Extraversion and Neuroticism in populations of shift workers on Diverse work patterns

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Abstract

We studied distribution of extraversion and neuroticism in a cohort of 481 shift workers (SWs), from different organizations with diverse shift-work patterns. The population of SWs consisted of 86 on running rotation (RR), 175 on weekly rotation (WR), 173 on quick rotation (QR), and 47 on split rotation (SR). We administered the Eyesenck's Moudsley Personality Inventory (MPI) to all SWs to determine their extraversion and neuroticism traits. The Chi-square test revealed a significant association between extraversion-neuroticism and shift-work pattern. The preponderance of extrovert trait in the studied population of shift workers sampled from all groups, except SR, was noticed. The prevalence of neurotic trait was the least in QR group. However, in the WR group the frequencies of both extrovert and neurotic traits were higher. On the basis of present findings, it appears that shift workers on QR pattern are more tolerant as the prevalence of neurotic trait is the least in this group. This finds indirect favour from the concept that the higher level of extraversion is associated with lower health problems and greater adjustment to the shift work.

Personality is one of the oldest area of psychological theorizing extended back following by ancient Greece[17] and became the interested field of researchers. In recent years the quality of human life has witnessed a gradual and steady improvement. Credit for this definitely goes to the process of globalization and industrialization that is taking place around the world. A reasonably good quality of human life demands round the clock services from different organizations dealing with health, security, transport, and entertainment. These organizations recruit manpower that works round the clock in shifts. It is well known that shift work modulates human health and social life negatively by way of disrupting circadian clock[35,36,42]. It does not allow shift workers to allocate adequate time for social interaction and participation[2,21,39]. This could be attributed to the consequences of pattern, duration, and

direction of rotation of shift schedules. Several reports demonstrate that the 12-h shift system is better than the 8-h shift system[15,40,51]. The 12-h shift system produces lesser amount of stress, and enhances off-duty sleep quality and social happiness. It has been found to be less detrimental for social participation as compared with that of the 8-h rotating schedule[14,20].

In India situation is altogether different. There is negligible number of women shift workers. However, it has been reported that the spouses and children of shift workers suffer from different types of anxiety[31]. Prior to this Smith and Folkard[38] reported that the spouses of shift workers experience social and domestic disruptions considerably.

Relationship between life style and different types of shift systems are equally debatable. Both rotating and permanent night shifts elevate difficulties in family life that tends to restrict leisure and social responsi-bilities[7,41]. In addition, these schedules have been reported to disturb sleep quality and sleep stages resulting in poor individual health and decrement in general performance[39,45].

Exraversion and neuroticism are often considered the two personality traits most relevant to the study of happiness[10]. Eyesenck and Eyesenck[9], stated that exroverts tend to vary between positive effect which is called neutral element, whereas neurotics display changes that go from negative effect to neutrality. Further it has confirmed the same relations by followers[3,25].

In the present study, a modest attempt has been made to find out the distribution of personality trait, *i.e.*, extraversion and neuroticism in shift workers on different types of shift rosters, viz., running rotation (RR), weekly rotation (WR), quick rotation (QR), and split rotation (SR).

Subjects :

Four hundred eighty one shift workers aged between 18 to 61 years (Median age = 35 y) volunteered to participate in this study. The population consisted of 86 (17.9%) running rotational shift workers (RR), 175 (36.4%) weekly rotational shift workers (WR), 173 (36.0%) quick rotational shift workers (QR), and 47 (9.8%) split rotational shift workers (SR). The study was designed in such a way that it neither interferes nor disturbs the normal routine of the subjects. The Eyesenck's Moudsley personality inventory (MPI) was administered to each subject belonging to each work type. They maintained dignity and confidentiality while responding to the different inventories. The subjects were interviewed invariably after the end of their study sessions. Time of interview session varied widely as they were functioning at different organizations characterized by divergent shift schedules.

