

SHIFT WORK SCHEDULE TYPES OF NURSES IN HUNGARY AND THEIR EFFECTS ON HEALTH STATUS

Doctoral (Ph.D.) thesis

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1. INTRODUCTION

Biological rhythms maintain basic life functions and ensure body balance (such as sleep-wake rhythm) also have an important role in the adaptation of changing circumstances. The human circadian rhythm (circadian rhythm about 24 hours) is determined by the internal biological clock (in the nucleus suprachiasmatic), the Zeitgeber (external stimuli) and the internal status of the body [Csernus&Mess, 2006; Takahashi & Menaker, 1979]. The regulation of rhythms on cellular level is linked to the operation of clock genes, while the synchronization of rhythms is done by the suprachiasmatic nucleus (SCN) [Csernus, 2006; Oláh et al, 2006].

The beginning of "shifting" can be dated to the late 19th century, when due to the carbon fibre bulb by Thomas Edison (1879) at the time of the Industrial Revolution night shifts were introduced in more and more factories, thus the heated boiler heat is not wasted [Caldwell, 2003]. Today, nearly 20% of the population in developed countries work in different shifts [Ha&Park, 2005].

Due to the continuous provision of health care several health care workers and physicians have to work even at night. Biological rhythms are disturbed in shifts workers and temporary internal desynchronization develops until the body internal clock does not adjust to the changed external circumstances, which requires about a week [Sanders et al, 1999; Weibel et al, 1998; Caldwell, 2003].

Most often, sleep and mood disturbance occurs [FL-James et al, 1996; Korompeli et al, 2013; Di Milia et al, 2013, Geiger-Brown et al, 2012; Wright et al, 2013], as well the circadian rhythm disorder may lead to, the appearance of other psychosomatic disorders in short and long term [Härmä & Ilmarinen, 1999; Costa, 2010; Mendes & Martino, 2012]. Several reports have documented the formation of cardiovascular- and gastrointestinal system disorders [Härmä & Ilmarinen, 1999; Nojkov et al, 2010; Nicoletti et al, appearing in 2015], and cancer [Haus & Smolensky, 2012; Costa, 2010].

The present research is a continuation of an animal study, in which nurses work shifts are modelled. Wistar rats behaviour was examined: light-dark box test to measure the degree of anxiety, sucrose consumption test (sugar consumption test) and serum cortisol level-measurement was applied [Olah et al, 2008; Muller et al, 2010].

Due to the negative impact of night work schedules on health and patient safety, the guideline of the European Parliament and Council (2003/88/EK guideline - certain aspects of the organization of working time) specifies that EU countries must provide employees that in case of night work the number of normal working hours should not exceed an average of eight hours in any 24-hour period.

2. AIMS

1. Our research aimed to map the characteristic working shifts of nurses and their impact.
2. To analyse the quality of sleep a specific questionnaire is necessary, which can be applied in those working in shifts.
3. To analyse the quality of sleep with a gauge assessment (actigraph) is also an aim.
4. To test the mental health the assessment of coherence-sense is a target, which is a valid indicator of health.
5. To analyse the psychosomatic complaints and subjective health status of nurses.
6. The opinion of nurses about working shifts has a high emphasis, since it is important how they consider the given type of work schedule.
7. The practical aim of our research is the detection of is the least stressful type of work schedule from the different shift work schedules and to recommend the ideal working shift. I believe that by applying the best working shift the stressful nursing job can be a little easier.

3. RESEARCH

3.1. NURSING SHIFTS IN HUNGARY

3.1.1. Work shifts in the national health system

Objectives: The purpose of the study was to assess nursing work schedule types in domestic inpatient care, to analyse the causes of irregular work schedules, as well as to examine the relation between different types of work shifts and sleep problems.

Methods: During a national online survey 236 senior nurses filled out the own-edited questionnaire. SPSS 20.0 program was used for descriptive statistics

Results: The head nurses reported about the work schedules of 8697 nurses, 51.89% of them work in a flexible shift-work. Regular work schedule was reported in 22.35% most of them in the following schedule: after a 12-hour day shift to a night shift 12 hours, followed by two-days rest (Chart 1). Where there is no system of shifts the most frequent causes are nursing shortage and the needs of nurses.

| NURSING WORK SCHEDULES IN HUNGARY | | n | % |
|---|--|-------------|------------|
| full-time schedule | | 1541 | 17,72 |
| night-only / mostly night shifts | | 33 | 0,38 |
| irregular | | 666 | 7,66 |
| flexible | | 4513 | 51,89 |
| 1 D - 1 N - 1/2 R <i>after a 12-hour day shift to a 12-hour night shift, and then one or two rest days</i> | | 1385 | 15,93 |
| 2 D - 1 N - 2/3 R <i>after two 12-hour day shifts to a 12-hour night shift, and then two or three rest days</i> | | 451 | 5,19 |
| 2 D - 2 R - 2 N - 2 R <i>after two 12-hour day shifts to two rest days, and then 12-hour night shifts, and then two rest days</i> | | 75 | 0,86 |
| 1 D - 2 N - 2/3 R <i>after a 12-hour day shift to two 12-hour night shifts, and then two or three rest days</i> | | 20 | 0,23 |
| 2 D - 2 N - 3/4 R <i>after two 12-hour day shifts to two 12-hour night shifts, and then three or four rest days</i> | | 4 | 0,05 |
| 5 D (8-hour) - 2 R - 5 E (8-hour) – 2 R - 5 N (8-hour) <i>after five 8-hour day shifts to two est days, and then five 8-hour evening shifts, and then two rest days...</i> | | 9 | 0,10 |
| <i>total</i> | | 8697 | 100 |

Chart 1: Nursing work schedules in Hungary

3.1.2. Survey about the least burdensome nursing work shift

Objectives: Determination of the least burdensome (top) and the most demanding (worst) shift work schedules applied in inpatient care based on the nurses 'votes'

Methods: In October 2016 a short questionnaire was distributed with 173 head nurses at clinics, hospitals social networking sites. With the help of five questions we aimed to find the least and most stressful nursing work shifts, and 5 questions concerned on the answerers (gender, age, province and department where they work, work schedule). During statistical analysis SPSS 20.0 and Microsoft Excel programs were used for descriptive statistics (absolute and relative frequency, mean \pm SD).

