Original Article

Interest and experience of anaesthesiology residents in doing research during residency training

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Access this article online

Website: www.ijaweb.org

DOI: 10.4103/ija.IJA_543_18

Quick response code

ABSTRACT

Background and Aims: The SingHealth Anaesthesiology Residency Program is a 5-year postgraduate training programme whose curriculum covers clinical and academic training, through research and educational activities. This study aimed to describe the needs of the residents in promoting research participation during residency. **Methods:** After obtaining ethics committee approval, we conducted an online anonymous survey among all residents in the Residency Program. The questionnaire comprised questions of demographic data, levels of research interest, areas of interest, the obstacles to research and the potential areas where help can be improved. SAS (version 9.4, 2017; SAS Institute Inc.) was used for descriptive analysis and logistic regression. **Results:** Sixty-seven of the 79 residents (84.8%) in the Program responded with 58 (73.4%) completing the survey. Fifty-six of the 62 (90%) expressed some level of interest in research. The top two areas of research interest were clinical research and medical education research. The top obstacles to research were lack of time (due to competing clinical time and work–life balance) and lack of mentorship. The top three areas of research support needed by residents were supervised research protected time, departmental research manpower support and mentorship with topic expertise. Senior Residents were more likely to have higher research interest, self-initiated research participation and consideration for research as part of career progression, compared with junior residents. **Conclusion:** Residents faced many obstacles in doing research during residency training. Our findings also highlighted some of the needs for research support reported by the residents during their specialty training.

Key words: Academic medicine, research, Residency Program

INTRODUCTION

The SingHealth Anaesthesiology Residency Program (SHARP) provides Anaesthesiology postgraduate training and it is governed by the policies of the Accreditation Council Graduate Medical Education – International (ACGME-I). SHARP covers a wide range of clinical anaesthesia training and scholarly activities over 5 years. Research activities are an integral part of the residency training within the scholarly activities of the Program and are incorporated to advance Academic Medicine.[1]

Being involved in research promotes critical thinking, helps with identifying potential clinical gaps and promotes lifelong learning, all of which are essential in the current and future development of an anaesthesiologist. It is an important skill in residency training, particularly in the competency of practice-based learning and improvement.[2] This requires residents to critically understand and incorporate scientific evidence related to patients'

How to cite this article: Truong HT, Chan JJ, Leong WL, Sultana R, Koh DL, Sng BL. Interest and experience of anaesthesiology residents in doing research during residency training. Indian J Anaesth 2019;63:42-8.

health problems and treatment into clinical practice. Furthermore, research experience gained during the formative years such as the residency period could influence residents' career choice to pursue an academic career. Residents who have completed research projects, received funding and presented their works at scientific meetings are more likely to pursue academic medicine careers.[3]

A previous study conducted in internal medicine in the same academic medical centre found that research training was appreciated by residents in training.[4] However, detailed analysis found the voluntary participation rate to be low at 32.9%. This could be attributed to heavy clinical duties, lack of time, mentorship and faculty support. Limited exposure to research training due to residents' clinical duties and work hour restriction is commonly reported, not only in internal medicine but also in other specialties such as surgery, psychiatry and dentistry. Similarly, the lack of mentorship and support is not confined to anaesthesiology but other specialties as well.[5,6]

The objective of this study was to investigate our anaesthesia residents' opinion on research, barriers to research and also assess needs of the residents to conduct research.

METHODS

We obtained waiver of participation consent from the relevant institutional ethics committee where the study was executed. An online survey was conducted using a self-administrated questionnaire. The online survey was made available for 2 months (November to December 2017). The questionnaire was composed of 21 questions, divided into two main sections: (1) demographic information and (2) level of research interest, research experience and required help in research.

