Assessment of Personality, Psychomotor Abilities, Spirituality and Team Work in Surgeons Depending on Experience: a Prospective Pilot Study

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Research

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Abstract

Background: A few studies described surgical personality, inquiring all its dimensions, as well as surgeons' psychomotor abilities and propensity for teamwork. Even fewer papers examined their spirituality and its impact on the effectiveness of daily surgical labor. The aim of this paper is to evaluate personality traits, psychomotor abilities and spirituality in surgeons and surgical residents, as well as propensity for teamwork in relation to their work experience.

Methods: The study involved 15 male surgeons aged 40-49 and 15 male surgical residents aged 30-39, who were divided into the case and control group according to their age. The Eysenck Personality Questionnaire, visual stimulus response rate, oculomotor, and manual ability assessments, movement stability testing, intrinsic/extrinsic religious orientation, and teamwork efficiency questionnaires were used.

Results: No statistically significant differences in personality traits, psychomotor abilities, religious orientation, and propensity for teamwork were recorded between surgeons and residents. These may support the specialty choice, and selection of surgical teams helping them to make important professional decisions, which well-affect the patients' outcome.

Introduction

Modern scientific psychology of personality originates in ancient medicine and probably begins with Hippocrates, who tried to explain the differences in emotional response and temperament by the theory of different types of personality (1). Subsequently, there is a stereotype of "surgical personality", which implies extroversion, self-belief, competence, competitiveness, and determination as some of the characteristics that are present in the majority of surgeons. However, only a few studies have attempted to describe a "surgical personality", inquiring all its dimensions, as well as surgeons' psychomotor abilities and propensity for teamwork (2, 3). Even fewer papers examined their spirituality and its impact on the effectiveness of daily surgical labor.

Personality traits are relatively stable individually based elements of neuropsychological dimension (4), which may explain patterns of individual's adaptive and expressive behavior (4, 5).

The psychomotor abilities in minimally invasive and laparoscopic surgery have been the most evaluated so far. Virtual reality has proven useful for the objective assessment of psychomotor skills of laparoscopic surgeons (6). Accordingly, more experienced surgeons have greater control over handling of instruments with a non-dominant hand and greater degree of coordination of two instruments movement (7), they performed significantly faster, were more accurate in using surgical instruments, had fewer errors, and conveyed greater consistency in the procedure performance as a group (8). However, seldom research evaluated the oculomotor skills or visual-spatial perception of a surgeon, which is a better predictor than psychomotor skills, since visual feedback improves surgical performance significantly (9), especially during endoscopic procedures (10).

Different types of individual religious orientations were distinguished (11). Individuals with an intrinsic orientation show greater degree of empathy, are more socially responsible (12), and genuinely believe in the doctrine of their faith, rooted in deep inner beliefs. On the contrary, individuals with an extrinsic religious orientation mostly behave "religiously" only to achieve certain external effects or some selfish goals (13).

Successful surgery and healthcare also depends on effective teamwork (14), which has been recognized as an important factor of good surgical care. Research on teamwork in the operating room is scarce, and only a few studies were aimed at improving surgical team performance (15, 16). Yet, surgical teamwork is at the top of guidelines for good practice (17).

Assessment of surgeon’s psychomotor abilities has recently became a priority when choosing a specialization. Daily exercise in simulated conditions is an important element in these abilities acquisition (18, 19). It is also important to evaluate the surgeon's ability to correct possible defects in the surgical procedures performance (20). Consequently, studies were conducted to examine how psychomotor skills can be measured and evaluated, and have been often unreliable (21). Recently developed methods of technical skills assessment include: the point system of errors, the use of virtual stimuli, the skill analysis system, and the use of global scoring scales (22–24).

The purpose of this paper is to evaluate personality, psychomotor abilities and spirituality in surgeons and surgical residents, as well as their preference for teamwork in relation to their work experience. The foregoing may contribute to the educational process, integration and objectification of candidates’ selection for clinical practice, as well as improve professional performance.

