Predicting Academic Achievement in the Medical School with High School Grades

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Objective: *The present study investigated whether high school grades can predict medical school grades after controlling for the effects of demographics and entrance examination scores.*
Material and Method: *The authors used hierarchical multiple regression analyses to predict medical school grades of 223 medical students in the 1997 entering class of the Faculty of Medicine Siriraj Hospital, Thailand, using age, gender, entrance examination scores, and high school grades as predictors.*
Results: *After controlling for demographics and entrance examination scores, high school grades provided significant prediction only for premedical grades. The type of entrance examination that students took and the type of high school curriculum that the students studied were significant predictors of medical school grades in every level.*
Conclusion: *Measures of cognitive abilities in academic content were good in predicting short-term academic achievement. Long-term academic achievement in the medical school could be better predicted from academic orientation, commitment to the medical study, and demographic traits.*

Keywords: *Predictive validity, High school grades, Medical school grades*

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Selecting students into a medical school is an important step in medical education. Medical curricula are generally a demanding educational process that requires a great deal of cognitive abilities, various kinds of skills, and personal qualities. The medical student selection process aims at enrolling students who have a high probability of completing the medical curriculum successfully. This is done using various kinds of admission criteria including educational background, academic achievement, personal qualities, ethnicity, geography, personal experience, personal interests, and communication skills. Academic criteria account for the largest part of medical student selection decisions around the world[1]. Different countries employ different measures to evaluate academic readiness of medical school applicants. The most common measures are standardized tests of medical aptitude and school grades.

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Medical student admission decisions in Thailand are based mainly on academic achievement, which was traditionally determined by the scores on medical school entrance examination. Prior predictive validity studies of entrance examination scores in predicting medical school grades in Thailand showed that entrance examination scores could explain 12-28 percent of variance in medical school grades, depending on institutional settings and the type of medical school grades under consideration[2-4]. However, selecting students solely by a single test score has been criticized to be inadequate and to be only a cross-sectional indicator of student's aptitude. An additional measure that represents academic achievement over a period of time should be needed.

School grades are the commonly used measure of academic achievement over a period of time. Different countries use different types of school grades to determine the academic fitness of medical school applicants. In North America where an undergraduate degree is a prerequisite for medical school application, undergraduate college grades are used. From the Medi-

cal College Admission Test (MCAT) validity studies, the MCAT scores and undergraduate grades together better predicted medical school performance than either considered alone[5-8]. In countries where students enter medical schools after completing high school, high school grades are considered.

Thai students enter medical schools after they finish their high schools (grades 10-12). High school grades represent academic achievement over a period of time and seem to be an appropriate measure to improve the predictive ability of the entrance examination scores in the same way the undergraduate grades help improve the predictive ability of the MCAT scores in the United States. Nevertheless, high school study is different from undergraduate college study in many ways, including the scope of subjects studied, students' responsibilities, study style, and workload. The predictive value of high school grades might be different from that of undergraduate college grades. However, there has not yet been any study on the ability of high school grades in predicting medical school achievement. This study explored this issue at the Faculty of Medicine Siriraj Hospital, Thailand. The purpose of the present study was to test whether high school grades have significant contribution to medical school grades prediction, above and beyond the prediction from demographic information and entrance examination scores.

Material and Method

Participants

The present study used data collected from the 1997 entering class of medical students at the Faculty of Medicine Siriraj Hospital, Mahidol University and had 224 students. One student did not provide his high school grades. Thus, only 223 students were included in the analyses. These students were admitted from two admission systems: the national entrance (111 students) and the institutional entrance (112 students). The national entrance selected applicants based on their scores on the national entrance examination that was administered by the Ministry of Education. [The national entrance examination scores could be used to apply for any higher education programs of the government universities throughout the country.] The institutional entrance selected applicants based on their scores on the institutional entrance examination of the Faculty of Medicine Siriraj Hospital. [The institutional entrance examination scores could be used only for the medical application at the Faculty of Medicine Siriraj Hospital.] Among the students who were admitted through the national entrance, 61 were male and 50 were female. Their ages at admission ranged from 16 to 20 years with a mean age of 17.86 years. For those who were admitted through the institutional entrance, 62 were male and 50 were female. Their ages at admission ranged from 16 to 19 years with a mean of 17.46 years.