All subjects signed an informed consent form prior to their participation in the study. The protocol of the study complied with the ethical standards of the journal[33].

Patterns of Shift Rota :

Running Rotation (RR) :

The RR involves work of $\geq$ 8 hours with outstation rest of 8-10 hours and headquarters (HQ) rest of 16-24 hours.

The SECR follows this roster for its running staff, such as train drivers and cabin staff. They are also classified as continuous running staff and perform duty to the maximum of 52 hours per week. During the period of this investigation, normally running staff followed backward rotation. They worked in the second night shift (00:00–08:00 h) followed by the first night shift (16:00–00:00 h) and thereafter the morning shift (08:00–16:00 h) (Figure 1). The timings of the shifts were flexible and varied considerably depending upon the actual train arrival/ departure schedules. They usually worked one shift in a row and maximum permissible length of duty away from headquarters is 3-4 days.

Weekly Rotation (WR) :

The pattern of WR, from second night (00:00-08:00) to the first night (16:00-00:00) and to the morning shift (08:00-16:00), is similar to the RR, but each SW of SECR worked six shifts in a row of each type. The timings of the shifts are rigid and SWs get 24-h rest on completion of each type of shift. The SWs performed their duties in the HQ. The SWs that included key men, fitter, constable, pump men, executives, office clerks, tracks men, mechanics, and sweepers, were randomly chosen from different departments of the SECR. Therefore, the nature of jobs of the SWs varied drastically (Figure 2).

Quick Rotation (QR) :

The JSPL adopts the QR shift pattern. It is characterized by backward rotation from night shift (22:00-06:00) to B-shift (14:00-22:00) and to A-shift (06:00-14:00). The randomly selected SWs were machine operators, supervisors, junior engineers, and assistant general managers. They worked two shifts of each type in a row. They took rest for a day after completion of all three shifts (Figure 3). The JSPL is a factory that manufactures sponge iron, mild steel slabs, ferrochrome, iron ore, mild steel, and coal based sponge iron.

Split Rotation (SR) :

The MJML is a factory that processes jute products and follows a unique shift pattern. This pattern has three types of shifts, namely A-shift (06:00-10:00 and 14:00-18:00), B-shift (10:00-14:00 and 18:00-22:00) and C-shift (22:00-06:00). The pattern of forward rotation is from A to B, B to C, and C to A. The former two shifts have two spells of four hours each. The C-shift is continuous for 8 hours. The SWs of A- and B-shifts excluded each other every 4 hours within the period between 06:00 and 22:00 over a continuous period of six days. A rest day follows completion of each shift (Figure 4). The SWs were machine operators, manual workers and supervisors.

Instructions :

The inventory was administered under standard conditions. A good "rapport" was established with the respondents both at individual and group levels. They were assured that the responses obtained on the inventory would be kept firmly secret and under no circumstances would be made public or used for profit making. Subjects were told to remain frank and give trustworthy answers and that their participation is for a noble cause, i.e., for the science and society.

Subjects were supplied with a Biographic

Data Sheet along with MPI inventories. They were instructed to fill up the biographical data sheet first before proceeding to register their responses on the inventories. The biographic data sheet included different fields, such as name, gender, age, date of birth, height, weight, marital status, number of children, qualifications, address, blood group and other health- and habit-related items. They were told not to read the inventories unless asked for. The respondents were reminded not to ponder on each question, but to give their first response that occurs to them spontaneously as fast as possible. After the completion of the session they were advised to check back and make sure that they have not missed any field of query on any one of the instruments.

Characteristics of the MPI and Determination of Scores :

The MPI, *i.e.*, the Eysenck's Moudsley Personality Inventory is widely used by researchers around the world[10,25,27,52]. This is designed for assessing Neuroticism-stability and Introversion-extraversion dimension of life style. The MPI consists of 12 questions each having three options. Each subject has the freedom to choose an answer, which he/she thinks to be the most appropriate for him/her, by putting a tick-mark inside the boxes drawn for each choice. It has six extraversion items with number 2, 3, 6, 7, 10 and 11, and six neuroticism items (1, 4, 5, 8, 9 and 12). The original MPI is in English (Eyesenck's Moudsley Personality), but in this study a modified Hindi version was used.

