering with their time with their family. Unfortunately we do not have enough information to justify these statements as our survey did not go into enough detail. The differences in shift schedules (rapid versus slowly rotating shifts), company culture and national customs, all these aspects might influence the results, so further research in this area is needed.

Another statistically important difference was found between men and women from Turkey. There is a difference of opinion on the sleeping routine, mental and physical aspects. Our assumption was confirmed that sleeping is more important for women than for men. Women also think that shift work affects them mentally and physically more than men.

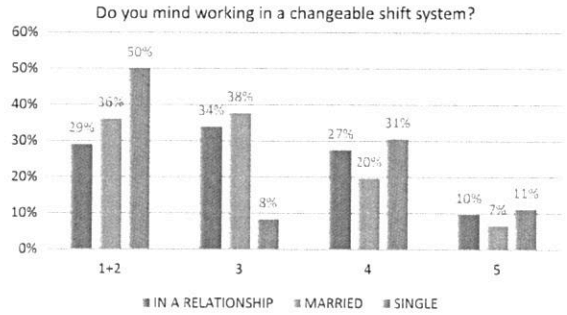

Fig. 13. Histogram of answers for family status versus work attitude.

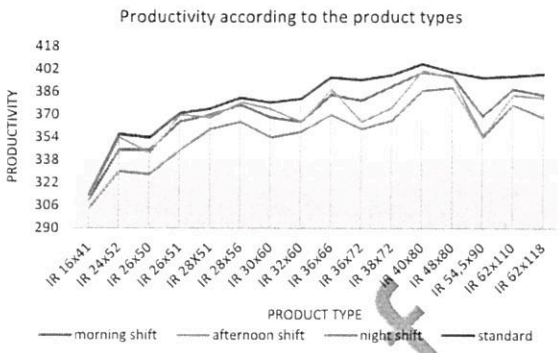

Fig. 14. Difference in productivity according to the shift type.

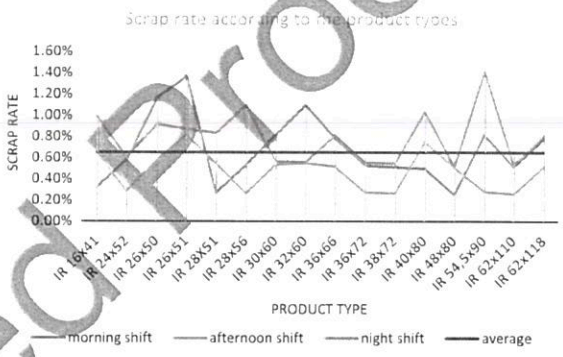

Fig. 15. Difference in scrap rate according to the shift type.

Last but not least, a statistically important difference was found between different family status groups. Differences have been proven especially in the physical and mental areas. Married respondents think that shift work influences them physically more than others think. Respondents in a relationship are not as concerned about the physical and mental aspects of shift work as married and single respondents. There is also a difference of opinion about the sleeping routine, health aspects and work attitudes, as we can see in Fig. 13. Although we expected that single respondents would be less concerned about shift work, research showed that most of them are satisfied or unsatisfied with their work, and only 8% responded neutrally. By contrast, we expected that married respondents or respondents in a relationship would cope worse with shift work because they need more time for their partners or family, but we can see that these people answered mostly neutrally, so it seems that they do not care as much about shift work as the single respondents. It may be because single people usually have a separate household and they either try to find a better job if they are unsatisfied, or they have no reason to do anything else and they are satisfied. On the contrary, married people or people in a relationship are looking after a joint household with their partner or family so they have more responsibility for the household income, and also they are not alone in running the household. So they are not really satisfied or unsatisfied with shift work, but they probably regard shift work as a usual part of life more than single people do.

As described previously, we have also been able to monitor the productivity and scrap rate in a Czech manufacturing company. The results in the following graphs (Figs. 14 and 15) show obvious differences. The data represents 20 working days. Regarding the productivity (Fig. 14), it is probably no surprise that the night shift had the lowest values, but quite surprisingly the afternoon shift reached the maximums for several products. The same results can also be seen for the scrap rate (Fig. 15). As presumed, the highest scrap rate was observed on the night shift, oscillating between average rates and values above, but surprisingly the lowest values were observed not on the morning shift but again on the afternoon shift. The above outputs confirmed the H4 hypothesis.

Several papers, such as [31, 32] have also examined the impacts of the economic crisis in 2008 on mental and physical health. The authors described that fear of the crisis influenced social relationships, which in turn affected job stress, particularly in terms of job demand. Employability might help employees to feel more secure during a crisis because people who have many alternatives in the labour market may be less affected by job insecurity than those with fewer alternatives [33]. This was probably confirmed within our study as well.

Our research was carried out in the first half of 2017, long after the economic crisis. The global market had stabilised and was growing again. According to Eurostat the rate of unemployment was 2.9% in the

Czech Republic (nearly the lowest in the last decade) and 10.9% in Turkey. The Turkish workers did not mind working in the changeable shift system at all, in contrast to the Czech workers who were more against the shift system. This could correspond also with the unemployment rate, as the Czech workers with the lower unemployment rate had more options for changing their job.

5. Conclusion

Shift work is a very topical subject and therefore we targeted our research at this area. The aim of this research was to compare the effects of different shift regimes and to find out if the nationality of respondents has an influence on the acceptance of shift work. A structured questionnaire was used to assess the impact of the shift work on attitudes to shift work, social, psychological, mental and health aspects and, last but not least, sleeping routines. Four hypotheses were stated at the beginning of the research which were confirmed or disproved in the following manner.

H1: There will be a difference in perception of the shift work between sexes; this hypothesis was confirmed only partially as differences were found between males and females only in the influence of shift work on sleeping routines and mental aspects.

H2: There will be a difference in the perception of shift work between nationalities; this hypothesis was confirmed partially only in the area of acceptance of changeable shift systems, social aspects of shift work and sleeping routines.

H3: There will be a difference in perception of shift work according to the family status; this hypothesis was nearly fully confirmed. All three family status groups (married, in a relationship, single) had an influence on the responses except the question about the social aspects of shift work.

H4: There will be a difference in worker performance on different shifts; this hypothesis was fully confirmed. Different shifts had different outputs in terms of productivity and scrap rate.

As many other authors have described in previous research, it is most important for companies to further study and design their organizational and socioeconomic conditions in such a way that the negative impact of shift work is reduced. This paper could serve as a lead for the design of those new conditions as we more or less confirmed the relations between shift work and nationality, sex and family status. However further research is required as there is still a lot of influencing parameters that haven't been examined in detail such as social status, family background or number of children in the household etc.

Acknowledgments

This paper was created with the subsidy of the project LO1502 – Development of Regional Technological Institute carried out with the support of Ministry of Education, Youth and Sports of the Czech Republic.

Conflict of interest

None to report.

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