Two types of high school curricula are used in Thailand: traditional and expedited curricula. The traditional curriculum is the standard curriculum that takes three years to complete. The expedited curriculum uses out-of-school self-directed study combined with traditional classroom instruction to shorten the study time to one to two years. Both curricula use the same grading system that ranges from 0 *(fail)* to 4 *(excellent)*. High school Grade Point Averages (GPAs) are the average grades received from all subjects studied in high schools with credit hours weighing. Among students who were admitted through the national entrance, 87 students were from the traditional curriculum, while 24 were from the expedited curriculum. Their high school GPAs ranged from 1.08 to 4.00 with the mean of 3.13. For those who were admitted through the institutional entrance, 86 students were from traditional curriculum, while 26 were from the expedited curriculum. Their high school GPAs ranged from 1.25 to 4.00 with the mean of 3.32.

Predictor variables

Three sets of predictors were used in the present study: demographic variables, entrance examination variables, and high school variables.

***Demographic variables*:** To control for the effects of demographic characteristics of students, age and genders were included in the regression models.

***Entrance examination variables*:** Both the national and institutional entrance examinations assessed students' knowledge in six main subjects taught in high schools: mathematics, chemistry, physics, biology, English, and social science. However, the two tests were not statistically equated and their test scores might be on different scales. To address this issue, the two test scores were standardized before conducting statistical analyses. Another predictor is the type of entrance examination. The type of entrance examination the students chose to participate should reflect their commitment to the program. This might correlate with academic achievement in the medical school, thus qualified this as another predictor. Finally, the predictive ability of entrance examination scores might be moderated by the types of examination. To check for this moderation effect, the interaction term between

the two variables was also considered as another predictor.

***High school variables*:** High school GPAs were average grades of students from all subjects they studied in high schools with credit hours weighing. Since there were two types of high school curricula used, the type of high school curricula that the students studied was another variable of interest. This should reflect their academic orientation. Students who studied in the traditional curriculum preferred spending more time in their high schools to explore various aspects of high school lives. On the other hand, students who studied in the expedited curriculum were generally more academically-oriented and preferred getting to their professional school as soon as possible. In addition, the interaction between high school GPAs and the type of high school curriculum was also studied to explore the moderation effect that high school curriculum had on high school GPAs.

Dependent variables

The medical curriculum used at the Faculty of Medicine Siriraj Hospital is a six-year program, dividing into three major phases: premedical, preclinical, and clinical levels. The dependent variables were grades from these three study levels. Premedical grades are average grades from their first year of study and focus on basic science. Preclinical grades are average grades from their second and third years of study and focus on preclinical sciences. Clinical grades are grades from their last three years of medical school and involve clinical work in clinical departments. These grades are average grades received from all subjects in the corresponding level with credit hour weighing. These grades can range from 0 *(fail)* to 4 *(excellent)*.

All 223 students completed their premedical study, providing complete data set for premedical grades. One female and two male students failed in their second year, leaving 220 students (99%) with preclinical grades. Finally, three female and six male students dropped out from their class during the clinical years and left 211 students (95%) with clinical grades.

Statistical analysis

To test whether high school grades have significant contribution to medical school grades prediction, controlling for the effects of demographic variables and entrance examination variables, hierarchical multiple linear regression was used. Predictors were entered into the regression models in three steps. In the first step, demographic variables (age and gender) were entered to control the effects of these extraneous factors on prediction. In the second step, entrance examination variables (standardized entrance examination scores, type of entrance examination, and their interaction) were entered. Finally, high school variables (high school GPAs, the type of high school curriculum, and their interaction) were entered. To avoid the problem of nonessential multicollinearity, high school GPAs were centered before being put into the regression models[9]. Three regression models were studied, one for each type of medical school grade. When the regression analyses revealed a significant interaction term, post-hoc probing of the moderation effect was studied with regressions that included conditional moderator variables. The moderation effect was then elaborated by the study of the simple slope of the regression line for each group of students[10]. All statistical analyses were conducted under the assumption of a Type I error rate of 0.05.

