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Original Article

The Effect of Long Working Hours among Medical Doctors in Northwest Malaysia: The Interplay between Personality Big Five Inventory and Fatigue

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ABSTRACT: *Medical professionals work in a constantly stressful environment. The nature of the profession requires routine extended working hours, but little is known about the effect of long working hours on selective physiological measures. A cross-sectional feasibility study was conducted from 1 October 2017 until 30 April 2018 on medical doctors in a tertiary health centre in northwest Malaysia. There was a total of 55 study participants recruited. The overall systolic blood pressure (SBP) was highest after working 24-hour stretch ($p=0.006$) and the overall diastolic blood pressure (DBP) were highest after working for 33 hours in a single stretch, at the end of on call rotation ($p<0.001$). Otherwise, there was no significant association between personality elements and fatigue scores. The study's preliminary result demonstrated the potential harmful effects of long working hours on cardiac autonomic physiology and may serve as a potential projection to involve the residency options and recruitment via personality assessment among medical doctors.*

Keywords: *Blood Pressure; Extraversion (Psychology); Heart Rate; Internship and Residency; Malaysia; Neuroticism; Personality Disorders; Pilot Projects*.

1.0 INTRODUCTION

The study of personality is the science of understanding human behaviour. There are various scales attempting to define human personality as a finite entity (Ones, Dilchert, Viswesvaran, & Judge, 2007) but the various existing scales complement one another, not one is exclusively superior. Among the many, the Big Five Inventory (BFI) is among the simplest to perform and narrate, decoding an individual's five essential fundamentals that make up a human personality. This validated personality tool (Ong, 2014) consists of five elements, which include Neuroticism, which assesses being frequently worried, tense and fearful; Extraversion, which measures being talkative, outgoing and sociable; Openness assesses being inventive, imaginative and experience-seeking; Agreeableness captures one as being gentle, forgiving and cordial; whereas conscientiousness measures being thorough, diligent and efficient (Hengartner, Kawohl, Haker, Rössler, & Ajdacic-Gross, 2016).

Clinical profession is a progressively challenging field with cyclical medical advances and breakthroughs. Legal suits filed against medical professionals for negligence and malpractices have become commonplace in the mainstream population. Medical doctors are the first-liners to attend the sick and they are expected to display a certain level of professionalism throughout the clinical contact with the patients despite the long working hours. These however, were difficult to maintain as emotions and actions were influenced by circumstances and the inherent characters of one's personality.

In view of the high public expectation on the medical professionals despite the stressful environment, personality inadvertently is one of the major determinants of a doctor's success, both in managing their outward physical life and in maintaining the inner peace and self-composure. Reports of increasing suicidal rates even among the well-paid doctors are alarming (Schernhammer & Colditz, 2004) especially in developed countries, like Japan and the United States of America. Working in a highly stressful environment where one is expected to constantly outdo their best, does create a hostile milieu for the development of psychological problems, even among the carer themselves.

Medical working hours differ from those non-clinical professions in the institution of on-call system whereby the medical doctors are required to standby in the hospital overnight in anticipation of emergency cases demanding

acute medical care. This is especially true with the major clinical disciplines. The working hours easily accumulate up to 33 to 36 hours in a single stretch. Fatigue is one of the key indicators in depression as defined in Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Studies of the effects of self-reported fatigue on the haemodynamic functioning has been of interest since the 1970s.

Even though multiple studies have reported the effect of fatigue to physiological function and emotional state (Deary & Tait, 1987; Kohansieh & Makaryus, 2015), very little is known about the effect of personality traits on their physique and mental state. This comprehensive study will act as a platform to discover the relationship between personality elements with the physiological measures and demographic characteristics among medical doctors in northwest Malaysia.

2.0 METHOD

This cross-sectional study was conducted from 1 October 2017 to 30 April 2018 on medical doctors in major clinical departments, who were subjected to active on-call rotation in Hospital Tuanku Fauziah, Kangar, Perlis, Malaysia. Medical-based clinical departments comprised of internal medicine department and paediatrics, while the surgical-based clinical departments include general surgery, orthopaedics, and obstetrics and gynaecology.

