Medical Student Selection: Which Matriculation Scores and Personality Factors are Important?

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Abstract

Sixty-five from a total of 160 medical students were administered the California Psychological Inventory (CPI) to identify which of all 18 scales can be used as a predictor for academic performance. The entrance examination scores of six subjects were also combined with the CPI variables for the purpose of the study. Students' performances were determined by Grade Point Average (GPA) collected between 1993-1997 (year 1 to year 5). Data was analyzed by descriptive and stepwise method of multiple linear regression analysis. The results showed that mathematics, biology and English language were positively correlated with all year GPAs-r^2 value was 10-18 per cent. Scales of "dominance", "flexibility" and "socialization" were positively correlated to the GPA, while "sociability" and "sense of well-being" were negatively correlated. R^2 value was increased to 16-59 per cent as prediction of GPA when the CPI variables were combined with scores of entrance examination. A comparison of this finding with other studies was conducted.

Key word : California Psychological Inventory (CPI), Medical Students, Personality, Performance, Achievement, Prediction

Medical students' personality and performance have been studied for a long time. The correlation between personality characteristics and various kinds of academic performance have been linked and found to be very interesting. The California Psychological Inventory (CPI) is one of the most useful and popular methods used in finding such a relationship[1-3]. In our previous study we found a strong relationship between the entrance examination scores in mathematics, English and biology and the students' Grade Point Average (GPA) in the 5 year curriculum, but only 10-18 per cent of variables were accounted for[4]. There might be other factors involved in such relationships including personality factors[5]. Several studies showed that the personality factor enables percentages of variance to be

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accounted for in medical performance[6]. With this in mind, the authors studied personality factors as the predictor of medical students' performances by taking CPI variables and combining them with Entrance Examination Subjects (EES) scores to predict performance which was determined by GPA. This method was assumed to be increased in power of prediction of performance and might find suitable factors for the medical selection process.

MATERIAL AND METHOD

Sixty-five out of 130 medical students were voluntarily administered the CPI (old version). Scores of CPI and of six entrance examination subjects including mathematics, physics, biology, chemistry, English and general (Thai language and social studies) were analyzed to find the best predictor of GPA. Data on students' grades and Entrance Examination scores were available from college records from 1992-1996.

The CPI

The CPI administered in this study was the old version developed by Dr. Harrison G. Gough and which has been in use since 1957[7]. Even though a new version (1987) has been issued, there is no Thai language edition available as yet. The old version of the CPI was translated into Thai by Dr. Narongsak Chan-nuan and his associates in 1980[8]. Even though it was the old version, it covered the personality factors we wanted to test. The CPI is one of the psychological testing systems, developed for assessing normative behavior in a population that is involved in everyday social living and constructive achievement. It consists of 4 true/false items and 18 scales that measure four aspects i.e. 1) poise, ascendancy, self-assurance and interpersonal adequacy 2) socialization, responsibility, interpersonal values, and character 3) achievement potential and intellectual efficacy and 4) intellectual and interest modes. It takes about 45-60 minutes to administer[9]. The CPI has been used extensively in many studies and places[10]. Consequently, we used the CPI as a psychological test to study which scales are best related to medical students' performance. We chose all 18 original scales as a tool to find the best predictor of scales.

Data was analyzed using Pearson's product moment correlation and multiple linear regression analysis (stepwise method)

Table 1. Mean and standard deviation of independent variables.

Variables	Mean	SD	Minimum	Maximum
General (A)	61.81	5.82	48	78
Mathematics (B)	55.72	11.27	30	91
Physics (C)	57.62	6.58	44	72
Chemistry (D)	55.51	9.16	36	80
English language (E)	62.44	10.26	39	91
Biology (B)	63.26	9.80	39	84
Flexibility (Fx)	8.17	3.74	1	16
Psychological mindedness (Py)	9.63	2.63	3	15
Capacity for status (Cs)	16.17	3.55	7	26
Self acceptance (Sa)	17.86	3.59	11	25
Achievement *via* independence (Ai)	18.30	4.48	7	30
Tolerance (To)	19.21	5.00	8	28
Flexibility (Fe)	19.92	3.43	10	26
Sociability (Sy)	22.76	5.69	3	34
Communality (Cm)	23.54	3.02	14	28
Achievement *via* conformance (Ac)	24.19	4.34	15	22
Self control (Sc)	25.67	7.84	8	41
Dominance (Do)	25.90	5.13	16	35
Self presence (Sp)	28.49	5.37	11	40
Responsibility (Re)	29.00	3.96	19	39
Sense of well-being (Wb)	30.10	5.45	17	39
Intellectual efficacy (Ie)	33.11	5.65	20	43
Socialization (So)	35.21	5.41	23	44
Good impression (Gi)	17.38	5.48	8	28

Table 2. Correlation matrix among variables.