Results: The average age of the respondents (n = 904) was 42.85 years (SD: 9.71 min 21; max 66), 94.8% of them were women (n = 857). 3.4% of the participants (n = 31) work in night-work (night shift only / primarily night shift), 36.2% hour basis (n = 327) in daytime shifts and 60.4% (n = 546) working in different shifts. Within the shift-work the majority (n = 359; 39.7%) work in flexible shifts, 116 in irregular (35.2%) and 111 nurses (12.3%) in regular work schedule. The questionnaires were filled in all districts of Hungary, the participated nurses working in 21 different departments.

According to 54.1% of the respondents (n = 489) the least burdensome work schedule with regard to regularity is the flexible; 406 nurses (44.9%) answered that it is the regular and only 1% (n = 9) suggested irregular shifts. In the case of shift work schedules the most famous (n = 420; 46.46%) or the least burdensome is the following: after one daytime shift (12 hours) 1 night shift (12 hours), and then one or two days of rest. The regular work schedule was chosen as second (n = 134, 14.8%), after 2 daytime shift (12 hour), two days rest, followed by two night shifts (12 hours).

3.2. EXAMINATION OF THE EFFECT OF DIFFERENT WORK SHIFTS OF NURSES

3.2.1. Examination of the effect of different work shifts of nurses with Standard Shift work Index

Objectives: In shift workers the circadian rhythm of numerous physiological processes is disturbed. Our aim was to implement a pilot study as the part of the adaptation process of Standard Shift Work Index [Barton et al, 1995], and the examination of the effects of the shift work on quality of sleep, somatic and psychological condition.

Methods: Our survey was conducted at the clinics of the University of Szeged in 2011 the participation of nurses non-randomly selected from mixed-, night- and daytime shifts (n = 211). SSI questionnaire was completed with additional private questions.

Results: Among the nurses working only in daytime shifts, less suffer from sleep disorders, than in mixed of night shifts ($p = 0.002$, $p = 0.005$), reported better health ($p = 0.001$, $p = 0.003$), and the least exhausted were also the daytime shift workers ($p = 0.011$, $p = 0.039$). Among night shift workers gastrointestinal symptoms were more frequent ($p = 0.044$, $p = 0.006$), compared to daytime shift nurses ($p = 0.004$) and to the mixed shift workers ($p = 0.003$) also suffer from more chronic diseases. The weekly amount of smoked cigarettes among smoker mixed shift workers ($p = 0.034$) and consumption of stimulating beverages containing caffeine ($p < 0.001$) were significantly increased since the beginning of the shift-work.

3.2.2. Examination of sleep quality of nurses working in different shift schedules with the application of Bergen Shift Work Sleep Questionnaire adapted into Hungarian

Objectives: This study aimed to develop the Hungarian version of Bergen Shift Work Sleep Questionnaire (BSWSQ) [Flo et al, 2012], and with the application of the questionnaire compare the sleep quality of nurses working in different-work shifts.

Methods: 326 nurses working in different shifts filled out the questionnaire. The convergent and discriminant validation of the questionnaire was made with the help of the Athens Insomnia Scale [Soldatos et al, 2000; Novak 2004] and the Perceived Stress Questionnaire [Cohen et al, 1983; in Stauder & Konkoly 2006].

Results: Compared to the translations and based on the experience of trial recordings the version was designed which was ultimately carried out the survey. The Cronbach's alpha characterising the internal reliability of questionnaire was 0.95, which is very good. Based on the correlations between responses to the questions of the questionnaire the latent structure can be examined with factor analysis (Kaiser-Meyer-Olkin measure 0.90; Bartlett's test results: $p < 0.001$). The cumulative score of AIS test used generally in the assessment of sleep quality - according to our analysis of the subsamples - the BSWSQ -H total score shows significant correlation ($p < 0.001$; $r = 0.609$), therefore showed a good convergent validity with the previous insomnia test certified in Hungarian sample.

The correlation between the total score of the BSWSQ-H and the total score of the PSS test is significant ($p < 0.001$, $r = 0.554$) compared to the AIS the correlation less strong. The temporal stability of the questionnaire were examined with convenient sampling on a smaller sample ($n = 22$; average age 39,59 years, standard deviation 10,22 years; 1 male, 21 female; 6 nurses working in daytime shift and 16 n night shift). Between the two fill 2 weeks elapsed, the Pearson correlation coefficient was 0,999 ($P < 0,001$). Based on the psychometric characteristics of the questionnaire, testing of sleep disorders associated with shift work on a Hungarian sample is adequate. The frequency of discrete symptoms deviated significantly ($p < 0.001$) between shift types. The worst sleep quality and daytime fatigue experienced after the night shift. The sleep quality of nurses in changing shift-work was worse compared to regular and flexible shift workers ($p < 0.001$).

3.2.3. Mental health, psychosomatic complaints and nutritional status of nurses working in different shifts

Objectives: Our aim was to compare the effects of different working diets on health nurse in a large number of elements nursing sample. Our investigation is focused on the frequency of the quality of sleep, sense of coherence, psychosomatic complaints, and nutritional status.