Results

Premedical grades prediction

In predicting premedical grades with demographic data, age has a significant negative association with premedical grades, = -0.28, t (220) = -4.37, $p < 0.05$. Students who entered the medical school at a younger age tended to do better, academically, in the premedical year. After controlling for the effect of demographics, entrance examination information provided significant improvement in predictive power, $R^2 = 0.29$, F (3,217) = 32.89, $p < 0.05$. Students who had higher standardized entrance scores or took the institutional entrance tended to have higher premedical grades, = 0.34, t (217) = 4.42, $p < 0.05$ and = 0.41, t (217) = 7.42, $p < 0.05$, respectively. There is no significant interaction between entrance examination scores and the type of examination (Table 1).

After controlling for the effect of demographic and entrance examination variables, high school variables also provided significant prediction for premedical grades, $R^2 = 0.07$, F (3,214) = 8.83, $p < 0.05$. Students who studied in an expedited high school curriculum tended to have higher premedical grades than those who studied in a traditional high school curriculum, = -0.28, t (214) = -2.64, $p < 0.05$. Surprisingly, high school GPAs did not provide significant contribution to the prediction of premedical grades, = 0.04, t (214) = 0.27, *ns*. However, there was a significant interaction between high school GPAs and type of high school curriculum, = 0.29, t (214) = 3.31, $p < 0.05$ (Table 1).

A significant interaction between high school GPAs and the type of high school curriculum suggested that the association between high school GPAs and premedical grades had been moderated by the type of high school curriculum. So, studies of simple slopes of high school GPAs on premedical grades for students in each type of high school curriculum were considered. Analyses of simple slopes indicated that high school GPAs have positive relationship with premedical grades only for students who studied in a traditional high school curriculum, = 0.31, t (214) = 4.71, $p < 0.05$, but not for students who studied in an expedited = 0.02, t (214) = 0.27, *ns*.

Preclinical grades prediction

In predicting preclinical grades with demographic data, age has a significantly negative association with preclinical grades, = -0.31, t (217) = -4.80, $p <$ 0.05. Students who entered the medical school at a younger age tended to perform better, academically, in the preclinical years. After controlling for the effect of demographics, entrance examination information provided significant improvement in predictive power, R^2 = 0.13, F (3,214) = 11.58, $p < 0.05$. However, only thee of entrance examination had a significant contribution, but not the standardized entrance scores, = 0.31, t (214) = 4.97, $p < 0.05$ *and* = 0.17, t (214) =1.95, *ns*, respectively. Again, institutional entrance was associated with higher preclinical grades. No significant interaction between entrance scores and the type of examination was noted.

After controlling for the effect of demographic and entrance examination variables, high school variables provided significant prediction for preclinical grades, R^2 = 0.04, F (3,211) = 4.17, $p < 0.05$. Students who studied in an expedited high school curriculum tended to have higher preclinical grades than those who studied in a traditional high school curriculum, = -0.37, t (211) = -3.04, $p < 0.05$. However, high school GPAs did not provide significant contribution to the prediction of preclinical grades, = 0.30, t (211) = 1.95, *ns*. No significant interaction between high school GPAs and the type of high school curriculum was noted, = 0.07, t (211) = 0.65, *ns* (Table 2).

Table 1. Hierarchical regression analysis for premedical grades prediction

Model	Variables		R	R^2	F
1			0.28	0.08	9.62*
	Age	-0.28*			
	Gender	-0.02			
2			0.61	0.29	32.89*
	Age	-0.15*			
	Gender	-0.07			
	Standardized entrance score	0.34*			
	Examination	0.41*			
	?zentscr x exam	0.04			
3			0.66	0.07	8.83*
	Age	-0.07			
	Gender	0.01			
	Standardized entrance score	0.28*			
	Examination	0.34*			
	zentscr x exam	0.04			
	centered (hgpa)	0.04			
	High school curriculum	-0.28*			
	?cenhgpa x hcur	0.29*			

Note: Age = age in years
Gender: 0 = female, 1 = male
Examination: 0 = National entrance, 1 = Institutional entrance
zentscr x exam = standardized entrance score x type of examination interaction
centered (hgpa) = centered score of high school GPA
High school curriculum: 0 = expedited curriculum, 1 = traditional curriculum
cenhgpa x hcur = centered high school GPA x type of high school curriculum interaction
* $p < 0.05$