The reliability of the Eyesenck's Moudsley Personality scale in term of internal consistencies is ascertained. The coefficient alpha values of the Neuroticism and Extraversion are 0.73 and 0.75, respectively.

The MPI scores were computed from the response sheet obtained from each subject. With reference to extraversion dimension each subject was classified either as introvert (score between 1 and 4), or ambivert (score between 5 and 8) or extravert (score between 9 and 12). Similarly, based upon neuroticism dimension each subject was classified as stable (score between 1 and 4), or neutral (score between 5 and 8), or neurotic (score between 9 and 12).

Statistical Analysis :

All data were stored in the form of records in database files. *Chi*-square test was employed to analyze independence of attributes, such as personality dimension and shift rota. The two sample K-S test was performed to compare distribution of the MPI scores between paired groups. The MPI scores were subjected to ANOVA for multiple comparisons. Data were analyzed using software, namely SPSS (Version 10.0), and CoStat (CoHort Software; Version: 4.02, ©1990).

Distribution of extraversion personality as function of shift roster :

Prevalence profile of extraversion personality traits, namely extravert, ambivert and introvert, among shift workers is summarized in Figure 5. Out of 481 subjects, 317 (65.9%) were extravert, 149 (31.0%) were ambivert and 15 (3.1%) were introvert, irrespective of shift rosters (Figure 5). Results of Chi-square test indicated a statistically

significant ($p < 0.000$) relationship between shift pattern and personality (Figure 5). The distribution of personality traits among RR subjects in respect of extravert, ambivert and introvert was found to be 51.2%, 41.9% and 7.0%, respectively. In the group WR, the corresponding figures were 84.0% (extravert), 14.9% (ambivert) and 1.1% (introvert). In the QR group those figures were 63.0% (extravert), 34.1% (ambivert) and 2.9% (introvert). The frequency distribution of personality traits (extravert: 36.2%, ambivert: 59.6, introvert: 4.3%) was different in the SR group characterized by relatively lower percentage of extravert and greater percentage of ambivert. Similarly the WR and QR groups exhibited greater percentage of extravert than that observed in RR and SR groups (Figure 5). The extraversion and neuroticism traits were compared using analysis of variance (ANOVA) followed by Duncan's multiple range test (Table-2).

Distribution of neuroticism personality as function of shift roster :

Prevalence of neuroticism personality traits, namely neurotic, neutral and stable, among shift workers is summarized in Figure 6. Out of 481 subjects, 117 (24.3%) were neurotic, 189 (39.3%) were neutral and 175 (36.4%) were stable, irrespective of shift rosters (Figure 6). Results of Chi-square test indicated a statistically significant ($p < 0.001$) relationship between shift pattern and neuroticism personality (Figure 6). The distribution of neuroticism personality traits among RR subjects in respect of neurotic, neutral and stable was found to be 16.3%, 46.5% and 37.2%, respectively. In the group WR, the corresponding figures were 41.1% (neurotic),

34.3% (ambivert) and 24.6% (stable). In the QR group those figures were 13.9% (neurotic), 35.8% (ambivert) and 50.3% (stable). The frequency distribution of personality traits (neurotic: 14.9%, ambivert: 57.4, stable: 27.7%) was different in the SR group characterized by relatively higher percentage of neutral category. Similarly the WR group exhibited greater percentage of neurotic than that observed in RR, QR and SR groups (Figure 6).