Methods

Sample

The case group consisted of more experienced surgeons (N = 15; aged 40–49 years with working experience of a specialist) and the control group of younger, less experienced surgical residents (N = 15; aged 30–39 years).

Measures

Personality traits. Personality traits were evaluated by Eysenck Personality Questionnaire (EPQ) (25), which measure three basic factors of personality psychoticism (P), extroversion-introversion (E), and neuroticism-emotional stability (N) (26), that are mutually independent (27).

Psychomotor abilities. Psychomotor abilities were evaluated by measuring the response rate to visual stimuli, and by oculomotor coordination and manual abilities assessment.

Reaction time is the time elapsed between a given stimulus and a response to it (28). Total reaction time needed for the task completion was recorded in milliseconds. The task was to respond to the random

ignition of one of four lights.

The mirror-drawing test was used to assess oculomotor coordination. It is a psychological test that evaluates the qualitative reactions (speed and accuracy) of tracing. Following such a method leads to interference between the actual direction of motion and the perceived direction (29). The time needed to complete the task was measured in milliseconds, and the number of errors was recorded. Both were analyzed for accuracy and speed.

The manual ability to perform movements quickly and accurately was assessed using a Minnesota dexterimeter (30). The goal was to complete the task as quickly and accurately as possible.

To check finger dexterity, the participants/respondents underwent the O'Connor Finger Dexterity Test (30). The time needed to complete the task was defined in seconds and logged into the protocol.

A tremormeter was used to test the stability of the arm's movement (30). The task was performed with a dominant and non-dominant hand. The average value of the total number of successful attempts was recorded.

Spirituality. A religious orientation questionnaire was used for spirituality assessment by the Intrinsic and Extrinsic Religious Orientation Scale (SIERO) (31), indicating how much a person is considered a believer, or whether he/she attends church regularly and adheres to its formal customs.

Effectiveness and quality of teamwork. The questionnaire of 6 categories of questions was used to analyze the effectiveness and quality of teamwork (32). It was concerned with a team synergy, a common goal, and skills of each team member, as well as with the use of working materials and innovations.

To examine the success rate of teamwork compliance in the operating room, a Global Technical Skills Assessment Index was used to evaluate the performance of each surgical team member during the surgery (33).

Statistical analysis

The symmetry of continuous variables was tested by the Kolmogorov-Smirnov test. The arithmetic mean and standard deviation were used to represent the mean and the scatter measure of continuous variables, since the distribution did not deviate significantly from the normal one. The Student t-test and the repeated measures test were used to compare investigated variables.

Results

Differences in personality between surgeons and residents were shown in Table 1. The most prominent personality trait in both groups was extroversion, but the difference between the groups was not statistically significant ($p = 0.736$) (Table 1).

Table 1
Difference in personality traits between the case and control group

Personality traits	Case group (Surgeons)		Control group (Residents)		t (df)	P
	M	SD	M	SD		
Psychoticism	3.571	1.988	5.100	2.643	-1.619 (22)	0.119
Extroversion	14.714	4.681	14.100	3.813	0.341(22)	0.736
Neuroticism	7.142	3.231	6.300	3.888	0.579 (22)	0.568
*p < 0.05						

There was a statistically significant difference between the groups in the average response time to one, two, or four stimuli, when analyzing the entire sample (F 2.44) = 10.476; p = 0.004). There was no statistically significant difference between the groups in the overall average response time to the stimuli, regardless of the number of stimuli (F (1.22) = 0.206; p = 0.654) (Fig. 1), as well as between the groups in the average reaction time when increasing the number of stimuli, although there was a tendency for a longer reaction time to multiple stimuli in the case group (F2.44) = 0.962; p = 0.337) (Fig. 1).

There was no statistically significant difference between the case and control group for any of the analyzed parameters in oculomotor abilities (Table 2).

