Correlation of Academic Activity Attendance and Examination Scores of Internal Medicine Residents

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Objective: *Internal medicine (IM) residency training program aims to train competent internists to provide healthcare services to community. Examination is usually done during and at the end of training. Data regarding effect of curricular activity attendance on examination performance are conflicting. This study aims to determine the effect of curricular activity attendance of IM residents on their examination scores and the correlation between in-training examination (ITE) and board certifying examination scores.*

Material and Method: *Activity attendance of IM residents was prospectively tracked during a 6-month period (June to November 2014) prior to ITE. Multivariate regression analysis was used to identify correlation between attendance and examination scores. Correlation between ITE and board certifying examination scores was also examined.*

Results: *The subjects included were 11 and 8 residents in their 2nd and 3rd year of training, respectively. Age, sex and medical school GPA were the same between groups. During the study period, 34 lecture-type activities and 81 case-based non-lecture sessions were provided to residents. Multivariable regression analysis showed that non-lecture activity attendance of more than 65% improve score in clinical skills part of ITE by 10.53% (p-value = 0.003), while every 1.0 point increment in medical school GPA improve clinical knowledge part of ITE by 19.24% (p-value = 0.009). The study showed moderate-to-strong correlation between ITE and board certifying examination scores (clinical knowledge r = 0.72, p-value <0.001; clinical skills r = 0.94, p-value <0.001).*

Conclusion: *Attendance to curricular activities, especially to case-based, non-lecture activities, is beneficial to IM residents as measured by ITE. There was a strong correlation between ITE and board certifying examination scores.*

Keywords: *Internal medicine, Resident, Examination, Activity attendance*

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Internal medicine (IM) residency training process has evolved parallel with progress made in medical science and technology. Advances in information technology have been the utmost important medium for knowledge dissemination. The aim of IM residency training is to train competent internists, who are capable of providing healthcare services to the community. Multi-modality evaluations of the training process and residents are necessary for assurance of competency, professionalism and educational quality.

Internal medicine residency training program in Thailand was established in 1969[1]. The faculty of Medicine Thammasat University started its own IM residency-training program in 2003. The Royal College of Physicians of Thailand (RCPT) has been responsible for the supervision and monitoring of all IM training programs in Thailand. In-training and central evaluations are mandatory for all residents to be certified as internists or physicians. Curriculum designs are composed of learning experiences from didactic lectures, morning reports, journal clubs, topic reviews and also direct learning from patient services. Despite flexible curricular design and time management, residents may not be able to attend all the designated activities due to their service burden, such as intensive care unit or external hospital rotations. The RCPT recommends that all residents should attend at least 50% of all curricular activities to assure residents' knowledge acquisition. However, studies regarding the effect of curricular activity attendance on examination scores of residents showed conflicting results[2-5]. Factors associated with residents' examination scores were activity attendance, year of training, time spent in self-directed learning, age at the start of training, graduation from outside the United States and medical school grade point average (GPA)[4]. Few studies have been published regarding residents' motivations for

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attending conferences[3,6]. However, the value, virtue and culture of residents and faculties in Western and Eastern countries may not be the same[7], and may result in different rate of activity attendance. There were no data on the association between IM residents' activity attendance and examination scores in Thailand before.

The primary aim of this study was to determine the effect of curricular activity attendance of IM residents on their examination scores. Secondary objective of this study was to determine the correlation between in-training examination (ITE) scores and board certifying examination scores of IM residents in our program.

Material and Method

The present study was a prospective, longitudinal observation of residents' attendance to activities provided in the curriculum of IM residency training. The study took place in a University teaching hospital with 600 beds and about 10 IM residents per year. Data collection was done through direct observation of IM residents' attendance or electronic identity card scan in front of the conference rooms during 6-month period from June to November 2014, after which the annual ITE would begin. First year residents were excluded because ITE was partially provided to first year residents. The study received approval from the institutional ethic committee, and conducted in concordance with the Declaration of Helsinki. Informed consent was waived due to the nature of the study.

Data collected, apart from activity attendance, were sex, age, year of training, current rotation and medical school GPA. De-identification mechanisms were used to protect subjects' privacy. The attendance recorded were coded as present, absent, or excused from the conferences. Excused status was pre-defined as the rotations that impede residents' attendance, such as rotating in external hospital or vacation leave.