The name list of the institutional medical doctors from various clinical disciplines was collected from the administrator's office. The selected subjects were chosen across different clinical disciplines and were notified via phone call. A call letter for a meeting with the team of investigators, for written consent purposes was also distributed through the respective heads of departments. Each individual participant was recruited for any one selected month throughout the study period. The frequency of the data collection for each participant differed according to the number of their on-call rotation of the selected month. A maximum of 10 participants were recruited every month until the minimum sample size for pilot study of 12 per group was achieved (Julious, 2005). Convenience sampling was used.

2.1 Data Collection

Each participant was given a pre-arranged visit schedule for collection of the study parameters, which include the blood pressure measurement, heart rate, Multidimensional Fatigue Symptom Inventory (MFSI) score, Big-Five Inventory scale, and weight and height measurement. A reminder phone message was sent to all respondents expected to visit the office on the measurement day.

2.1.1 Fatigue assessment

Fatigue assessment was done using the self-administered Multidimensional Fatigue Symptom Inventory (MFSI) (Stein, Jacobsen, Blanchard, & Thors, 2004). It consisted of 30 questions with acceptable psychometric measurements, designed in a 4-point Likert scale ranges from 0-Not at all to 4-Extremely. MFSI scoring was done in a dedicated Clinical Research Centre (CRC) office after the participant has completed the 24-hour rotation of each on-call scheduled. The average MFSI score was later calculated at the end of the study.

2.1.2 Physiological parameters

During the scheduled visit, the blood pressure and heart rate were measured with a standard automated blood pressure monitor, Omron HEM-7203. If the first reading were abnormal, defined as the systolic blood pressure (SBP) of more or equal to 130 mmHg and/or a diastolic blood pressure (DBP) of more or equal to 90; a repeat blood pressure of at least 1-minute interval was measured. The lower value of the two was recorded. The first BP reading was taken after a 10-minute rest.

The physiological parameters were evaluated at baseline (at the beginning of on call rotation), mid call (after 24-hour rotation) and at the end of rotation (after 33-hour rotation).

2.1.3 Personality assessment

Personality assessment was done using the self-administered Big Five Inventory (BFI) of 44 questions in a 5-point Likert scale, ranging from 0-Disagree strongly to 5-Agree strongly. Each of the five domains in BFI, which are Extroversion, Agreeableness, Conscientiousness, Neuroticism and Openness, was calculated from the sum score of specific number of questions. BFI scoring was done once during the first CRC visit.

2.1.4 Physical assessment

Height and weight measurement were done using Detecto 750 on the first CRC visit. The body mass index (BMI) was calculated from Quetelet's index (Cole, Freeman, & Preece, 1995).

The study took place for one month for each individual subject. The frequency of the data collection depended on the subjects' respective on-call rotation that month. A maximum of ten subjects will be recruited every month. The new recruitment will be on the following month onwards till the target sample size is achieved. Those who have been selected in the study previously will not be re-selected in later recruitment.

Medical doctors in clinical disciplines who were required to perform active on-call rotation with overnight hospital standby of at least 30 hours cumulatively in a single shift were included in the study. Those who did not consent were excluded and those who failed to comply with the visit schedule for three consecutive periods were withdrawn with replacement.

Analysis was performed using the IBM Statistical Package for Social Sciences (SPSS) for Windows Version 21.0. In this study, descriptive statistics were employed for selected variables including age group, BMI category and gender. Numerical data such as the five elements of Big Five Inventory, MFSI score and physiological parameters were presented as means and standard deviations.

Comparison between the mean score of the BFI elements, mean MFSI score and physiological parameters with the different clinical-based specialties were analysed using the Independent *t*-test. Correlation coefficients between different elements of BFI with BMI, age, MFSI score and physiological parameters were assessed using Spearman's rank-order correlation. All probability values were two-sided, and a level of significance of less than 0.05 ($p < .05$) was considered as statistically significant (Martin, Lang, & Secic, 1998).

This study has received scientific and ethical approval from the Medical Research and Ethics Committee (MREC) of Ministry of Health, Malaysia on 7 September 2017 with the registration ID: NMRR-17-1682-36645.