Furthermore, result of Kolmogorov-Smirnov test compliments *Chi*-square result and depict that distribution of extraversion score in SR group is significantly different from the WR ($Z = 3.281$; $p < 0.001$) and QR ($Z = 2.032$; $p < 0.001$) groups and WR is significantly different from RR ($Z = 2.934$; $p < 0.0001$) and QR ($Z = 2.101$; $p < 0.001$) (Figure 7; Table 1). Correspondingly the neuroticism score in SR group is significantly different from the WR ($Z = 1.598$; $p = 0.012$) and QR ($Z = 1.409$; $p = 0.038$) groups and WR is significantly different from RR ($Z = 1.888$; $p = 0.002$) and QR ($Z = 3.442$; $p < 0.001$) (Figure 8; Table-1).

Personality reflects life satisfaction (LS) to a great extent[13]. However, it is debatable if LS is influenced by traits alone or the immediate environment[23,43,47,48]. Further, bulk of the research conducted in this area suffers from limitations in that most of the respondents in those studies were university students. Therefore, it would be difficult to extrapolate the findings that show an association between personality traits and LS for a general human population, probably the least for a typical human population that works

in shifts. In this study, attempts have been made to ascertain if different types of shift schedules modulate personality traits differently, thereby giving indications about LS among shift workers in general and as function of the pattern of shift schedules in particular. In the present study, the investigated population had four different backgrounds as far as types of shift schedules are concerned. The population in question involved running rotational shift workers (RR), weekly rotational shift workers (WR), quick rotational shift workers and split rotational shift workers (SR).

The frequency of introverts was the least among the studied population. The frequencies of extravert (66%) and ambivert (31%) taken together make it a staggering 97% shift workers that could be placed towards positive end of the personality scale. It has been speculated earlier that extraversion could predispose individuals towards positive affect[37]. These authors studied police workers and documented that extraverts had lower health problems and better shift work coping abilities. Indirect support emerged from the work of Jylha and Isometsa[16]: they reported that urban introverts often suffer from depression. Further it has been shown that the extraverts easily adjust to changing shift schedules[19]. There has been a number study to have a generalization on the relationship of personality type with that of the shift work coping abilities. However, this relationship remains debatable even today[1,18,24,36].

The prevalence of extraversion was higher among WR and QR shift workers. Conversely the frequency of introverts was higher among the RR and SR groups.

Therefore, it seems that QR (JSPL) and WR groups have better tolerance to shift work. The RR and SR shift workers could be intolerant to the shift work as they characterize low ratio of extravert to introvert. Now question arises: Is the distribution of extraversion-introversion traits in the studied organizations is by default? Alternatively, the distribution could be a mere consequence of the types of shift rotations. The other possibility involves plasticity angle of personality. The latter gets credence from the work of Watson *et al.*[49], who have demonstrated that personality could change several times in a subject's life with the passage of time, more likely every 2.5 years. In contrast, McCrae and Costa[28], documented that no further significant changes occur in the personality once adulthood is reached. However, personality traits, such as extraversion and neuroticism are reflections of the functions of central nervous system (CNS); the former is related to the cortical arousal, while the latter is linked with the autonomic nervous system[8,44].

It is generally believed that higher extraversion traits are associated with better health and prosperity. While this generalization may be tenable for shift workers the present findings do not allow us to differentiate the effects of one pattern of shift schedules from others on personality traits.

Shift workers on QR pattern appear to be more tolerant as the prevalence of neurotic trait is the least in this group. This finds indirect favour from the concept that the higher level of extraversion is associated with lower health problems and greater adjustment to the shift work.