Table 2. Hierarchical regression analysis for preclinical grades prediction

Model	Variables		*R*	R^2	*F*
1			0.33	0.11	13.05*
	Age	-0.31*			
	Gender	-0.11			
2			0.48	0.13	11.58*
	Age	-0.23*			
	Gender	-0.14*			
	Standardized entrance score	0.17			
	Examination	0.31*			
	zentscr x exam	0.05			
3			0.52	0.04	4.17*
	Age	-0.18*			
	Gender	-0.09			
	Standardized entrance score	0.14			
	Examination	0.26*			
	zentscr x exam	0.01			
	centered(hgpa)	0.30			
	High school curriculum	-0.37*			
	cenhgpa x hcur	0.07			

Note: Age = age in years
Gender: 0 = female, 1 = male
Examination: 0 = National entrance, 1 = Institutional entrance
zentscr x exam = standardized entrance score x type of examination interaction
centered (hgpa) = centered score of high school GPA
High school curriculum: 0 = expedited curriculum, 1 = traditional curriculum
cenhgpa x hcur = centered high school GPA x type of high school curriculum interaction
* $p < 0.05$

Clinical grades prediction

In predicting clinical grades, both age and gender had a significant association with clinical grades, = -0.34, $t(208) = -5.64$, $p < 0.05$ *and* = -0.33, $t(208) = -5.40$, $p < 0.05$, respectively. Students who were female and entered the medical school at a younger age tended to have higher clinical grades. After controlling for the effect of demographics, entrance examination information provided significant improvement in predictive power, $R^2 = 0.11$, $F(3,205) = 11.11$, $p < 0.05$. Students who had higher standardized entrance scores or took the institutional entrance tended to have higher clinical grades, = 0.18, $t(205) = 2.05$, $p < 0.05$ and = 0.24, $t(205) = 4.12$, $p < 0.05$, respectively. There was no significant interaction between entrance scores and the type of examination.

After controlling for the effect of demographic and entrance examination variables, high school variables also provided significant prediction for clinical grades, $R^2 = 0.04$, $F(3,202) = 4.58$, $p < 0.05$. Students who studied in an expedited high school curriculum tended to have higher clinical grades than those who studied in a traditional high school curriculum, = -0.30, $t(202) = -2.65$, $p < 0.05$. However, high school GPAs did not provide significant contribution to the prediction of clinical grades, = 0.18, $t(202) = 1.27$, *ns*. No significant interaction between high school GPAs and the type of high school curriculum was noted, = 0.15, $t(202) = 1.60$, *ns* (Table 3).

Discussion

The present study confirmed the validity of the entrance examination scores in predicting academic achievement in the medical school. After controlling for the effects of demographic variables, the standardized entrance examination scores had a significant contribution in predicting premedical and clinical grades. However, entrance examination scores could not predict preclinical grades. Entrance examination scores were a good predictor of premedical grades because of their content similarity. On the other hand, the prediction of grades in preclinical and clinical years was less accurate because preclinical and clinical content was different from the entrance examination content. Significant pre-

Table 3. Hierarchical regression analysis for clinical grades prediction

Model	Variables		*R*	R^2	*F*
1			0.48	0.23	31.07*
	Age	-0.34*			
	Gender	-0.33*			
2			0.58	0.11	11.11*
	Age	-0.26*			
	Gender	-0.37*			
	Standardized entrance score	0.18*			
	Examination	0.24*			
	zentscr x exam	0.07			
3			0.62	0.04	4.58*
	Age	-0.21*			
	Gender	-0.31*			
	Standardized entrance score	0.16			
	Examination	0.18*			
	zentscr x exam	0.05			
	centered (hgpa)	0.18			
	High school curriculum	-0.30*			
	cenhgpa x hcur	0.15			

Note: Age = age in years
Gender: 0 = female, 1 = male
Examination: 0 = National entrance, 1 = Institutional entrance
zentscr x exam = standardized entrance score x type of examination interaction
centered (hgpa) = centered score of high school GPA
High school curriculum: 0 = expedited curriculum, 1 = traditional curriculum
cenhgpa x hcur = centered high school GPA x type of high school curriculum interaction
* $p < 0.05$

diction of clinical grades might be due to constructs other than the subject content including test-taking ability, problem solving skills, logical thinking, and verbal ability. Nevertheless, academic achievement in preclinical years seemed to depend more on cognitive ability in acquiring preclinical content, leaving less variance for these skills.