	A	B	C	D	E	F	Fx	Py	Cs	Sa	Ai	To	Fe	Sy	Cm	Ac	Sc	Do	Sp	Re	Wb	Ie	So	Gi
A		-0.184	-0.058	-0.195	0.321	0.029	-0.025	0.190	-0.000	0.022	0.082	0.192	0.175	0.025	0.017	0.053	0.142	-0.048	0.020	0.132	0.95	0.140	0.291	0.071
B			0.284	0.341	-0.178	0.069	0.022	0.021	-0.087	0.095	0.105	-0.225	-0.322	0.011	-0.145	-0.062	-0.028	0.062	-0.221	0.040	-0.030	-0.049	-0.191	0.150
C				0.088	0.000	0.209	0.173	-0.065	-0.047	-0.100	-0.039	-0.233	-0.149	-0.110	-0.045	-0.253	-0.141	-0.161	-0.189	-0.105	-0.069	-0.152	-0.220	-0.106
D					-0.287	-0.158	0.009	0.115	-0.099	0.093	-0.001	-0.186	-0.266	-0.129	-0.048	-0.066	-0.017	0.079	-0.153	-0.095	0.115	-0.042	-0.190	0.166
E						-0.063	0.126	0.266	0.161	0.176	0.157	0.147	0.009	0.018	0.095	0.008	0.087	0.089	-0.049	0.160	0.075	0.141	0.173	0.156
F							-0.016	0.165	0.140	-0.135	-0.079	0.108	-0.187	-0.000	-0.170	-0.010	0.013	0.006	0.121	-0.056	0.028	0.192	0.113	-0.061
Fx								0.121	0.045	-0.276	0.447	0.524	0.058	-0.233	-0.003	0.150	0.240	-0.173	-0.002	0.212	0.213	-0.012	-0.031	0.049
Py									0.529	0.119	0.284	0.481	-0.182	0.345	0.054	0.400	0.640	0.410	0.348	0.325	0.517	0.550	0.252	0.450
Cs										0.235	0.270	0.446	0.038	0.386	0.084	0.272	0.170	0.411	0.460	0.172	0.359	0.533	-0.010	0.265
Sa											-0.074	-0.026	0.007	0.314	-0.011	0.640	-0.292	0.561	0.431	-0.161	-0.008	0.126	-0.038	-0.032
Ai												0.634	0.172	0.043	0.176	0.412	0.543	0.046	0.025	0.424	0.559	0.495	0.184	0.334
To													0.158	0.211	0.250	0.654	**0.713***	0.250	0.288	0.568	**0.779***	**0.783***	0.537	0.524
Fe														-0.075	0.135	0.036	0.330	-0.181	-0.088	0.188	0.054	0.050	0.310	0.041
Sy															0.043	0.354	-0.038	0.521	0.375	0.149	0.174	0.281	-0.005	0.136
Cm																0.077	0.160	0.094	-0.044	0.295	0.192	0.101	0.240	0.141
Ac																	0.639	0.320	0.218	0.501	0.639	0.683	0.527	0.519
Sc																		-0.016	-0.134	0.600	**0.754***	0.564	0.572	**0.733***
Do																			0.589	0.147	0.282	0.334	0.055	0.527
Sp																				0.086	0.270	0.311	0.044	0.009
Re																					0.523	0.476	0.390	0.517
Wb																						0.693	0.440	0.652
Ie																							0.527	0.460
So																								0.368
Gi																								

* $p < 0.05$

RESULTS

Mean and standard deviation of all independent variables are shown (Table 1).

The relationship as shown below indicates low correlation among variables except between To-Ie, Sc-Gi, Sc-To, Sc-Wb, and To-Wb where the correlation coefficient was more than 0.71 (r^2 >0.50). It could be said that it was inappropriate to include the variables "Sc" and "To" in the analysis because of their high correlation with some variables as mentioned earlier. However, as the inclusion of these two variables had no bearing on the results, they were kept in the correlation matrix as shown in Table 2.