The five demographic questions asked participants about gender, age, marital/parental status, current residency year and medical education information. In the second section, information collected was on the area of research interest, past and current research involvement, self-perceived research skill competency level, obstacles in doing research, proposed support measures and recommended research training details. Most of the questions were in multiple choice format, in which some questions allowed multiple applicable answers. The question on level of interest in research was scored using Likert scale with the five available options ranging from *Not at all interested* to *Extremely interested*. All the questions with an *Other* in one of the response options included a free-text box for alternative responses. The questionnaire also included an option at the end for the residents to input text if they had any further comments, feedback or concerns. The questionnaire was first developed by two study investigators, of whom one is a Core Faculty in the Residency Program. The survey was then sent to a faculty physician and the Residency Program Director for feedback on content validity, relevancy and readability. The revised questions were pretested on a senior resident. Subsequently, we piloted the survey on seven other members of the Residency Program and two members of the Anaesthesiology and Perioperative Science Academic Clinical Program to ensure reliability and clarity. These contributors did not participate in the study and had no prior knowledge about the study. When the survey instrument had been confirmed of its readability, clarity and validity, all the study investigators went through a final round of checking the questions. Data collection only commenced when all authors agreed on the final version of the questionnaire.

All 79 of the residents – junior and senior – in the SHARP were invited to participate in the study. In Singapore, SHARP is the largest programme in the country. It has the highest number of residents compared with two other Anaesthesiology Residency programmes in the nation. The SHARP curriculum spans over 5 years. Junior residents (JR) are those in the first 3 years of the programme. Following the ACGME-I guidelines, JRs must complete a set of requirements to graduate to Senior Residency. Senior Residents (SR) are residents in the last 2 years of the residency programme. By the end of Senior Residency Year 2, SR are required to take an exit examination. Residents who complete the first 3 years of SHARP but have not passed the Master in Medicine (MMed) Anaesthesiology examinations are called Resident in Medical Officer Posting Exercise (MOPEX-R).

As residents rotate through different training modules in the six anaesthesia departments of three major hospitals in Singapore, an online survey was thought to be the most suitable format of the study instrument. The questionnaire was generated and stored in an online survey platform powered by LimeSurvey in the secured portal of the Residency Program. The survey tool generated unique links to invite participants via emails and anonymised responses were collected. Survey participation invitation emails were sent out to all residents in the programme.

Weekly reminders were generated until the survey ended. Survey participation was on a voluntary basis without a renumeration component.

All demographic and research experience data were summarised as frequency with corresponding percentage for categorical data and mean (standard deviation) or median (interquartile range), whichever appropriate, for continuous data. Research interest was treated as binary categorical data with categories *interested* and *not interested*. *Extremely interested*, *very interested* and *somewhat interested* were treated as *interested category*, whereas *slightly interested* and *not at all interested* were treated as *not interested* category of outcome variable research interest. The internal consistency of the questionnaire was measured using Cronbach's alpha. Univariate and multivariable logistic regression was used to identify independent factors for being *interested in doing research*. Variables with P value <0.05 in the univariate logistic regression method were chosen for multivariate model, and stepwise regression method was used to find multivariable model. Based on the rule of thumb, multivariable logistic regression models should be used with at least 10 events per predictor variable. Based on our data, the proportion of trainee interested in doing research is 72.6% (~45/62). Based on recommendation, we could adjust for a maximum of 45/10 ≈ 4 variables in the multivariate model. We adjusted for the following variables: *type of previous involvement in research: data mining*, *type of previous involvement in research: manuscript submission for publication*, *reason for taking part in research activity: interested in the study (voluntary participation)*, *area of research interest: not applicable*, *area of research interest: clinical*, *obstacles in doing research: lack of personal interest* and *obstacles in doing research: lack of research skills*. We applied a stepwise variable selection method to produce a final multivariate model. We also checked Akaike Information Criterion and area under the curve manually by adding other selected variables one by one on top of the final multivariate model. Association from logistic regression was expressed as odds ratio (OR) with 95% confidence interval (CI). For all statistical analyses, two-sided P value <0.05 was considered statistically significant. SAS (version 9.4, 2017; SAS Institute Inc.) was used to analyse the data.