Methods: Cross-sectional, quantitative, descriptive research has been conducted in 2016 spring. A simple non-random sampling was made in the following institutions (in the possession of ethical and university leadership approval): University of Pécs Clinical Centre, Paediatric Clinic ($n = 109$), Mohács Hospital ($n = 87$), St. Lukács Hospital Dombóvár ($n = 45$), Komló Health Centre ($n = 36$), and Nagyatád Hospital ($n = 50$). In addition, in the breaks of professional trainings organized by the University of Pécs Faculty of Health Sciences

Directorate of Professional and Postgraduate Training nurses filled in our questionnaires (in Nagykanizsa, Zalaegerszeg, Veszprém, Tatabánya and Pécs) (n = 319). A total of 639 persons 471 nurses (73,7%) are currently working in different shifts, 157 people (24,6%) in daytime shift, and 11 of them (1,7%), in night shift. 96,9% of the respondents were women (n = 619), the average age was 43,1 years (SD 9,44, min 21, max 66), for 20 years on average (SD: 11,46) working as a nurse. Eligibility criteria: minimum 1 year of employment in nursing at an inpatient institution. Exclusion criteria: restless legs syndrome (RLS) and sleep apnoea during the examination of the quality of sleep.

Bergen Shift Work Sleep Questionnaire (BSWSQ-H) [Flo et al, 2012; Fusz et al, 2015]; questionnaire, the Berlin Questionnaire (Berlin Sleep Apnoea Questionnaire) [Netzer et al, 1999], the questionnaire to assess the probability of sleep apnoea; the Hungarian version of the 13-item Sense of Coherence Scale (Coherence sense Questionnaire, SOC13) [Antonovsky, 1987; Arctic & Varga, 2006] were applied; furthermore, questions about work, shift policy and health behaviour and health status were asked. The statistical analysis was performed with SPSS 20.0 and Microsoft Excel software, using the following statistical methods: descriptive statistics (absolute and relative frequency, mean \pm standard deviation), χ^2 -test, ANOVA, paired t-test, factor analysis, multiple linear regression, Mann -Whitney and Kruskal-Wallis test. The results of the statistical tests were considered significant ($p < 0.05$) with a 95% probability level.

Results: The average age of the respondents were 43, 1 years (SD: 9, 44). Most participants had high school degrees (n=467; 73, 1 %).

The answerers work for 20 years on average (SD: 11, 46) in health care, for 12, 36 years (SD: 10, 06) in the current shift. 471 nurses (73,7 %) works in different shifts, 157 of all respondents (24,6 %) in daytime shift and 11 (1,7 %) in night shift (only/mostly night). 464 people responded to the question that how many times in a month are they work at night: an average of 5,96 times (SD: 2,19; min: 1, max: 17). 250 respondents (39,1%) prefer to work at night because of the extra money, 119 (18,6%) like to work at night because of quietness, 57 prefer the night shift because there is a possibility to learn, while 31 people described themselves as "owl" cronotype, and fond of night work. A total of 148 persons (23%) have part-time job, 54 (8, 5%) is currently studying. During the survey a part-time job was presumed as an influencing factor, so that in case of the used scales this question was verified. The number of nurses with part-time jobs is similar in different groups ($p = 0,138$), and differences were not found in the work shifts with different regularities ($p = 0,619$). No significant difference was found in case of the occurrence of psychosomatic complaints in between those having part time job and those not ($t = 0,57$, $p = 0,57$); There were no differences between the two groups when analysing the quality of sleep

as well (BSWSQ; $t = 0.16$, $p = 0.87$) and the sense of coherence (SOC $p = 0.36$; $t = 0.92$). Based on these results, a part-time job workers were not excluded from the research. The average age of nurses working at chronic wards, was 45.12 years (SD: 8.56); while in case of nurse working at active wards it was 42.2 years (SD 9.76; $p = 0.03$).

9.7 % of the nurses ($n=62$) thought that they eat healthy; 33, 5 % ($n=214$) eat partly healthy. 61.6% of shift workers do not eat healthy, while in daytime workers this ratio was 41.7% ($p < 0.001$), however, the regularity of work order is not related to the quality of food ($p = 0.29$). For the purpose of rest and recreation, 175 people (27.4%) carry out activities involving regular physical activity (increase in heart rate, sweating). Most of the respondents do sports rarely ($n = 331$; 51.8%); and 123 (19.2%) admits to never perform sporting activities. In case of work order types, the following results were obtained: 35.8% ($n = 54$) of the daytime group and 25.2% of shift workers sports regularly; and there are more in the mixed shifts group who never do sports (21.6%), the difference is significant ($p = 0.013$).

The health status was classified by nurses into four categories: excellent ($n = 34$; 5.3%), good ($n = 250$; 39.1%), adequate ($n = 314$; 49.1%) and poor ($n = 39$, 6.1%). The worst health status was assessed by the night workers while daytime workers considered their health status the best ($p = 0.044$). The work order regularity also correlated with the answers, the best scores for health were given by the group of flexible work schedule, while the worst in the irregular group ($p = 0.017$). Chronic disease was reported in 48.4% of the sample ($n = 309$) mostly hypertension was mentioned ($n = 127$; 19.9%). In case of sleep apnoea and RLS diagnosis respondents were excluded from the analysis of the factors affecting sleep quality, because these diseases affect sleep, so distort the results regarding the influence of other factors. Nutritional status of respondents were determined by the body mass index: 25.96 kg / m² (SD 4.6; min 15; max 48). The BMI of night shift workers or nurses from chronic wards were higher ($p = 0.013$ and $p = 0.01$). We asked about the body weight change since the beginning of the shift work, the answers show that 233 people (49.5% from mixed shifts) gained weight. The regularity of work order is related to weight gain, most respondents weight gain in the irregular schedule group ($p=0.004$), while in case of sports and nutrition difference was not found between the groups (Figure 1).