Table 2
Difference in the time of performing the oculomotor task, the number of errors, and the time spent in error between the case and control groups

Time (ms)	Case group (Surgeons) M and SD		Control group (Residents) M and SD		t (df)	p
V star	36.01±	10.36	34.66±	10.54	0.312 (22)	0.758
G star	17.73±	3.85	20.51±	12.05	0.813 (22)	0.425
GU star	1.34±	1.23	2.67±	3.60	1.289 (22)	0.211
Note: *p < 0.05; V star - the time of following a star; G star - number of errors; GU Star - time spent in error						

When testing the manual abilities, there was no statistically significant difference between the groups in the skills of the dominant and non-dominant hand (Table 3).

Table 3
Difference in the manual abilities of the dominant and non-dominant hand (Minnesota dexterimeter) between the case and control groups

Variables	M ± SD values				Student t-test (df)	P
	Case group (Surgeons)		Control group (Residents)			
Dominant hand	173.08±	23.04	176.52±	20.73	0.376 (22)	0.710
Non-dominant hand	186.96±	22.51	195.31±.	36.52	0.693 (22)	0.495
Placement by dominant hand	69.18±	9.24	69.13±	6.52	0.016 (22)	0.987
Placement by non-dominant hand	76.01±	7.78	75,72±	8,09	0.089 (22)	0.930
Rotation by dominant hand	67.66±	8.82	64.68±	5.62	0.940 (22)	0.358
Rotation by non-dominant hand	73.59±	7.93	70.54±	8.02	0.925 (22)	0.365
Note: *p < 0.05						

When testing arm's movement stability, a statistically significant difference in the finger skills was found between the case and control group (p = 0.022) (Table 4).

Table 4
Difference in finger skills between the case and control groups (O'Connor's dexterimeter)

	MS	F	p
Surgeons/residents	1004	1.098	0.308
FingerSkills	2434	6.209	**0.022***
Surgeons/residents* FingerSkills	101	0.258	0.617
*p < 0.05			

There was a statistically significant difference in the finger skills of the dominant hand compared to the non-dominant hand in both groups (p = 0.001), with the task being significantly better performed by the dominant hand (p = 0.001) (Table 5). Statistically significant difference in the stillness of the hand between the groups was not found (Table 6).

Table 5
Difference in finger skills of the dominant and non-dominant hand between the groups (Post-hoc analysis)

Surgeons/ Residents	Dominant/non-dominant hand	Case group (Surgeons)	Case group (Surgeons)	Control group (Residents)	Control group (Residents)
		Dominant hand	Non-dominant hand	Dominant hand	Non-dominant hand
Surgeons	Dominant hand		**0.001***	0.950	0.061
Surgeons	Non-dominant hand	**0.001***		**0.028***	0.830
Residents	Dominant hand	0.950	**0.028***		**0.001***
Residents	Non-dominant hand	0.061	0.830	**0.001***	
*p < 0.05					

Table 6
Difference in movement stability between the groups (tremormeter)

Variables	M ± SD values				Student t-test (df)	P
	Case group (Surgeons)		Control group (Residents)			
Stillness of the dominant hand	6.67±	0.53	6.62±	0.60	0.201 (22)	0.843
Stillness of the non-dominant hand	6.11±	0.97	6.19±	0.43	0.234 (22)	0.817
*p < 0.05						

When testing spirituality and religious orientation, no statistically significant differences between the groups was found. Both groups achieved higher scores on the extrinsic religious orientation in relation to intrinsic orientation (Fig. 2).

The differences in the assessment of teamwork efficiency were analyzed (Table 7). There were no statistically significant differences in the teamwork efficiency in any of the examined categories between the groups.

Table 7
Difference in teamwork efficiency between the groups

Efficiency of teamwork	Case group (Surgeons)	Control group (Residents)	t/Z (df)	P
Synergy in the team (Mdn; Q1-Q3)	3.75 (3.625–3.875)	3.562 (3.125–3.875)	0.936 (22)	0.34‡
Skills (Mdn; Q1-Q3)	3.375 (3.250–3.625)	3.187 (3-3.375)	1.434 (22)	0.15‡
Innovations (M ± SD)	3.250 ± 0.923	3.266 ± 0.703	-0.047 (22)	0.96†
Quality (M ± SD)	3.107 ± 0.837	3.187 ± 0.437	-0.276(22)	0.78†
Common objective (M ± SD)	2.973 ± 0.840	2.962 ± 0.658	0.033 (22)	0.973†
Usage of the working material (M ± SD)	2.785 ± 0.740	2.616 ± 0.137	0.708 (22)	0.486†
Total measure of team success (M ± SD)	3.169 ± 0.747	3.101 ± 0.454	0.255 (22)	0.800†
Note: †t-test; ‡Mann-Whitney U test; *p < 0.05				

Discussion

The purpose of this study was to investigate possible differences in personality, psychomotor abilities, spirituality, and teamwork between surgeons and residents, depending on their work experience.