The ITE and board certifying examinations were divided into 2 major parts, the clinical knowledge and clinical skills part. The ITE was scheduled as annually, but the clinical knowledge part of board certifying examination would take place in the second year of training while the clinical skills part would take place during the third year. Previous studies reported that ITE and board certifying examination were correlated[8-11], so the ITE scores were used for correlation analysis in the primary objective.

Residents' characteristics, divided into two groups according to their year of training, were reported using descriptive statistics. Comparisons between second and third year were done using Chi-square, Fisher's exact test, paired t-test or Mann-Whitney U test where appropriate. Correlations were performed using pairwise Pearson's correlation. Univariable and multivariable regression analysis were performed to determine the effect of factors and reported as regression coefficient. All statistical analyses were performed using Stata® version 13.0 (StataCorp, Texas, USA). Results were considered statistically significant if their *p*-values were less than 0.05.

Results

Nineteen IM residents (11 second year and 8 third year) were included in the study. One hundred and fifteen curricular activities occurred during the study period, including 34 lecture-type activities (including journal club and topic review) and 81 case-based non-lecture activities (for example: morning reports, interesting cases, morbidity/mortality conferences, medical tournaments, clinico-pathological conferences and international case conferences). Characteristics and examination scores of the included residents are as shown in Table 1. Median lecture and non-lecture activities attendance for the whole cohort were 37.93% and 69.70%, respectively. For the purpose of practical interpretation, the cut-offs for lecture and non-lecture activities were defined as 35% and 65%, respectively.

Correlations between activity attendance and ITE scores are shown in Table 2. Significantly positive correlation was found between non-lecture activity attendance and clinical skill part of ITE score in second year IM residents ($r = 0.62$, p-value = 0.042).

Univariable analyses were performed using linear regression. The results are shown in Table 3. Factors with p-value less than 0.1 were included into multivariable linear regression analysis. The results of multivariable analysis are as shown in Table 4.

Board certifying examination scores strongly correlate with the ITE scores, both clinical knowledge ($r = 0.72$, p-value <0.001) and clinical skills part ($r = 0.94$ p-value <0.001) as shown in Fig. 1.

Discussion

Medical knowledge acquisition is one of the key components to achieve high competency and to improve continual medical education. Curricular activity or conference attendance is one of knowledge acquisition methods. The present study added another evidence that curricular activity attendance effects IM

Table 1. Characteristics and examination score of 19 IM residents

Characteristics	Second year (n = 11)	Third year (n = 8)	*p*-value
Female sex	4 (36.36)	5 (62.50)	0.370
Mean age-year (SD)	28.64 (1.21)	28.50 (0.76)	0.782
Mean medical school GPA (SD)	3.31 (0.26)	3.22 (0.31)	0.503
GPA more than 3.25	6 (54.55)	3 (37.50)	0.650
Median lecture-type attendance - % (IQR)	35.29 (32.14-48.28)	43.39 (35.10-47.45)	0.409
Lecture attendance more than 35%	6 (54.55)	6 (75.00)	0.633
Median case-based non-lecture activity attendance - % (IQR)	60.49 (51.85-69.70)	79.32 (72.61-85.98)	0.005
Non-lecture activity attendance more than 65%	5 (45.45)	7 (87.50)	0.147
Mean in-training examination scores - % (SD)			
Clinical knowledge	51.72 (8.15)	53.54 (11.49)	0.690
Clinical skills	57.18 (6.77)	63.53 (11.07)	0.139
Mean board certifying examination scores - % (SD)			
Clinical knowledge	60.76 (7.00)	50.66 (13.6)*	-*
Clinical skills	-	67.49 (4.39)	-

Data in table was presented as n (%) unless indicated otherwise.
IM = internal medicine; IQR = interquartile range; SD = standard deviation
* The clinical knowledge board certifying examination score for third year resident was included only to determine correlation with in-training examination. It cannot be used for other comparison because the examination was done prior to the period of study.

Table 2. Correlations between activity attendance and ITE scores

Correlation	Clinical knowledge		Clinical skills	
	Coefficient (r)	*p*-value	Coefficient (r)	*p*-value
Second year residents				
Lecture-type attendance	0.037	0.913	-0.250	0.459
Case-based non-lecture attendance	0.237	0.483	0.623	0.042
Third year residents				
Lecture-type attendance	-0.110	0.796	-0.178	0.674
Case-based non-lecture attendance	-0.203	0.630	0.153	0.717

The reported coefficients were correlation coefficients.