3.0 RESULTS

There was a total of 55 study participants recruited in the study.!The mean age of the study participants was 29.8 (SD=2.09) years old. There were 28(50.9%) males and 27(49.1%) females. The mean body mass index (BMI) among the male participants was 27.4 (SD=3.31) and the mean BMI among female was 25.2 (SD=4.00), $t(46)=2.076$, $p=0.044$. There were 27(48.2%) medical-based participants and 28(50.0%) surgical-based participants. There was no difference in the mean sleeping hours during on call rotation between the medical-based doctors (2.3 ± 1.16 hours) and the surgical-based doctors (2.8 ± 1.25 hours), $t(48) = -1.303$, $p=0.199$. The association between detailed demographic background and Big-Five Inventory (BFI) outcomes among the study participants are depicted in Table 1.

Table 1 Demographic background and Big-Five Inventory (BFI) outcomes among study participants

Variable(s)	Medical-based (*N*=27) *n* (%)	Surgical-based (*N*=28) *n* (%)	*p*-value[a]
Age			0.515
27 – 30 years old	16(44.4)	20(55.6)	
31 – 34 years old	9(60.0)	6(40.0)	
35 – 38 years old	1(33.3)	2(66.7)	
≥ 39 years old	1(100.0)	0(0.0)	
Gender			0.079[b]
Male	17(60.7)	11(39.3)	
Female	10(37.0)	17(63.0)	
BMI			0.200
Underweight	1(100.0)	0(0.0)	
Normal	2(22.2)	7(77.8)	
Overweight / Obese	18(48.6)	19(51.4)	
	Mean (SD)	**Mean (SD)**	***p*-value[c]**
Big Five Inventory			
Extroversion	24.3(5.61)	23.7(5.05)	0.695
Agreeableness	35.9(3.86)	35.1(4.59)	0.492
Conscientiousness	32.1(4.65)	29.5(3.73)	0.035*
Neuroticism	23.0(7.03)	24.5(6.22)	0.435
Openness	32.1(4.48)	32.3(4.37)	0.919
MFSI	30.5(17.14)	23.3(21.51)	0.191
SBP	126.4(13.85)	122.4(15.35)	0.331
DBP	73.8(12.08)	71.2(9.81)	0.421
HR	81.9(12.75)	85.9(10.88)	0.246

Note: *DBP: diastolic blood pressure; HR: heart rate; MFSI: multidimensional fatigue symptom inventory; SBP: systolic blood pressure*

[a]Fisher exact test

[b]Pearson chi-square test of independence

[c]Independent sample *t*-test

**Statistically significant*

Those who scored higher on *Neuroticism* score have lower BMI (r=-0.408, p=0.004). The mean *Neuroticism* score was significantly higher in female than in male, p=0.004. The mean *Conscientiousness* score was significantly higher in medical-based doctors than in surgical-based doctors, p=0.035.

Higher *Extroversion* scores were moderately correlated with higher baseline systolic blood pressure (SBP) (r=0.310, p=0.034), while higher *Neuroticism* score was moderately correlated with lower baseline SBP (r=-0.433, p=0.002). On the other hand, higher *Agreeableness* (r=-0.399, p=0.005) and *Neuroticism* score (r=-0.380, p=0.008) were moderately correlated with lower baseline heart rate. Shorter sleeping hours during on call rotation is moderately correlated with higher multidimensional fatigue symptom inventory (MFSI) scores, r=-0.317, p=0.025.

Table 2 shows the correlation between the five elements of BFI parameters with regards to the BMI, MFSI score, age and gender of the study participants.

Table 2 Correlation between BFI parameters with BMI, MFSI score, age and gender of study participants

	Extroversion		Agreeableness		Conscientiousness		Neuroticism		Openness	
	r	*p*-value[a]	*r*	*p*-value[a]	*r*	*p*-value[a]	*r*	*p*-value[a]	*r*	*p*-value[a]
Age	0.168	0.243	-0.079	0.584	-0.105	0.469	0.034	0.816	0.217	0.131
BMI	0.053	0.726	0.107	0.475	-0.150	0.308	-0.408	0.004*	0.039	0.796
MFSI	-0.069	0.643	0.128	0.386	-0.150	0.308	0.121	0.411	-0.172	0.244
SBP	0.310	0.034*	0.064	0.670	0.266	0.071	-0.433	0.002*	0.065	0.664
DBP	0.115	0.441	-0.180	0.227	0.263	0.075	-0.021	0.890	-0.085	0.568
HR	-0.111	0.456	-0.399	0.005*	0.009	0.953	0.380	0.008*	-0.162	0.276
	Mean(SD)	*p*-value[b]	Mean(SD)	*p*-value[b]	Mean(SD)	*p*-value[b]	Mean(SD)	*p*-value[b]	Mean(SD)	*p*-value[b]
Gender		0.411		0.276		0.257		0.004*		0.949
Male	24.6(5.33)		36.1(3.95)		31.4(3.51)		21.2(6.14)		32.2(4.56)	
Female	23.3(5.24)		34.8(4.51)		30.0(4.99)		26.4(6.05)		32.2(4.28)	