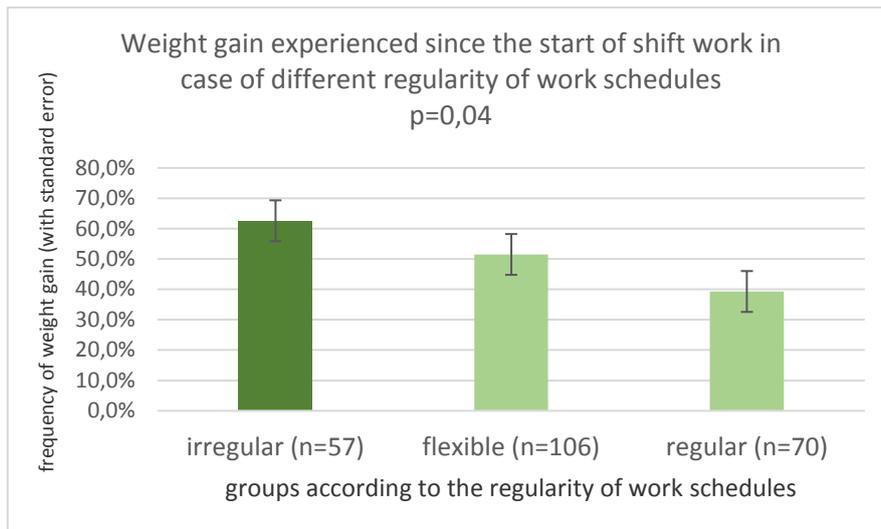


Figure 1: Weight gain experienced since the start of shift work in case of different regularity of work schedules (n=233)

We analysed the average incidence of all psychosomatic complaints in case of sociodemographic and work-related variables. Since the sleep problems also included within psychosomatic complaints, we therefore worked with a constricted database, namely the respondents with sleep apnoea and RLS were excluded (n = 80) thus a total of 559 nursing information were analysed; in which psychosomatic complaints were reported on average 23.59 occasions (min 0, max: 130). The occurrence of psychosomatic complaints were not influenced by age (p = 0.53); gender (p = 0.79); and marital status (p = 0.11). The ward type affected the incidence of complaints: workers from an active ward (n = 403) reported average 21.31 complaints, while chronic ward workers (n = 103) reported 34.70 complaints during the previous month (p <0.001). Daytime workers (n = 141) indicated less complaint (average: 19.14/month) than shift workers (n = 408; mean: 25.14 / month; p = 0.012).

The regularity of work schedules and work schedule types are not related to the frequency of psychosomatic complaints. The healthy eater group (n = 249) indicated less complaint (average: 17.88/month), as opposed to unhealthy eaters (n = 307; mean: 28.37/month; p <0.001). Regular exercise is not related (p = 0.25); however body weight change is related to psychosomatic complaints because those who lost or gained weight, observed more symptoms (p = 0.006). Psychosomatic complaints and sense of coherence correlates (r = -0.213; p <.001), those reported better sense of coherence had fewer complaints. To the question of who are the most exhausted, the answer is that workers of irregular work schedules (irregular versus flexible: p = 0.02; irregular vs. normal: p = 0.02).

According to our results there are less exhausted among those having a strong sense of coherence between also in case of the same strain (irregular work schedules), they are more resistant to load: 44.4% vs. 67.3% ($p = 0.031$).

According to the work schedule regularity significantly different was found as 77.8% of the irregular schedule workers, 62% of flexible and 64% of regular schedule workers the sleep quality was deteriorated since the beginning of the shift-work ($p = 0.013$). 39.7% ($n = 254$) of the nurses involved in the study take sleeping pills regularly, which is not related to the type of work schedule. Sleep quality measured by the Bergen Shift Work Sleep questionnaire after a daytime shift (12 hours) showed a significant difference, since the nurses working in irregular schedule sleep worse (higher dot) than employees in flexible working order ($p = 0.007$) (Figure 2).

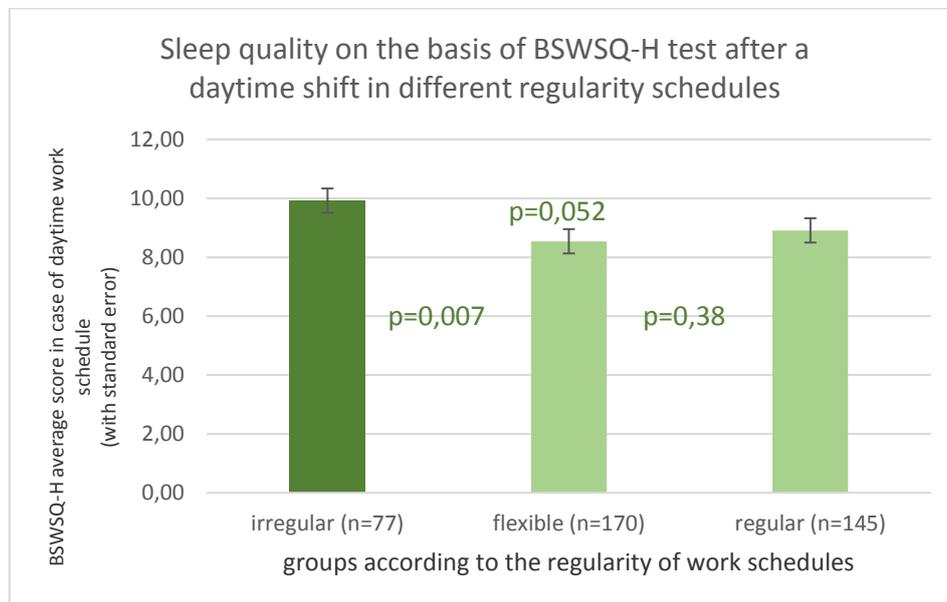


Figure 2: Sleep quality in different regularity schedules ($n=392$)

Daytime work nurses show better coherency than workers in mixed or night work order ($p < 0.001$). The coherence sense of those working in irregular order is lower (SOC13 average: 57.8) than nurses working in flexible work schedule (SOC13 average: 61.2; $p = 0.013$) (Figure 3).