Table 3. Univariable regression analysis

Variables	Clinical knowledge		Clinical skills	
	Coefficient	*p*-value	Coefficient	*p*-value
Lecture-type attendance more than 35%	-2.35	0.615	-5.34	0.229
Case-based non-lecture activity attendance more than 65%	5.07	0.271	12.46	0.001
Female sex	-10.82	0.008	-7.53	0.071
Third year residency training	1.82	0.690	6.34	0.139
Age (increment of 1 year)	-2.00	0.374	-1.39	0.526
Medical school GPA (increment of 1.00)	24.91	<0.001	18.28	0.014

Table 4. Multivariable regression analyses

Variables	Clinical knowledge		Clinical skills	
	Coefficient	*p*-value	Coefficient	*p*-value
Case-based non-lecture activity attendance more than 65%	1.68	0.602	10.53	0.003
Female sex	-5.40	0.135	-3.03	0.353
Medical school GPA (increment of 1.00)	19.24	0.009	11.05	0.083

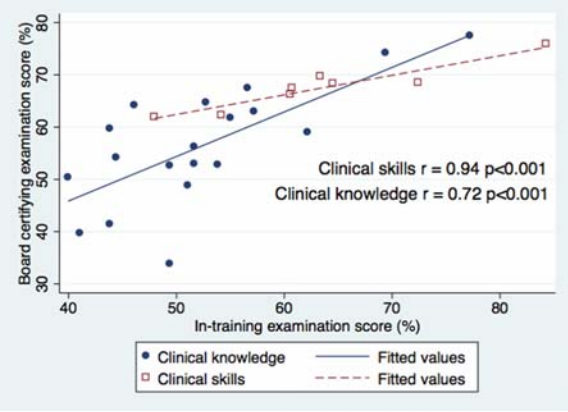

Fig. 1 Correlation between ITE scores and board certifying examination scores by RCPT.

residents' examination scores in concordance with previous studies[4,5], specifically the effect of non-lecture activity attendance on clinical skills examination score. The study shows that attendance of non-lecture activities more than 65% improves clinical skills examination score by 10.53% when adjusted for sex and medical school GPA. Previous study reported that active learning process could help residents to acquire knowledge with improved satisfaction[12]. Non-lecture activities could provide such process better than lectures because residents have to prepare their cases or topics themselves. Most of them included pathognomonic clinical signs or laboratory results so that attendance to these activities was associated with improvement in clinical skills as confirmed in the present study result.

Although medical knowledge acquisition has traditionally been achieved through lectures, the present study showed no correlation between lecture attendance and ITE scores of IM residents. Lecturing is mostly a one-way communication, which imparts information to passive learners by lecturers[13]. Efficacy of lecturing on knowledge retention or examination score is currently debatable[2,3,5]. Lecturing may not be the best way to improve examination scores of IM residents. However, results needed to be interpreted carefully because of overall low rate of lecture attendance in this study. Appropriate interventions need to be done to improve lecture attendance such as integrating audience response system[14]. Study regarding Thai IM residents' motivation to attend conferences may help in this process as it has been done in the US[6].

The present study showed that medical school GPA was significantly correlated with clinical knowledge examination scores. Residents with high GPA may be studious and have good knowledge retention and application skills. The result was similar to a previous study[15]. There was also a trend of correlation between GPA and clinical skills score. This could be explained that clinical skills examinations test various modalities such as history taking, physical examination and laboratory results interpretation. All of these modalities would need practicing, apart from knowledge retention and application.

The causality of activity attendance on examination scores cannot be confirmed with the present study design. One might argue that activity attendance may be just a marker of residents' perseverance. If that is the case, then the effect of lecture and non-lecture activity attendance on examination scores should not be different as shown in the present study.

The present study has its limitation. It is a single institution cohort with a small sample size. Some of the effects may be present, but not statistically significant with this low number of subjects. Moreover, the results of board certifying clinical skill examination was not available in the study, thus the effect of intrinsic institutional effect cannot be excluded. Studies carried out in larger settings or preferably multi-institutional may help in confirming the results of the present study.