Equal level of extroversion in both surgeons and residents was emphasized, what is in accordance with the results of other studies indicating that doctors who work in the same field of the medical profession tend to behave similarly (34). Extroverted individuals often choose professions where they can make social contacts, and where they are more motivated by the rewards obtained for better performance (35).

The study investigating the association between personality traits, and career choices among physicians, showed personality differences between medical career and specialty choices, indicating that such differences may develop during education (36). Other researches confirmed consistent relations between personality and academic/professional job performances (35, 37). Higher extroversion and carefulness of surgeons were prognostic factors for specialty choice (38). This indicates that introverted individuals rarely have the opportunity to be enrolled in the screening choice process.

Better verbal skills may benefit job candidates to present themselves better during job interviews (39). Extroverted individuals make more social relationships, seem to be happier, try to make a better impression on their milieu and are generally more socially successful (40). Extroversion with a low level

of neuroticism and a high degree of intelligence is also associated with a speed of mental processing (41). Introverted surgeons are more careful and less risk-averse (42). They process information longer in long-term memory and planning, emphasize the event as a whole, and do not show reduced effects of learning, but they have slightly lower teamwork success (43). Introversion was more emphasized among the medical undergraduates in China, while their European counterparts were more extroverted (44). Probably, traditional, cultural and political society dissimilarities, as well as personality differences may be responsible for this.

Psychomotor abilities are an important predictor of a work success of healthcare professionals. Individuals who were more exposed to video games or who played a musical instrument expressed better efficiency (46). However, only few studies examined an impact of these abilities on medical personnel. Although previous studies have shown differences in the psychomotor skills in relation to experience and age (7, 45), our study did not confirm that, presumably due to relatively small number of respondents enrolled. Additionally, only male and younger surgeons and residents participated in the study, making the investigated sample relatively homogeneous, since age difference between the groups was only 10 years in average.

A study on a group of ophthalmic surgeons who performed a simulated microsurgical testing showed no difference in response time to visual stimuli related to surgical experience (47), what is confirmed by our results.

There was no significant difference between surgeons and residents in the time of performing the task, in the number of errors, and in the time spent in error using the Mirror Star Tracing test. However, the same test was used to confirm the loss of accuracy and precision during the prolonged surgery in fatigued surgeons (48).

Agility is defined as the ability to manipulate surgical instruments with a specific mental representation of the task (49). Therefore, examination of the manual abilities among the surgeons is more about the skills than the accuracy of performing a particular task.

Our data indicate that finger skills are more accomplished in surgeons than residents. However, difference in the finger skills of the dominant hand compared to the non-dominant hand was found in both surgeons and residents, with the task being better performed by the dominant hand.

Hand tremor hasn't been shown to affect the ability to perform microsurgeries, because modern surgical instruments are designed to reduce the tremor effects and to enhance the accuracy of surgery (50). There was no significant difference between surgeons and residents in the assessing of the movement stability, and stillness of the hand.

Up to our knowledge, this research is the first one in Bosnia and Herzegovina that examines and compares extrinsic and intrinsic religiosity between surgeons and residents. There are only a few studies investigating the spirituality of a medical staff. A national U.S. survey showed that overwhelming

majority of doctors believe in God, while simple majority of them believed in some kind of afterlife and were convinced that religion influences implementation of their knowledge in medicine (51). Another study confirmed that religiosity has an important role in surgeons' clinical practice (52).