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Table-1. Comparison of distributions of the MPI Scores between paired groups,
using two-sample Kolmogorov-Smirnov test

Group	RR	WR	QR	SR
Extraversion score				
RR	-	2.934* (0.001**)	1.221 (0.101)	1.092 (0.184)
WR	-	-	2.101 (0.001)	3.281 (0.001)
QR	-	-	-	2.032 (0.001)
SR	-	-	-	-
Neuroticism score				
RR	-	1.888* (0.01**)	0.991 (0.279)	0.687 (0.732)
WR	-	-	3.442 (0.001)	1.598 (0.05)
QR	-	-	-	1.409 (0.05)
SR	-	-	-	-

*Kolmogorov-Smirnov Z; **Asymp. Sig. (2-tailed); [RR]Running rotation; [WR]Weekly rotation; [QR]Quick rotation; [SR]Split rotation

Table-2 Extraversion and Neuroticism score of shift workers as function
of different pattern of shift rosters

Group	N	Extraversion	Neuroticism
RR	86	8.41 ± 0.26^a	5.60 ± 0.31^{ab}
WR	175	10.38 ± 0.13^c	7.29 ± 0.25^c
QR	173	9.27 ± 0.18^b	4.87 ± 0.24^a
SR	47	7.91 ± 0.25^a	5.94 ± 0.37^b
F-value; df; p-value		26.95; 3,477; <0.001	17.86; 3, 477; <0.001

Means with similar superscripted letters do not differ from each other significantly (based on Duncan's multiple-range test). See also to legend to Table 1
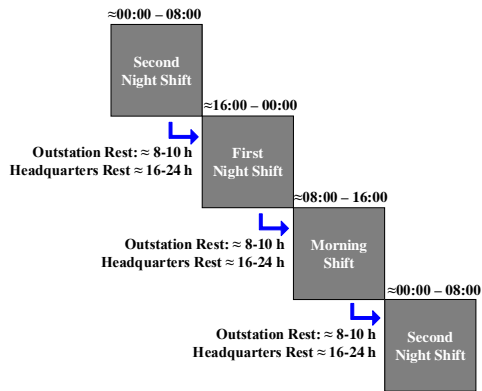
Figure 1. Percent prevalence of extraversion as function of shift roster. [RR]Running rotation; [WR]Weekly rotation; [QR]Quick rotation; [SR]Split rotation;

Shift pattern *versus* Extraversion: $\chi^2 = 12.93$; $df = 6$; *p-value* = 0.044; WR *vs.* RR: $\chi^2 = 31.96$; $df = 2$; p < 0.001; WR *vs.* QR: $\chi^2 = 19.07$; $df = 2$; p < 0.001; WR *vs.* SR: $\chi^2 = 43.09$; $df = 2$; p < 0.001; QR *vs.* SR: $\chi^2 = 10.93$; $df = 2$; $p = 0.004$
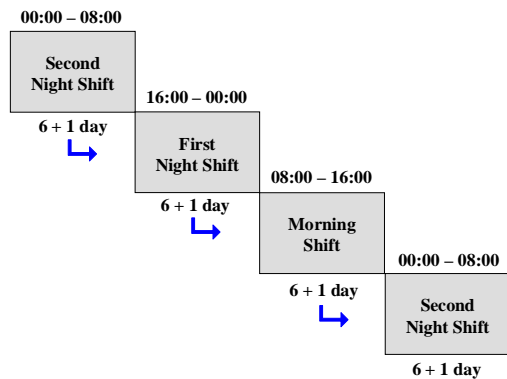

Figure 3. Frequency distribution of extraversion score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1.
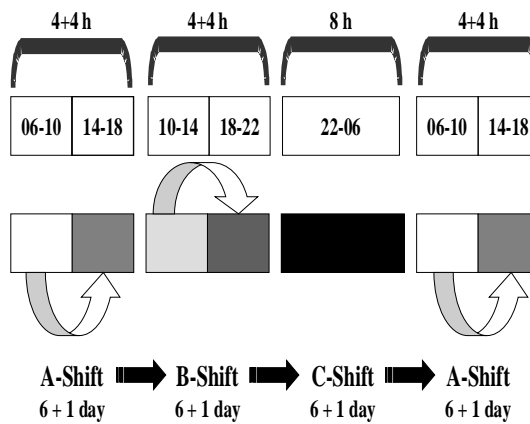