Conclusion

Non-lecture activity attendance of IM residents is significantly associated with better score in clinical skills part of in-training examination. Medical school GPA predicts high score in clinical knowledge part of in-training examination. Improvement in ITE score is also associated with better board certifying examination performance. Overall lecture attendance in this study is too low to conclude whether lecture attendance has effect on examination score or not. Attendance to curricular activities, especially to non-lecture activities, is beneficial to IM residents as measured by ITE.

What is already known on this topic?

Medical knowledge acquisition is achieved during the course of medical education. Most curricula provide teaching in traditional lecture format, despite its uncertain effectiveness. During the past few years, medical educators try to develop innovative teaching to facilitate better learning process. Non-lecture academic activities, such as topic reviews, journal clubs, interesting cases etc., have increasingly been incorporated to the curricular designs. The effect of curricular activity attendance on examination scores of internal medicine residents is currently debatable with conflicting results from published studies.

What this study adds?

This study adds another body of evidence that curricular activity attendance is significantly correlated with in-training examination scores of internal medicine residents. The study also demonstrates that in-training examination scores are significantly associated with board certifying examination scores.

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Potential conflicts of interest

None.

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ความสัมพันธ์ระหว่างการเข้าร่วมกิจกรรมวิชาการกับคะแนนสอบระหว่างการฝึกอบรมของแพทย์ประจำบ้านอายุรศาสตร์

วศิเทพ ลิ้มวรพิทักษ์

วัตถุประสงค์: *การฝึกอบรมแพทย์ประจำบ้านอายุรศาสตร์เป็นไปเพื่อให้ได้มาซึ่งอายุรแพทย์ที่มีความรู้ความสามารถเพื่อบริการสังคม โดยจะมีการสอบประเมินผลในระหว่างและเมื่อสิ้นสุดการอบรม ยังเป็นที่โต้แย้งกันว่าการเข้าร่วมกิจกรรมวิชาการมีผลต่อคะแนนการสอบของแพทย์ประจำบ้านหรือไม่ การศึกษานี้จึงจัดทำขึ้นเพื่อหาความสัมพันธ์ดังกล่าว รวมทั้งต้องการทราบความสัมพันธ์ระหว่างคะแนนสอบระหว่างการฝึกอบรมและคะแนนสอบเมื่อสิ้นสุดการอบรม*

วัสดุและวิธีการ: *การศึกษาไปข้างหน้าโดยบันทึกการเข้าร่วมกิจกรรมวิชาการของแพทย์ประจำบ้านในช่วงเวลา 6 เดือนตั้งแต่มิถุนายนถึงพฤศจิกายน พ.ศ. 2557 ก่อนการสอบประเมินผลระหว่างการฝึกอบรม ทำการศึกษาผลของการเข้าร่วมกิจกรรมวิชาการต่อคะแนนสอบและหาความสัมพันธ์ระหว่างคะแนนสอบระหว่างการฝึกอบรมและคะแนนสอบเมื่อสิ้นสุดการอบรม*

ผลการศึกษา: *แพทย์ประจำบ้านชั้นปีที่ 2 และ 3 จำนวน 11 และ 8 คน ตามลำดับเข้าร่วมการศึกษา อายุ เพศ และเกรดเฉลี่ยไม่มีความแตกต่างกันระหว่างสองชั้นปี มีการจัดกิจกรรมวิชาการเป็นการบรรยาย 34 ครั้งและกิจกรรมวิชาการอื่นๆ อีก 81 ครั้ง การศึกษาแบบ multivariable regression พบว่าการเข้าร่วมกิจกรรมที่ไม่ใช่การบรรยายมากกว่าร้อยละ 65 เพิ่มคะแนนสอบภาคปฏิบัติร้อยละ 10.53 ($p = 0.003$) และเกรดเฉลี่ยที่เพิ่มขึ้น 1.0 เพิ่มคะแนนสอบภาคทฤษฎีร้อยละ 19.24 ($p = 0.009$) คะแนนสอบระหว่างการฝึกอบรมมีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญ (ภาคทฤษฎี $r = 0.72$, $p<0.001$, ภาคปฏิบัติ $r = 0.94$, $p<0.001$)*

สรุป: *การเข้าร่วมกิจกรรมวิชาการโดยเฉพาะกิจกรรมที่ไม่ใช่การบรรยายมีประโยชน์ต่อแพทย์ประจำบ้าน โดยสัมพันธ์กับคะแนนสอบประเมินผลระหว่างการฝึกอบรม*