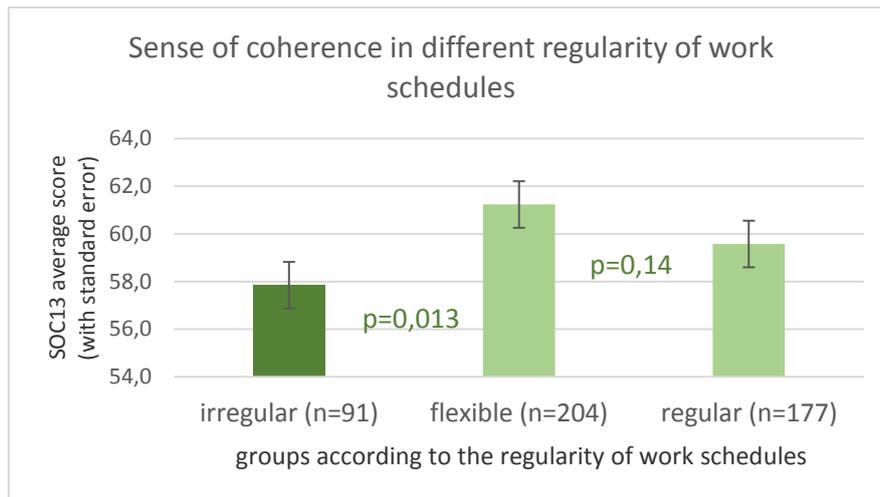


Figure 3: Sense of coherence and the regularity of work schedules (n=472)

The subjective health status compared to the used scales and BMI results. We found significant results for each case, nurses with poor subjective health status reported more psychosomatic complaints ($p < 0.001$), more sleep problems ($p < 0.001$), have lower sense of coherence ($p < 0.001$) and higher body mass index ($P < 0.001$).

3.2.4. Actigraph survey

Objectives: To test the quality of sleep for seven days in nurses wearing actigraph who fill in sleep diaries and questionnaires. Our goal was to examine the effect of regular and irregular work schedules on sleep quality by objective and subjective measurement tools.

Methods: Quantitative, longitudinal, descriptive study was conducted among nurses working at inpatient wards at the University of Pécs, Clinical Centre, Department of Paediatrics from 15 May to 15 July 2016. Exclusion criteria were diagnosed restless legs syndrome, diagnosed sleep apnoea, sleep disorders associated with diagnosed disease, consumption of pharmaceuticals, medicines due to sleep disorders and pregnancy. Altogether 55 people participated in the study for seven days, but three measurement became invalid, so that eventually 52 people were included in the study.

The average age of the participants were 40, 23 years (SD: 10, 54), 94% were women (n = 49). The quality of sleep was determined by the ActiGraph GT1M (Pensacola, FL, USA) type of activity meter supplemented with sleep diary. With the actigraph the length of the rest period, the number and time of movements during the rest period can be observed. The amount of sleep (total sleep time; TST), waking time after falling asleep (sleep onset after wake; WASO) and

the number of awakenings only can be estimated by actigraph, exact values can be determined by polysomnography (PSG). Statistical analysis was performed by using the following methods: descriptive statistics, one-sample t-test, two-tailed t-test, variance analysis, linear regression (SPSS 20.0). The significance level was set at $p < 0,05$.

Results: The daytime shift workers are resting for 6,41 hours on average, which is 5,88 hours among regular shift workers, while irregular shift workers spend 5,75 hours with rest ($F = 0,67$; $p = 0,52$). The movement activity during rest period of nurses working in daytime shifts is the average of 14,71 occasions, in regular shift workers 17,17; and in case of irregular shift workers it is 15,50 occasions ($F = 0,37$; $p = 0,7$). After the daytime shift average of 8,75 hours, whereas after the night shift an average of 4,70 hours are spend with rest ($t = -11,75$, $P < 0,001$). The length of rest periods were influenced by the frequency of psychosomatic complaints ($p = 0,013$). The number of night shifts affected psychosomatic complaints ($r = 0,26$; $B = 3,01$; $p = 0,016$).

4. DISCUSSION

4.1. Conclusions

Several studies demonstrating the harmful effects of shift work. However, few studies were found about that what types of shift work exist and which are more burdensome. Only a few literature included specific proposals for preventing and treating problems caused by shift work [Costa, 2010; Bódizs, 2000].

During our research we carried out six surveys between 2011 and 2016, which gave numerous novel information and answered our questions.

During the **mapping of domestic nursing work shifts** it became clear that due to the nursing shortage the shift schedule is a challenge. The irregularity of work schedules due to labour shortages, yet many care leader seeks regular shift system application. The most common is the flexible (elastic) work schedule, when the leader adapts to the needs of nurses, but the shifts do not follow each other in a regular order (51,89%; n = 4513). In the "popularity contest" of work schedules, the flexible received the most votes (54, 1% of; n = 489), followed by a regular work schedule. The most common and also the most popular (the least burdensome) according to 46, 46% (n = 420) of the respondents was the following: after one daytime shift (12 hours) 1 night shift (12 hours), and then one or two days of rest. The second best regular work schedule was (n = 134, 14, 8%) after 2 daytime shift (12 hours), two days rest, and two night shift (12 hours). Griffiths and colleagues examined the work schedule of nurses in twelve European countries. According to the results day shift length is most often less than 8 hours, and for night shifts the length is mostly between 8.1 to 10 hours. Only 15% of the 31 627 respondent nurses work in ≥ 12 -hour shifts. According to our results in case of 12-hour or longer shift patient safety and quality of care decrease [Griffiths et al, 2014]. The 2003/88/EK guideline draws attention that more than 8 hours night shift is unsafe.