Figure 2. Percent prevalence of neuroticism as function of shift roster. Shift pattern *versus* Neuroticism: χ^2-*value* = 54.645*; df* = 6*; p*< 0.001; WR *vs.* RR: $\chi^2 = 15.78$; $df = 2$; p < 0.001; WR *vs.* QR: $\chi^2 = 38.08$; $df = 2$; p < 0.001; WR *vs.* SR: $\chi^2 = 12.11$; $df = 2$; p = 0.02; QR *vs.* SR: $\chi^2 = 8.46$; $df = 2$; $p = 0.014$. For other details, see legend to Figure 1.

Figure 4. Frequency distribution of neuroticism score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1.
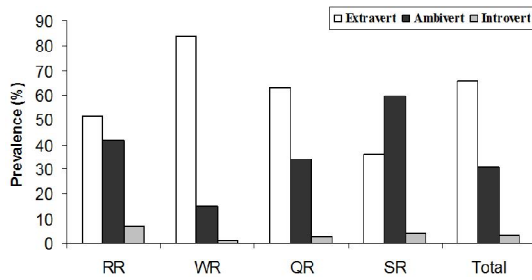
Figure 5. Prevalence of extraversion score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1.
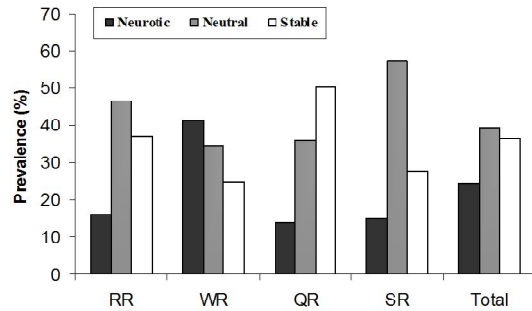

Figure 6. Prevalence of neuroticism score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1.
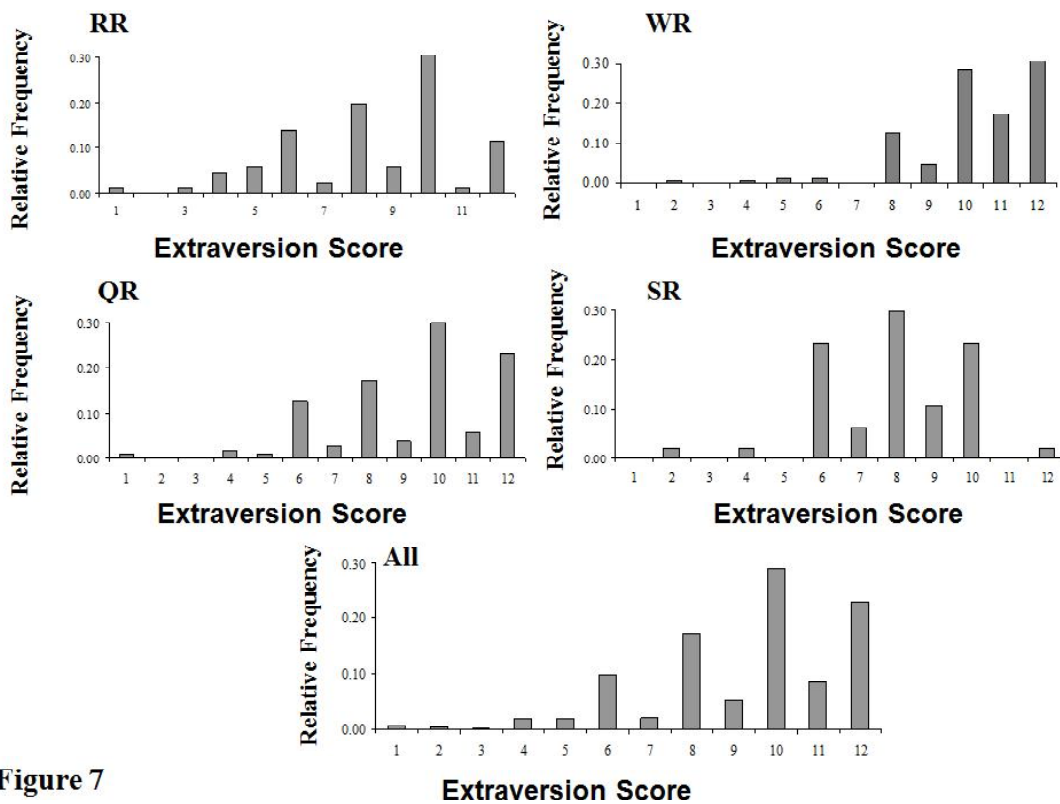