In this study surgeons and residents expressed higher extrinsic than intrinsic religiosity. Overwhelming extrinsic religiosity found in our study can probably be explained by the trend towards traditional society-encompassing religiosity, which is typical for our culture nowadays.

Extrinsic religiosity is the traditional heritage of the environment we live in, according to the expectations that a person should practice the religious rites of the religion to which he/she belongs. These results indicating higher level of religiosity in this educated population were non-expectant, because religious beliefs tend to decrease as education and income level increase in general.

Successful surgery and healthcare are highly dependent on effective teamwork. According to our results, the differences in the teamwork efficiency between surgeons and residents were not found in any of the examined characteristics. The studies of healthcare teamwork efficiency were mostly hampered by the lack of empirical data, and a distinctive method of teamwork efficiency measuring, what made comparison between them more difficult and complex (53). However, it seemed that surgeons and residents may equally develop technical skills of a teamwork (54).

In conclusion, main differences were not obtained between surgeons and residents in almost all investigated parameters. The younger residents were probably more technically adept because they were exposed to the various technological challenges from early childhood that require manual skills and prompt cognitive response. Therefore, they apparently compensated for the lack of experience in such a way.

However, it is possible that the differences between the groups would be more obvious if older and more experienced surgeons were included. Additional limitation of this pilot study arises from relatively small series, and due to data obtaining from a non-random sample. Hence, further studies on this topic on a larger sample and scale should certainly be needed.

Declarations

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Authors' contributions

All authors certify that we have participated substantially in the design, data collection and organization, as well as in writing the study. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets are available from the corresponding author (Dr. Mladenka Vukojević) on reasonable request.

Ethics approval and consent to participate

Ethics approval was obtained from the University Hospital Ethical Borad. The data used in this research was collected subject to the informed consent of the participants.

Consent for publication

All authors consent to the publication of the manuscript.

Competing interests

The authors declare no potential conflicts of interest.