RESULTS

A total of 79 invitations to the online survey were sent, and several reminders were given to optimise the response rate. We received 67 responses (84.8%), of which 58 (73.4%) were fully completed. Descriptive results included answers from the incomplete questionnaires. Only 25 (39.7%) responders were SR. All the SR completed their MMed examination [Table 1].

Fifty-six of the 62 (90.3%) expressed some level of interest in research ranging from *slightly interested* to *extremely interested*. Thirty (50.0%) residents professed to have *somewhat interest* in research, whereas two (3.2%) were extremely interested in doing research. The top two areas of research interest were clinical research (n = 53) and medical education research (n = 26). There was also reported interest in medical technology related research. Figure 1 shows

Table 1: Demographic of survey participants

	Summary
Gender, *n* (%)	
Male	19 (28.8)
Female	47 (71.2)
Age (years)	
Median (range)	30.0 (27-39)
Marital/parental status, *n* (%)	
Single	33 (52.4)
Married without child	19 (30.1)
Married with child/children	11 (17.5)
Current year, *n* (%)	
Resident 1 (R1)	4 (6.4)
R2	15 (23.8)
R3	15 (23.8)
Medical Officer Posting Exercise - Resident	4 (6.4)
Senior Resident 1 (SR 1)	10 (15.8)
SR2	15 (23.8)
Highest degree, *n* (%)	
MBBS	23 (36.5)
MD	8 (12.7)
MMED	32 (50.8)
MD-PhD	0 (0.0)
PhD	0 (0.0)
MCI	0 (0.0)

MBBS – Bachelor of Medicine, Bachelor of Surgery; MD – Doctor of Medicine; MMED – Master of Medicine; PhD – Doctor of Philosophy; MCI – Master in Clinical Investigation

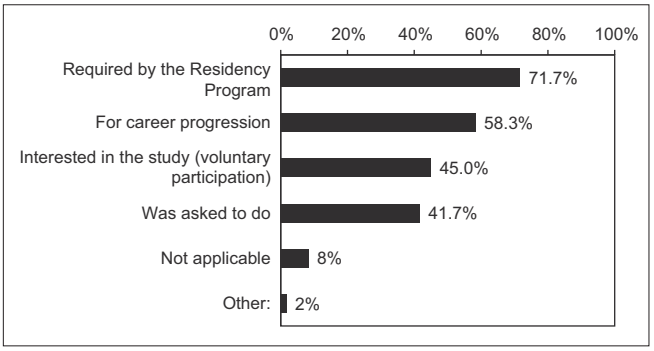

Figure 1: Bar graph showing reasons for taking part in research

the most common reasons for taking part in research. Cronbach's alpha with and without missing data was 97.51% and 96.05%, respectively, indicating a reliable measuring scale of research interest level and other related dimensions.

When asked about previous research involvement, the most frequently cited activities were related to data, such as data collection and entry. However, only 18.0% of the residents had drafted and submitted a grant application [Table 2]. Multivariate analysis showed that residents volunteered to participate in research projects [OR (95% CI) 11.108 (1.727, 71.461), $P = 0.0112$], and residents who were in departments with research manpower support [OR (95% CI) 5.669 (1.365, 23.548), $P = 0.0169$] were independently associated with an increased chance of being interested in doing research.