Figure 7

Figure 7. Relative frequency of extraversion score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1
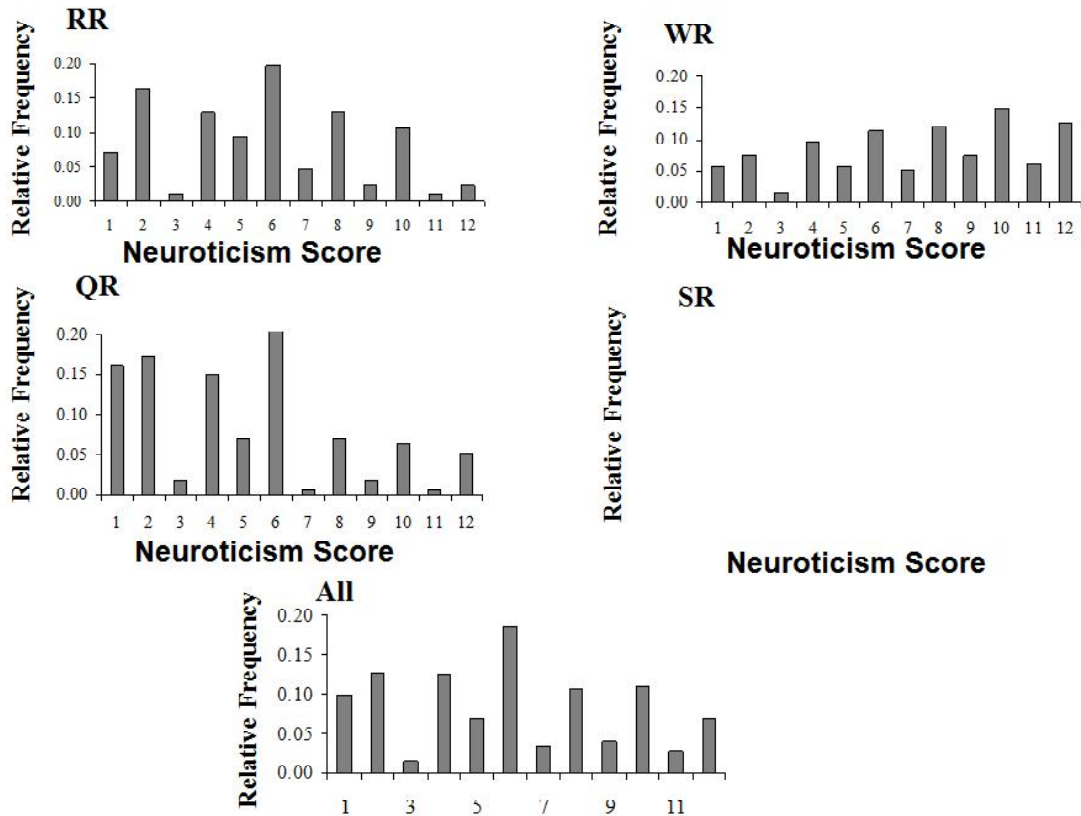
Figure 8. Relative frequency of neuroticism score as function of shift rosters, adopted by SECR, JSPL, and MJML. For other details, see legend to Figure 1

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