During the review of the guideline in 2010, Hungary was highlighted, since restrictions on night shift work was not put into practice. There were several reasons, such as a nursing shortage. The migration of nurses and the lack of human resources are significant problems in our country, Bethlehem drew attention to this in his study that the number of nursing jobs between 2006 and 2010 decreased by 8% [of Bethlehem, 2012]. According to the Pharmaceutical and Healthcare Quality and Development Institute (GYEMSZI) 2011 Health Yearbook, in 2011 22 897 health workers lacked from the health system and this deficit continued to grow since then. Ujváriné found, that the more satisfied the nurse was (n = 754) with the flexible management

of the working time and schedules, the more likely to remain on the field in the following year ($p = 0.005$) [Ujváriné et al, 2011].

With the **application of Standard Shift Work Index** our research goal was to compare nurses working in morning, night and mixed shifts, thus 53 questions was not adequate for nurses working in daytime and night shifts. The 79- SSI questions were not answered by everyone or failed to answer, thus we dispense with the evaluation of 13 questions. The 23-page questionnaire is very long, filling is time-consuming, and for that reason this questionnaire was set aside in the future.

In case of chronic fatigue a significant difference was observed between the daytime, night and mixed work shifts ($p = 0.007$), daytime workers feel tired the least. The night shift workers are more flexible in sleep habits than daytime workers ($p = 0.032$). The results of the fatigue/animation questionnaire showed that daytime workers are the least tired compared to night shifts workers ($p = 0.011$) and mixed shift workers ($p = 0.039$). In accordance with our results a negative effect of night and mixed shifts on sleeping is demonstrated in a number of studies [Flo et al, 2012; Di Milia et al, 2013; Korompeli et al, 2013; Geiger-Brown et al, 2012; Niu et al, 2013; Tremaine et al, 2013]. The best subjective state of health was found in daytime workers, as opposed to the night-work ($p = 0.001$) and mixed shift workers ($p = 0.003$). Night shift workers suffer from gastrointestinal complaints the most, by contrast, the daytime employees ($p = 0.044$) and mixed shift workers ($p = 0.006$). The night shift-workers suffer the most from chronic diseases compared to daytime and mixed shift workers ($p = 0.004$; $p = 0.003$). Other researchers also draw attention to common gastrointestinal complaints among shift workers [Saberri & Moravveji, 2010; Wong et al, 2010; Mendes & Martino, 2012; Haus & Smolensky, 2012; Ofori-Attah & Nemeth, 2015]. Since the start of the shift work, the health status of workers decreased, smoking is increased ($p = 0.034$), and the consumption of caffeine stimulant also grown (coffee, tea or cola) ($p < 0.001$). Similar results were obtained in other surveys [Peplonska et al, 2015; Marquezea et al, 2012; Ofori-Attah & Nemeth, 2015].

Bergen Shift Work Sleep Questionnaire was translated to English, and the linguistic validation was completed, psychometric characteristics were analyzed. Our work aimed to replace the deficit, which was found in Hungary in the field of questionnaires to assess the quality of sleep in case of shift workers. Our data suggest that the Bergen Shift Work Sleep Questionnaire (BSWSQ H) meets the necessary psychometric requirements, which allows a systematic examination of the symptoms of discrete insomnia in various shifts. The results were

compared with the results described in the original Norwegian questionnaire validation study [Flo et al, 2012], where the most complaints were also found after the night shift, and reported the best sleep quality during the rest days. Similar results were found in morning and afternoon shifts as in the Norwegian sample, however, in the Norwegian sample, regarding items about sleep problems the average point was higher in afternoon shift workers, in our country there was no difference between the two shifts. According to the results of factor analysis, the BSWSQ-H questionnaire mainly explores the role of shifts in sleep quality in terms of the consequences of insomnia, and this is just produced in the daytime and night shifts, while according to the results of Flo the three shifts and rest days are displayed as a separate factors. With the usage of the questionnaire we aimed to assess the effect of different work schedules on sleep quality, namely we compared work types to find out which one is more burdensome. The only/mostly night-shift workers reported the worst sleep quality, in case of sleep after the night shift. The quality of sleep and daytime drowsiness is strongly correlated with the regularity of work schedules ($F = 8.57$, $p < 0.001$); according to post hoc tests opposed to the regular and flexible working schedule, most of the sleep problems are experienced in nurses working in irregular order in case of each type of schedule. If someone work in shifts for a long time, the organization adapts to the changed agenda [Kim et al, 2013], it was confirmed as the cronotype of night shift workers were evening type, while the daytime nurses-were found to be morning type.

The results of **the study entitled "Sleep problems and health shift"** also highlight the fact that the irregular shift work schedule is stressful.

Our results also draw attention to the role of health protective behaviours. Only 9.7% ($n = 62$) of nurses believe that they eat healthily; among the higher educated a higher rate concentrate on healthy diet ($p = 0.003$); and daytime workers also showed better results compared with shift-workers ($p < 0.001$). For the purpose of rest and recreation, 175 people (27.4%) carry out activities including physical activity regularly (increase in heart rate, sweating). Most if the respondents do sports rarely (51.8%) and according to the admission of 123 people they had never done sport activities. Level of education ($p = 0.07$) and the daytime work ($p = 0.013$) also showed a positive effect in this case. A proper diet and regular exercise are related in the examined sample ($p < 0.001$); and nutritional status can be positively influenced by correct health behaviour, since the BMI of those doing exercises on a regular basis and healthy eaters are lower than other respondents ($p = 0.003$ and $p = 0.001$).