The type of entrance examination was a significant predictor for medical school grades in every level. Students from the institutional entrance tended to do better than students from the national entrance. The students from the two systems studied together in the same class throughout the medical curriculum with no differential treatment in instruction and assessment methods. The finding that the institutional entrance recruited students who had higher academic achievement in the medical school could be the result of two things. Firstly, this could be due to the schedule advantage of the institutional entrance examination that took place before the national entrance examination, thus allowing it to recruit a number of qualified students beforehand, and eliminating the needs of these students to take the national entrance examination. Secondly, this might also suggest the contribution of attitudes toward medical study in predicting academic success in the medical school. The institutional entrance examination scores could be used only for the medical school application at the Faculty of Medicine Siriraj Hospital, while the national entrance examination scores could be used for the application for all undergraduate programs in the government universities. Taking the institutional entrance examination suggests a higher degree of commitment toward medical study at the Faculty of Medicine Siriraj Hospital. This positive attitude might also contribute to academic achievement in the medical school.

High school information provided a unique contribution to the prediction of medical school grades in all levels, beyond the predictive ability of demographic and entrance examination variables. However, the variable that consistently provided unique prediction was the type of high school curriculum, not high school GPAs as expected. Academic orientation had significant effects on academic achievement in the

medical school. Students who came from the expedited high school curriculum were generally more academically-oriented. This academically-oriented attitude had a positive effect on medical study. Students from the traditional high school curriculum preferred spending more time in high school to acquire not only academic content, but also extracurricular experience. Although this attitude could be good for medical practice in various ways, this did not show up to support academic achievement in the medical school.

High school GPAs provided a unique contribution to medical school grades prediction only in the premedical year, and only for students from the traditional high school curriculum. High school GPAs of students from the expedited high school curriculum had no predictive value. Because the traditional system of medical school admission never made use of high school GPAs, students in the expedited high school curriculum generally did not take grades in the expedited high school study seriously. Their goal was to pass the basic requirements of high school study and to get high scores in the entrance examination. Thus, GPAs from the expedited high school curriculum were not a good indicator of students' abilities. On the other hand, students in the traditional high school curriculum put their efforts in all aspects of their high school experience. Thus, GPAs from the traditional high school curriculum conveys a valid inference for academic abilities of students. However, due to a significant difference between high school study and medical school study, especially in preclinical and clinical years, high school GPAs could not provide prediction of long-term academic achievement in the medical school. They could provide a prediction only for achievement in a premedical year which still has significant similarities with high school study.

Age and gender could explain a significant amount of variance in medical school grades. Interestingly, their predictive power became more evident in higher level of medical study in which the entrance examination and high school variables gradually lost their predictive power. For premedical grade prediction, age and gender had no significantly unique predictive ability when controlling for the effects of entrance examination and high school variables. Age provided a significantly unique contribution in preclinical grades prediction, but still with less power than the type of entrance examination and the type of high school curriculum. For clinical grades, both age and gender were significantly unique predictors. Gender was the predictor that explained the largest amount of unique variance in clinical grades. Academic achievement in clinical years related more with demographic traits than with academic aptitude measured by entrance examination and high school grades. Certain traits in female students provided a significant benefit for the study in the clinical years. These could be communication skills, sensitivity, delicacy, and flexibility. Additional research is needed to identify the contribution of these traits in academic achievement in a clinical study.

Age was an important predictor of preclinical and clinical grades. Students who entered the medical school at a younger age generally had higher medical school grades than those who entered the school at an older age. On the one hand, this could be due to the academic talent of those who could master the entrance examination at a younger age. On the other hand, this could be the issue of attention. Older students generally have more social responsibilities than younger students. With fewer extracurricular activities, younger students could have more time to focus on their studies.

There are a few limitations in the present study. The first one is the limited population generalizability. The predictive validity study of admission criteria always has limited generalizability due to a restriction of predictor score range included in the regression analyses. Because students with low entrance examination scores are never admitted into the medical school, the entrance score range available for the study was limited only in the high range. This limitation of score variance not only limited the predictive power of entrance examination scores, but also limited the generalizability of the findings to those with low entrance examination scores.

The second limitation is the limited predictive power due to the maturation effect. Because of the long time period between the measure of predictor variables and the measure of outcome variables, maturation was a significant confounding variable in the present study. Premedical grades were measured about one year after medical school entrance. Preclinical grades were determined a couple of years later. Finally, clinical grades were not available until six years after medical school entrance. Maturity and changes in skill levels of students that occurred as a result of medical school instruction should account for a significant degree of degradation in regression coefficients in preclinical and clinical grades prediction.