Table 2: Research interest, training and experience

	All residents
Level of interest in research, *n* (%)	
Extremely interested	2 (3.2)
Very interested	12 (19.4)
Somewhat interested	31 (50.0)
Slightly interested	11 (17.7)
Not at all interested	6 (9.7)
Area of research interest (choose all applicable), *n* (%)	
Clinical	53 (88.3)
Education	26 (43.3)
Health services	18 (30.0)
Medical technology	18 (30.0)
Basic science/translational	3 (5.0)
No interest	5 (8.3)
Others	0 (0.0)
Previous research activities (choose all applicable), *n* (%)	
Data collection	50 (81.9)
Data entry	49 (80.3)
Conference abstract/poster writing and submission	48 (78.7)
Manuscript writing	47 (77.0)
Conference oral and/or poster presentation	45 (73.8)
Research Ethnic Review Board application submission	41 (67.2)
Data analysis	36 (59.0)
Study design	31 (50.8)
Manuscript submission for publication	29 (47.5)
Data mining	25 (40.9)
Thesis writing	17 (27.9)
Grant application drafting and submission	11 (18.0)
Others: case series review, bench work	2 (3.2)
None	0 (0.0)
Previous research training (choose all applicable), *n* (%)	
Extensive training (i.e., completed a Master of Science, or a Master of Clinical Investigation or a Doctor of Philosophy)	0 (0.0)
Some training (e.g., attended workshops and lectures, able to perform some research activities with confidence)	31 (51.7)
No training	29 (48.3)

During the survey, among the residents 20 (33.3%), 20 (33.3%), 11 (18.3%) and 9 (15.0%) were involved in no project, one project, two projects and three or more projects, respectively. The results showed that 12 (20.0%) residents did not spend any time doing research, whereas 46 (76.7%) indicated spending between 1% and 10%, which was 8 h or less each week, conducting research work. Only two residents declared that research time took up between 10% and 50% of their time in a week, which was between 8 h and up to 40 h.

The obstacles to resident research were manifold and varied. The top three obstacles to resident research were lack of time (due to competing clinical time; 83.1%), lack of mentorship (66.1%) and lack of time (work–life balance, need for family time; 64.4%). The option for 'lack of mentorship' gave several examples to survey respondents, such as the unavailability of suitable mentors or mentor with inadequate mentoring interest/experience [Figure 2]. To overcome the research obstacles, the top three areas of support needed were supervised research protected time (74.6%), providing departmental research manpower support (72.9%) and mentorship with topic expertise (67.8%) [Figure 3].

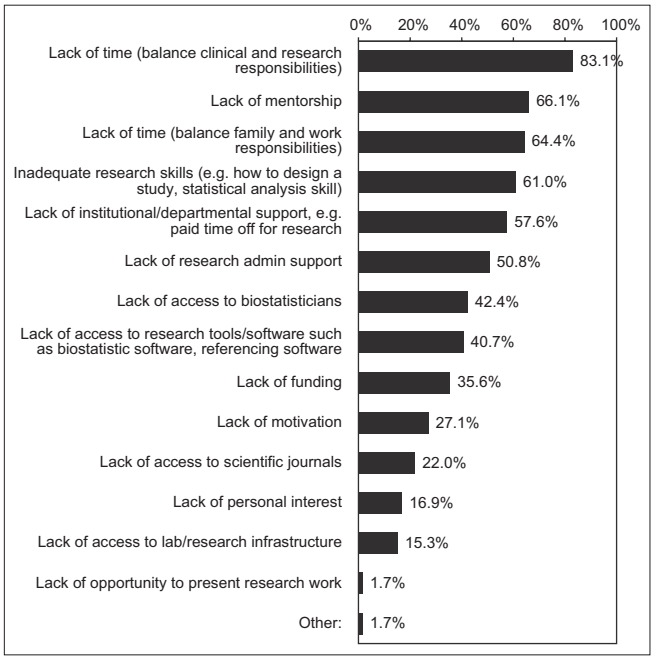

Figure 2: Bar graph showing obstacles in doing research

Perception of research resource availability was assessed. Thirty-one (53.4%) residents reported that they knew about free biostatistics consultation services available. Twenty-seven (46.5%) residents knew that funding for research can be obtained from an available Pilot Research Grant scheme, other institutional internal grants and other external grants. Twenty-four (41.4%) residents were aware of other resources provided by the institutions such as librarian services, availability of referencing tool such as Endnote (n = 21, 36.2%) and a research clinic by the Clinical Research units in various institutions (n = 13, 22.4%). There were six (10.3%) residents who had no knowledge of the existing research supports provided by the departments and institutions.