Participants classified their health status into four categories: excellent (5.3%), good (39.1%), adequate (49.1%) and poor (6.1%). In elderly age groups they keep their own health poor in a greater proportion ($p = 0.003$). Educational level correlates with health perception, the worst perception was found in the lower educated group, while the best judged status result was in the higher levels of education ($p < 0.001$). Health status was considered worst in the group of night workers, and best in the daytime group ($p = 0.044$). The work order regularity also correlated with the answers, the health status was described as best in the flexible work group, while the worst in the irregular group ($p = 0.017$).

Nutritional status was described by BMI: 25, 96 kg/m² (SD: 4, 6; min: 15; max: 48). Age was correlated with BMI, the average value of BMI was higher in the older age group ($p < 0.001$). BMI of night shift workers or those working at chronic wards was higher ($p = 0.013$ and $p = 0.01$). The work order regularity is related to weight gain, most fattening happened in the group of irregular work schedule ($p = 0.004$), while in case of sports and nutrition no difference was found between the groups. In the study of Feith and his colleagues 62.9% of graduate nurses gave positive evaluation on a five-point scale (excellent, good) about the state of their health, while negative (bad, very bad) value was given by 4.2% of the total sample. The average BMI of the sample consisting of graduate nurses and female physicians: 23.95 kg / m², yet 21% of them was overweight, 11% obese and 5% is severely obese. The majority of respondents eating healthily. [Feith, 2007; Feith et al, 2008].

Daytime workers reported fewer psychosomatic complaints opposed to shift workers ($p = 0.012$). The regularity of work schedules and their types are not related to the frequency of psychosomatic complaints. The healthy eater group indicated fewer complaints, as opposed to unhealthy eaters ($p < 0.001$). Regular exercise is not ($p = 0.25$); however, body weight change is related to the psychosomatic complaints, those who lost weight or gained weight, observed more symptoms ($p = 0.006$).

The psychosomatic complaints and sense of coherence correlates ($r = -0.213$; $p < 0.001$), that is, those reported better coherence have fewer complaints. Examining the complaints separately we found that SOC associated with cephalic pain ($r = -0.123$; $p = 0.002$), sleep problems ($r = -0.164$; $p < 0.001$), fatigue ($r = -0.248$; $p < 0.001$); and rapid heartbeat-feeling ($r = -0.132$; $p = 0.001$). Examining these with the correlation of each other, the most powerful complaint is "exhaustion". To the question of who are the most exhausted, the answer is that workers of irregular work schedules ($p = 0.037$). Our results show that in the group with strong sense of coherence there are less exhausted nurses under the same strain, namely, they are more resistant to load ($p = 0.031$). In case of shift workers therefore the psychosomatic complaints are less in

those with strong sense of coherence. In the survey of Varga et al, attention was drawn to that one of the reasons for nurses attrition is the weaker sense of coherence [Varga et al, 2012]. Therefore the aim is to strengthen the sense of coherence in students during education. One way is the education for healthier lifestyle, especially the sport.

According to respondents, after a day shift they sleep an average of 7.08 hours (min 4, max: 12; SD: 1.30); while after the night shift 4.54 hours (min 0, max: 12; SD: 2.19), the difference is significant ($p < 0.001$). According to the work schedule regularity, difference was observed, since the quality of sleep was deteriorated in 77.3% of the irregular, 62.8% of the flexible and 58.9% of the regular work schedule group ($p = 0.016$). 39.7% ($n = 254$) of the involved nurses take sleeping pills regularly. As age progresses, the number of those taking sleeping pills is increase ($p = 0.014$). In a previous study, in which representatives of many professions participated ($n = 455$), the ratio of those taking sedatives was only 11.5% [Fusz et al, 2016].

Since the frequency of sleep problems may be related to age and gender, and the work schedule irregularity, their impact had to be filtered out. With the increasing age usually sleep disturbance become more frequent ($p = 0.018$; $p = 0.042$; $p = 0.14$); gender generally did not affect the frequency of sleep disorders; and no significant results were obtained in case of irregular work schedules; however coherence-sense strongly related to sleep disturbance ($p < 0.001$; $p = 0.091$; $p < 0.001$) controlling the effect of the above described. The stronger the sense of coherence in an individual, the less symptoms of sleep disorders appears.

Sleep quality of various regularity work schedules were compared to workers with one-way variance analysis. assessed In case of sleep quality examined by Bergen Shift Work-Sleep sleep Questionnaire significant difference was obtained, since the irregular schedule workers sleep worse than those working in regular schedule ($p = 0.023$) and flexible ($p = 0.003$). However, higher level of education have stronger sense of coherence ($p = 0.007$). Those working in daytime shifts ($p < 0.001$); and a flexible work schedule workers also showed better results ($p = 0.038$).

Subjective health was status compared with the applied scales and BMI results. Significant results was found in each case, namely, nurses with poor subjective health status reported more psychosomatic complaints ($p < 0.001$), and more sleep problems ($p < 0.001$), has lower sense of coherence ($p < 0.001$) and higher body mass index ($p < 0.001$). Our results suggest that health parameters measured in our study generally correlate with age, health behaviour, level of education, type (daytime vs. mixed) and irregularity of work schedule.