Note: *DBP: diastolic blood pressure; HR: heart rate; MFSI: multidimensional fatigue symptom inventory; SBP: systolic blood pressure*

[a]Spearman correlation test

[b]Independent samples *t*-test

**Statistically significant*

The SBP, DBP and heart rate were noted to vary throughout the medical officers' on call rotation (Table 3).

Table 3 Physiological variation throughout on-call rotation in relation to the monthly on-call frequency

	SBP[A] Mean (SD)	SBP[B] Mean (SD)	SBP[C] Mean (SD)	*p*-value[a]	DBP[A] Mean (SD)	DBP[B] Mean (SD)	DBP[C] Mean (SD)	*p*-value[a]	HR[A] Mean (SD)	HR[B] Mean (SD)	HR[C] Mean (SD)	*p*-value[a]
Overall	123.2(11.60)	124.3(12.97)	119.8(14.50)	**0.006***	71.9(2.09)	72.1(9.34)	76.1(9.27)	**<0.001***	84.7(10.85)	82.9(9.45)	79.3(9.82)	**0.001***
OC-1	126.8(8.64)	136.4(12.76)	128.2(11.78)	0.455	77.6(5.94)	77.4(12.18)	84.4(9.13	0.259	87.0(9.27)	83.4(8.96)	82.8(13.52)	0.269
OC-2	122.7(9.94)	122.7(8.98)	121.3(9.12)	0.716	71.8(5.93)	72.5(8.58)	77.3(5.85)	**0.001***	83.7(11.03)	80.5(11.35)	77.7(8.59)	0.066
OC-3	125.7(14.27)	124.7(15.29)	122.3(16.61)	0.361	72.5(10.33)	72.8(10.13)	76.0(10.99)	**0.048***	83.6(12.33)	84.8(7.36)	80.4(11.09)	0.190
OC ≥4	119.4(11.08)	121.0(13.04)	111.0(15.99)	**0.002***	68.8(7.55)	68.5(7.73)	71.2(8.77)	0.167	86.2(10.23)	83.3(9.69)	78.7(8.80)	**0.002***

Note: *DBP: Diastolic blood pressure; HR: Heart rate; SBP: Systolic blood pressure*
[a]*RM ANOVA*
[A]*Pre-call: Beginning of 24-hour on-call rotation*
[B]*Post-call: Completion of 24-hour on-call rotation*
[C]*End post-call: Completion of 33-hour on-call rotation*
***Statistically significant**!*

The overall SBP was noted to vary significantly at different times of the day (p=0.006), with the highest SBP recorded at the 24-hour point of rotation, and the lowest at the end of rotation, at the 33-hour working point. Medical officers who have undergone more than three on call rotation were noted to have the most significant variation in the SBP throughout the day (p=0.002). Overall DBP were highest at the end of on call rotation, after working for 33 hours in a single stretch, and lowest at the beginning of the on call (p<0.001). On the other hand, the overall heart rate was highest at the beginning of the on call (p=0.001) and there was a significant varying trend in the heart rate fluctuations throughout on call rotation for those with more than three on call per month (p=0.002).

4.0 DISCUSSION

In Malaysia, the clinical training of the medical fraternity begins with a two-year internship program in an assigned public hospital. The current clinical internship in Malaysia is endorsed as shift systems that accumulate up to 60 working hours per week. Competent interns are then promoted to medical officer posts, who easily work for 69 to 84 hours per week, if not more.

Majority of the study participants were between 27 to 30 years of age, which customarily corresponded to junior medical doctor phase. The number of male and female participants was comparable. The nature of the clinical work between the medical-based and the surgical-based specialities varies significantly in practice hence, merit separate analysis. Furthermore, previous studies have shown that there were inter-speciality differences in the physicians' attitudes, clinical approaches, and judgement inclination in given same clinical scenarios (Fürstenberg et al., 2017; Mori, Shimada, Maeda, Morita, & Tsuneto, 2016; Pappas, Gouva, Gourgoulianis, Hatzoglou, & Kotrotsiou, 2016).