When EES and CPI variables were taken into the equation by multiple linear regression analysis (stepwise method), the results showed that only English and mathematics were important in the first year, biology and "Sy" were added in the second year. In the fourth and fifth year, high GPA depended on English, mathematics, "So", "Fx", "Do", and negative "Wb". These variables followed the same pattern in the fifth year, with the exception of "Fx". (Table 4)

R^2 values, standard errors, F-value and significant F of each dependent variables (GPA)

Table 5 shows that after combining CPI variables to EES, it extended r^2 value which indicated that the power of prediction had increased more than two times.

DISCUSSION

Findings show that mathematics, English and biology are the best predictors in a medical course. This corresponds with Mouzan's study(11) which showed that physics, chemistry, English

Table 3. Best fitted model of regression of GPA1-GPA5 on a combination of EES and CPI variables.

GPA 1* = 0.9333 + 0.0160 English + 0.0146 Math; $r^2 = 0.23$
GPA 2 = -0.0237-0.0241 Sociability + 0.0163 Biology + 0.020 English + 0.0149 Math; $r^2 = 0.36$
GPA 3 = 1.5139 + 0.0186 English; $r^2 = 0.16$
GPA 4 = -0.2164-0.0425 Sense of well-being + 0.0341 Socialization + 0.0285 Flexibility + 0.0166 English + 0.0255 Dominance + 0.00181 Math; $r^2 = 0.59$
GPA 5 = 0.4286-0.038 Sense of well-being + 0.027 Socialization + 0.015 English + 0.028 Dominance + 0.014 Math; $r^2 = 0.54$

* GPA 1-5 = GPAs in year 1-5 respectively

Table 4. R^2 value, standard errors, F-value and significant F among dependent variables.

Dependent variables	r^2	SSE	F	Signif F
GPA1	0.23	0.447	8.148	0.0008
GPA2	0.36	0.450	7.482	0.0001
GPA3	0.16	0.513	11.069	0.0015
GPA4	0.59	0.314	12.648	0.0000
GPA5	0.54	0.303	12.130	0.0000

Table 5. R^2 value of GPAs explained by EES comparing with EES + CPI variables.

	r^2 value				
	GPA 1	GPA 2	GPA 3	GPA 4	GPA 5
EES	0.18	0.15	0.10	0.15	0.18
EES+CPI variables	0.23	0.36	0.16	0.59	0.54

(medical college admission test-MCAT) and biology, chemistry, mathematics (high school grade) were predictors of the performance. Astonishingly, chemistry was not taken into the equation as shown in other studies[12]. Biology has been found to play an important role in many studies[13] as well as chemistry which was not found correlated in this study. Chemistry has a positive correlation with performance in many studies. Montague & Odds found that chemistry played a more important role than biology, but this was not found in the present study[14].

Of CPI variables, "Dominance" "Socialization", "Flexibility" were positively correlated to GPA all year round, whereas "Sense of well-being", "Sociability" had a negative correlation. Gough[15] found that "Achievement *via* conformance", "Dominance", "Capacity for status", and "Good impression" had correlation to achievement while Hobfoll et al[16] found "Dominance", "Self-acceptance", and "Sense of well-being" as predictors for performance. Gawrongski and Mathis's study[17] showed that "Dominance", "Socialization", "Self control", "Good impression", "Responsibility", "Achievement *via* conformance" and "Flexibility" differentiated the high achievement groups of students from the low group. McDonald et al[18] studied anesthesiologists' performance using the CPI system and found that there was a correlation in "Dominance", "Independence", "Empathy", "Responsibility", "Socialization", "achievement", "motivation" and "Sense of well-being". (The old version of CPI has no "Independence", "Empathy", "achievement" or "motivation" scales.) We can see that "Dominance" was the common scale in many studies, including in our study, whereas, other scales varied, especially "Sense of well-being" which was positively correlated to achievement in the study conducted by Hobfoll et al and Magargee[19] which contrasts with the present study.

On the power of prediction, we found that r^2 value increased satisfactorily when CPI variables were added. "Socialization" was positively correlated with GPA as it was in the authors' previous study. "Dominance" was found to be the one of the best predictors, as other studies have also found. The role of "Dominance", "Socialization", "Flexibility" 's correlation with achievement had been stated in many studies. This study supported previous findings. Surprisingly, neither "Sociability" nor "Sense of well-being" were suitable for high achievement students which indicates that high GPA occupying students are unhappy and dissatisfied with what they have[20]. Personality factors played an outstanding role in the second year (GPA2). It may be explained that students who had social-like behavior could not adapt themselves to the abrupt changes in their learning style in such a very difficult year. Thus, social-like behavior ("Sociability") had a negative correlation to achievement, although it was not unwanted behavior. Students with a sense of well-being might have less motivation than others, so they study just to pass the examination. How good their grade is depends on how interested they were in particular subjects. Students with low scores in sociability might have spent more time on studying, and achieved higher grades, contrary to the social-like students who like to be involved in extra-curricular activities.