There was also a limitation in the outcome variables. Academic achievement as reflected by medical school grades is only one of the many indicators of successful medical study. Despite a requirement of

various kinds of skills and abilities to achieve good medical school grades, academic excellence is still the key determinant of these grades. Many non-academic skills are important for good medical practice including communication skills, professionalism, leadership skills, and research skills. Focusing only on an academically dependent outcome provide an incomplete picture of medical training. Other types of outcomes should be considered for future study to provide a better understanding of medical school admission. Other measures of personal qualities and character attributes such as empathy, honesty, reliability, and cultural competence would help complement academic measures used in most predictive validity research in medical education[1]. Medical education research is dominated by the assessment of student performance and satisfaction, lacking the evaluation of patient outcomes[11]. With the growing calls for accountability in health care, it is critical to examine the linkage between medical education and health care outcomes as well[12].

Conclusion

High school GPAs could predict only premedical grades of students from a traditional high school curriculum. The type of high school curriculum that reflected academic orientation was more important in predicting long-term academic achievement in the medical school. Standardized entrance examination scores can provide significant prediction for premedical and clinical grades, but not for preclinical grades. The type of entrance examination that students chose to participate in, which suggested personal commitment toward medical study, was more important in predicting long-term academic achievement. Measures of cognitive abilities in academic content were good only for predicting short-term academic achievement. Long-term academic achievement in the medical school could be better predicted with academic orientation, commitment to the medical study, and demographic traits.

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การทำนายผลการศึกษาในโรงเรียนแพทย์ด้วยคะแนนเฉลี่ยระดับมัธยมปลาย

เชิดศักดิ์ ไอรมณีรัตน์

วัตถุประสงค์*: ผู้วิจัยต้องการประเมินความสามารถในการทำนายผลการศึกษาในโรงเรียนแพทย์ด้วยคะแนนเฉลี่ยระดับมัธยมปลายภายหลังจากการควบคุมความแตกต่างทางเพศ อายุ และคะแนนสอบคัดเลือกเข้าโรงเรียนแพทย์*

วัสดุและวิธีการ*: ผู้วิจัยใช้การวิเคราะห์สหสัมพันธ์พหุคูณชนิดลำดับขั้นเพื่อสร้างสมการทำนายคะแนนเฉลี่ยในโรงเรียนแพทย์ของนักเรียนแพทย์คณะแพทยศาสตร์ศิริราชพยาบาล จำนวน 223 คนซึ่งเข้าศึกษาในปี พ.ศ. 2540 โดยใช้อายุ เพศ คะแนนสอบคัดเลือกเข้าโรงเรียนแพทย์ และ คะแนนเฉลี่ยระดับมัธยมปลาย เป็นตัวทำนาย ตามลำดับ*

ผลการศึกษา*: ภายหลังจากที่ได้ควบคุมความแตกต่างทางเพศ อายุ และคะแนนสอบคัดเลือกเข้าโรงเรียนแพทย์แล้ว พบว่า คะแนนเฉลี่ยระดับมัธยมปลายสามารถทำนายผลการศึกษาในโรงเรียนแพทย์ได้เฉพาะการศึกษาเตรียมแพทย์ แต่ไม่สามารถทำนายผลการศึกษาในระดับปรีคลินิก และ คลินิกได้ วิธีการสอบเข้าโรงเรียนแพทย์ และหลักสูตรที่นักเรียนศึกษาในระดับมัธยมปลายกลับมีความสามารถในการทำนายผลการศึกษาในโรงเรียนแพทย์ได้ในทุกระดับ*

สรุป*: ความรู้ในเนื้อหาวิชาที่ศึกษาในระดับมัธยมปลายสามารถทำนายความสำเร็จในโรงเรียนแพทย์ได้เพียงระยะสั้น ความสำเร็จในการศึกษาระยะยาวในโรงเรียนแพทย์มีความสัมพันธ์กับ อายุ เพศ ความสนใจทางวิชาการ และความมุ่งมั่นที่จะเรียนแพทย์มากกว่าความรู้ในเนื้อหาวิชาที่ศึกษาในระดับมัธยมปลาย*