Our study found that medical doctors collectively scored highest in the *Agreeableness* element of the BFI, across the different clinical specialities (medical-based *vs.* surgical-based). *Agreeableness* captures the trait of being gentle and compassionate, forgiving and sympathetic (Hengartner et al., 2016), which are requisite characters of a refined healthcare professional hence, the observed dominant trait among the study participants. Among those from the medical-based specialities, *Neuroticism* was the least scored among the five major elements in the BFI, while *Extroversion* was the least scored among the surgical-based doctors.

The mean score of *Neuroticism* was significantly higher in female, which relates to the high prevalence of psychopathology and the high burnout rate among females at workplace (Embriaco et al., 2007; Pappas et al., 2016). Our finding was in agreement with another cross-cultural report from 55 nations that found that women reported higher levels of *Neuroticism*, *Extraversion*, *Agreeableness*, and *Conscientiousness* than did men (Schmitt, Realo, Voracek, & Allik, 2008). *Neurotic* personality trait is associated with anxiety and stress (Spielberger, 2013; Weston & Jackson, 2015) which consequentially inspire health-impairing and risky behaviours such as smoking, drug abuse and suicidal intention (Auerbach, Abela, & Ringo Ho, 2007; Weston & Jackson, 2015).

The mean *Conscientiousness* score was significantly greater among the medical-based doctors than the surgical-based doctors. *Conscientiousness* measures one as being systematic, efficient and meticulous (Hengartner et al., 2016). Our finding was supported by another report which found that the medical-based clinical professionals generally tailored the treatment plan with significant consideration of the patients' comfort and the preference of the family members, apart from observing the standard clinical practice guideline (Mori et al., 2016). Another study exploring the differences in the psychological profiles between the different clinical specialities among Greek doctors also found that surgeons scored significantly higher scores in the hostility psychological subscale in the Symptom Check List 90-Revised (SCL-90-R) questionnaire (Pappas et al., 2016). Lower BMI was also significantly correlated to higher *Neuroticism* score, contradicting another study which found no correlation between the two variables (Hengartner et al., 2016).

Numerous reports have documented the influence of personality on physical health and psychopathology (Hengartner et al., 2016). Medical doctors from medical-based specialities scored higher mean MFSI scores as compared to the surgical-based specialities [30.5(SD=17.14) *vs.* 23.3(SD=21.51)]. This may signify the different pressure of clinical work in different medical specialities. However, there were no significant correlation between MFSI and any of the five elements of BFI.

There were no significant differences in the sleeping hours during the overnight on-call rotation between the different clinical specialties (medical-based *vs.* surgical-based) and across the different gender. This indicates that the duration of sleeping hours during on-call rotation was not influenced by the nature of the clinical speciality and gender, despite several psychological reports of stereotypical labelling the male gender as an opportunist artful dodger, unreliable and lazy (Dworzanowski-Venter, 2008; Sbaratta, Tirpak, & Schlosser, 2015).

Our study also found that less sleeping hour was significantly correlated with higher MFSI score, highlighting the cumulative effect of growing fatigue with disturbed sleeping hours during on-call rotation. The SBP, DBP and HR significantly fluctuated throughout the on call rotation. DBP was noted to be increased at the end of rotation, after a 33-hour working stretch. This is a cause for concern as a sustained elevated DBP over time is damaging for the cardiovascular system.

5.0 CONCLUSION

The study findings illustrated the often-overlooked hazardous effects of long working hours among medical professionals, along with the interplay of personality factors and selective demographic characteristics.

Despite the small sample size, the study has found empirical evidence of the harmful effects of long working hours on the blood pressure and heart rate, hence future studies looking for the sustained cardiovascular changes among medical professionals who routinely work long hours are warranted.

Our findings have implications for future researches in the clinical psychology, particularly in the medical subfield of training and development, the role of gender dynamics and performance appraisal among medical doctors. This study preliminary result also demonstrated the potential projection to involve the residency options and recruitment into various clinical disciplines and sub-disciplines, evaluation of job performance and job retention among medical doctors.

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