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Figures

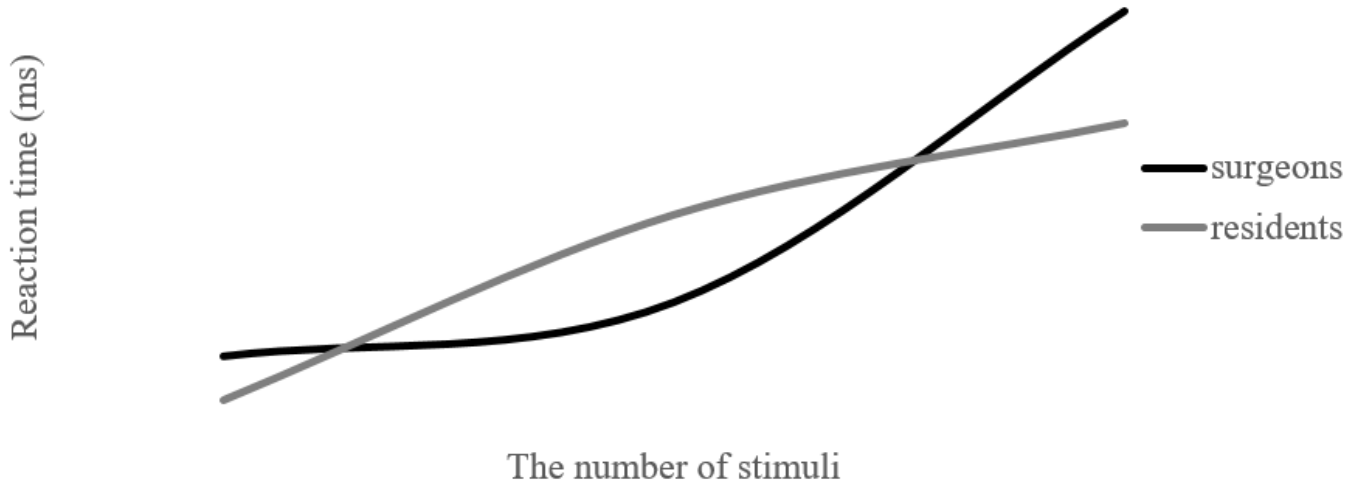

Figure 1

Average reaction time (ms) to visual stimuli in the case and control group

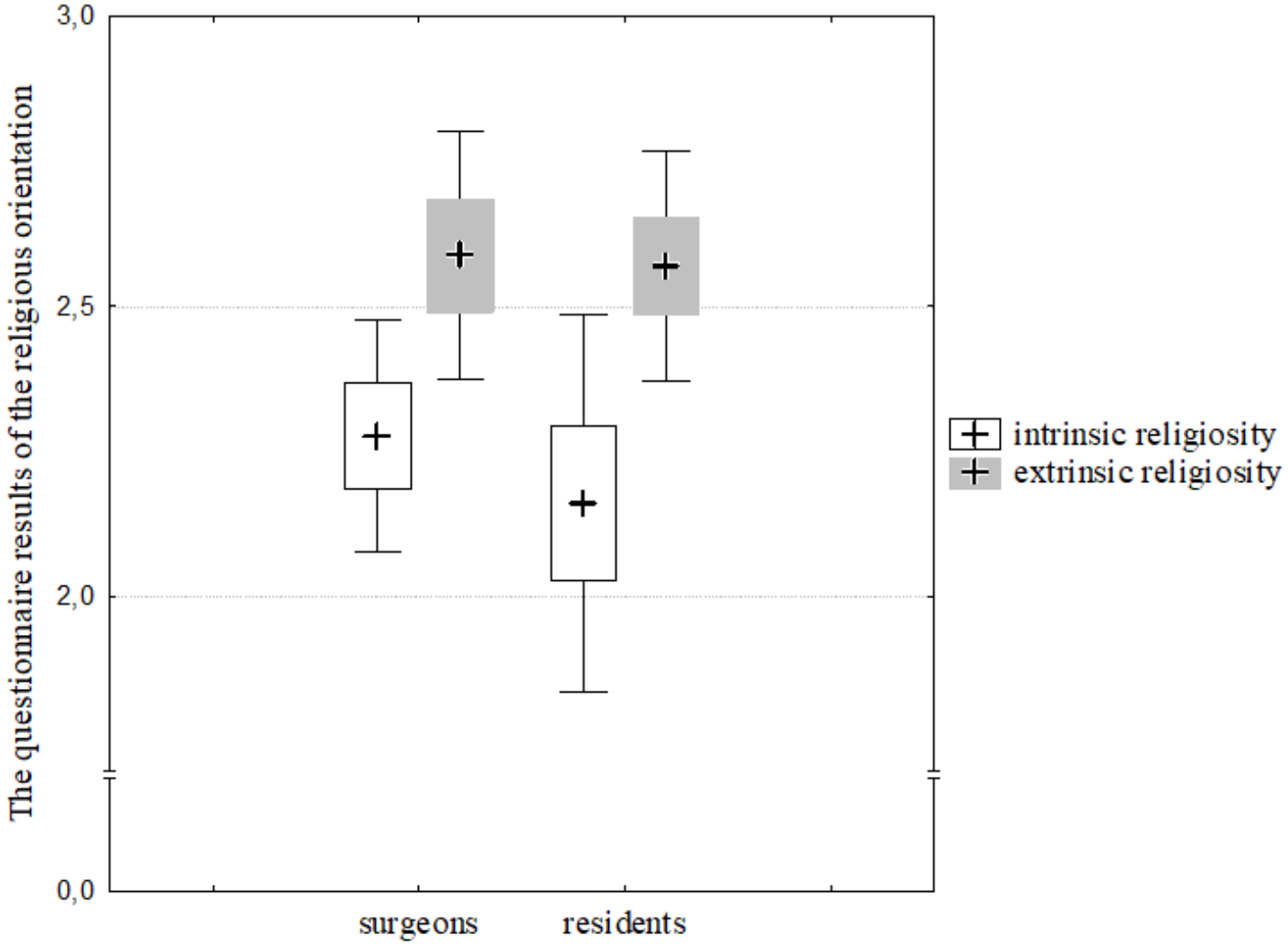

Figure 2

Differences in the religious orientation between the groups