Again, in the fourth year, major changes of learning style occurred. Students had to extensively adapt themselves into their new setting, both academically and socially. The equation showed that students who had high scores on "Dominance", "Socialization" and "Flexibility" gained advantages. This was also evident in the fifth year. This result told us what subjects were important and what personality factors should be considered for the selection process (i.e. "Dominance", "Socialization" and "Flexibility"). However, scores on "Sense of well-being" and "Sociability" scale need not to be low (although it indicates positive correlation with high GPA). "Sociability" as well as "Well-being" are two of the characteristic of a good doctor which most medical students should possess. As we know, studying medicine is very hard. Limitations on time and too much content of subjects make require students to exert great effort to control themselves in their own studying. Students who enjoy social activities do not have enough time for studying which leads to a bad outcome and poor results. (high Sociability)

Although "Sense of well-being" and "Sociability" were negatively correlated with high GPA, they are good characteristics for doctors. Thus, in a selection process, we may ignore scores on such scales. On the other hand, we should try our best to develop these personality factors in our students while they are undergoing their medical training. Other variables such as socio-economic and attitudinal factors may be of benefit in producing doctors

who can work in rural areas. The authors believe that only medical students from relatively low socio-economic status will become doctors who are capable of working in such areas with less stress, but with an attitude which will enable them to play more influential roles in the community. We would like to conclude that the selection process should put more emphasis on other variables.

However, to apply the CPI (especially scales of "Dominance", "Socialization", and "Flexibility") as a tool for selection process may be careful because the study carried out when the samples were in the fifth year by which time their personalities have been changed[21,22]. Although some studies found that personality characteristics had little change in medical courses whether from curricular or extra-curricular influences[23,24]. Longitudinal study of significance of personality factors since admission to the final year need further investigation.

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การคัดเลือกนักศึกษาแพทย์: คะแนนสอบเข้ามหาวิทยาลัยวิชาไหน และ ปัจจัยทางบุคลิกภาพชนิดใดที่มีความสำคัญ

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มีการศึกษาหาการทำนายผลสัมฤทธิ์ทางการเรียน ด้วยคะแนนสอบเข้ามหาวิทยาลัย และลักษณะทางบุคลิกภาพด้วยแบบทดสอบบุคลิกภาพ California Psychological Inventory (CPI) ในนักศึกษาแพทย์ มหาวิทยาลัยเชียงใหม่จำนวน 65 คนที่สอบเข้ามหาวิทยาลัยเมื่อปีการศึกษา 2535 โดยใช้เกรดเฉลี่ย (Grade Point Average) ตั้งแต่ชั้นปีที่ 1 ถึง 5 เป็นตัวบ่งชี้ถึงผลสัมฤทธิในการเรียน ผลการศึกษาพบว่า คะแนนสอบเข้าวิชาคณิตศาสตร์ ภาษาอังกฤษ และชีววิทยาเป็นตัวทำนายผลที่ดี ตลอด 5 ปีการศึกษา และพบว่า บุคลิกภาพ CPI ในมาตรา "การมีอำนาจเหนือผู้อื่น", "การยืดหยุ่น", "การปฏิบัติตัวต่อสังคม" มีความสัมพันธ์ทางบวกกับ GPA ในขณะที่ "ความชอบสมาคม", "ความรู้สึกผาสุก" มีความสัมพันธ์ในทางลบ อำนาจการทำนายผลสัมฤทธิ์ (r^2 value) เพิ่มขึ้นถึง 16–59% เมื่อนำคะแนนสอบเข้ามารวมเข้ากับคะแนนบุคลิกภาพ CPI ในขณะที่เฉพาะคะแนนสอบเข้าอย่างเดียวจะครอบคลุมตัวแปรเพียง 10–18% ผลการศึกษาสอดคล้องกับการศึกษาส่วนใหญ่ และน่าจะเป็นประโยชน์ในการคัดเลือกผู้เข้าเรียนแพทย์

คำสำคัญ : แคลิฟอร์เนีย ซัยโคโลจิคอล อินเว็นทอรีย์, นักศึกษาแพทย์, บุคลิคภาพ, การแสดง, ความสำเร็จ, การทำนาย

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