52 nurses working in inpatient wards attended **in the actigraph study** at the University of Pécs, Clinical Centre Paediatric Clinic. Ten nurses (19.2%) work in daytime order, from Monday to Friday from 6:00 to 14:00, they are the head nurses, 18 persons (34.6%) from those working in more shifts work in regular shifts, and nurses working irregular work schedule are included in the third group (n = 24; 46.2%). Reviewing the international literature, in actigraph surveys the number of nurses and their age is similar to our sample, while actigraph were worn for a longer period (on average 14-28 days) than in our study (7 days) [Niu et al, 2013; Tremaine et al, 2013; Hirsch et al, 2014; Haire et al, 2012].

Daytime workers spend average of 6.41 hours (minimum 4.46 hours, up to 8.54 hours; SD 1.25; n = 7), with resting, in regular mixed shift average of 5.88 hours (minimum 4.58 hours, up to 7.86 hours, SD 0.91, n = 12); while in case of irregular work 5.75 hours (minimum 2.14 hours, up to 8.20 hours; SD 1.49; n = 16); the difference was not significant (F = 0.67; p = 0.52); while significant differences was found in the research of Niu [Niu et al, 2013]. In a national survey conducted in 2006, an average of 6.5 hours are spend with sleeping on weekdays and almost 8 hours on weekends (rest days) in case of graduate nurses and female physicians. 15.2% of respondents almost never wake up refreshed and only 12.5% indicated that they wake up rested [Feith, 2007]. In our survey conducted in 2015, we measured the average daily sleep time of nurses (n = 58; mean 6.38 hours) compared to representatives of other professions. Our results show that office workers (n = 87; mean 6.89 hours, p = 0.06), teachers (n = 51; mean 6.96 hours, p = 0.08) and other medical staff (n = 21, mean = 7.10 h; p = 0.028) sleep more than nurses. The quality of sleep was in relation with the amount of sleep, those received a worse value of Athens Insomnia Scale was sleeping less (r = 0.32, B = -1.045, p <0.001) [Fusz et al, 2016].

The motion activity of nurses working in daytime during rest period was on average 14.71 occasions (min: 10; Max: 19; SD: 3.55; n = 7); 17.17 occasions in case of regular work schedule (min 6, max 38; SD 7.94; n = 12); while in irregular schedule workers is was 15.50 (min: 7; Max: 29; SD: 6.41; n = 16); the difference was not significant (F = 0.37; p = 0.7). Nurses working in daytime spend 54.86 minutes with movement in the resting period (min: 38 min, max: 79 min; SD: 15; 65 minutes; n = 7); while the regular shift workers on average 59.67 minutes (min: 29 min; up to 143 minutes; SD: 30.14; n = 12); irregular schedule workers 60.83 minutes (min: 24 min; up to 182 minutes; SD: 37.49; n = 16), the difference was not significant (F = 0.09; p = 0.92). After the day shift, followed by a rest day, an average of 8.75 hours are spend with rest (min: 6.18 max: 11.10; SD: 1.63), while after the night work, followed by a day of rest, on average 4.70 hours are in a rest period by the nurses (minimum 2.62; maximum 6.20, SD 1.09), the difference is significant (t = -11.75, p <0.001); This result coincides with the

research of Hirsch where respondents slept on average 8.93 hours after the day shift, and rested for 4.84 hours on average after a night shift [Hirsch et al, 2014]. The length of the rest period ($p = 0.013$) and average time of movements during rest periods ($p < 0.001$) correlated with the frequency of psychosomatic complaints.

Limitations of the study in all of the studies is that the samples are not representative.

Due to the cross-sectional nature of the questionnaire the surveys are not suitable for accurate exploring of result-causal relationships. Scales on health status and frequency of psychosomatic symptoms are not suitable for determining the actual prevalence of morbidity.

In the actigraph study with the increase of sample size and test time expectedly the differences would have been significant.

4.2. Proposal for the development of ideal work shift

Based on the results of our research and the review of the literature [Caldwell, 2003; Bódizs, 2000; Costa, 2010; Griffiths et al, 2014] we found the following nursing work shifts the less burdensome:

- **flexible work schedule** - taking into account the needs of the workers – **with regular elements**, that is as far as possible, aligned with the following recommendations:
- **10-hour shifts followed each other in the clockwise direction, in a short rotation system**: 1 morning shift, then 1 afternoon shift, after it 1 night shift, followed by 2 days of rest.

We recommend that leaders call the attention of workers in several shifts to the following:

- the shift-work may result sleep disorder, psychological, psychosomatic and somatic complaints due to the disturbed circadian rhythm
- knowledge and application of sleep hygiene rules is important
- regular exercise and good nutrition is a benefit
- in case if they perceive problems with night shifts, notify their supervisor or seek out a specialist (eg. neurologist, somnologist or psychiatrist in case of sleeping disorders)

5. NOVEL RESULTS IN THIS TOPIC

1. In Hungary we explored firstly the most commonly applied nursing work schedules in Hungary.
2. Shift Work Index questionnaire was firstly performed by us in Hungary, which was no longer used due to the test experience at Szeged, however, a flexible working arrangements as defined in the questionnaire was introduced to the public consciousness, and this classification (regular, irregular, flexible) is also used in subsequent studies.
3. Bergen Shift Work Sleep Questionnaire was applied first in Hungary for assessing the quality of sleep of shift workers, which is adapted for Hungarian, according to national conditions (Bergen Váltott Műszakos Alvás Kérdőív).
4. We have created a questionnaire package "Sleep disturbance and health in work shifts", which can promote to monitor the health of nurses.
5. In Hungary, we examined firstly the sleep quality of nurses with actigraph.
6. The opinion of nurses regarding the work schedule was examined within the framework of a large number of survey. The most common and also the most popular (the least burdensome) schedule is flexible.
7. In the light of our results, we gave a proposal to develop the ideal shift work schedules.

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