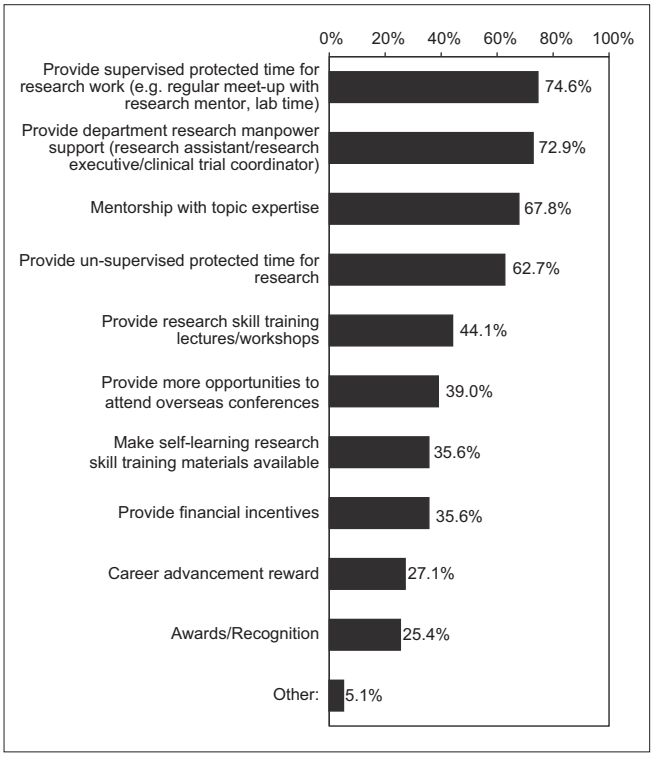

Figure 3: Bar graph showing factors to encourage more research involvement

The study investigated what training the residents required. Basic biostatistics (n = 42, 72.4%), study planning (n = 38, 65.5%), manuscript writing and publication (n = 37, 63.8%) and grantsmanship (n = 32, 55.2%) were the top skills residents indicated. The most preferred frequency of research training was once every 3 months (n = 25, 43.1%) and the duration of research training workshop was half a day on a weekday (n = 26, 36.2%).

SR were more likely to have higher research interests compared with JR (24/25 vs. 35/37, P = 0.020) and considered research activities crucial for career progression (18/24 vs. 17/36, P = 0.030). It was noteworthy that the SR highlighted career advancement reward was important to encourage more research involvement (11/24 SR vs. 5/35 JR, P = 0.007). Many SR found the importance of gaining grantsmanship skills (73.9% SR vs. 42.9% others, P = 0.020). These skills are critical once the SR exit the Residency to become junior faculties [Table 3].

DISCUSSION

This study conducted in a Singapore Academic Medical Centre found that a majority of Anaesthesiology

Table 3: Univariate analysis of research perspective of SR (n=25) vs R/R in Posting Exercise (MOPEX-R) (n=38)

	Current year		*P* (*t*-test/ Chi-square)
	R1-R3/MOPEX-R (n=38)	SR1-SR2 (n=25)	
Level of research interest, *n* (%)			
Extremely interested	2 (5.4)	0 (0.0)	0.020
Very interested	7 (18.9)	5 (20.0)	
Somewhat interested	13 (35.1)	18 (72.0)	
Slightly interested	13 (27.0)	1 (4.0)	
Not at all interested	5 (13.5)	1 (4.0)	
Reasons for taking part in research activity, *n* (%)			
For career progression	17 (47.2)	18 (75.0)	0.030
Obstacles in doing research, *n* (%)			
Lack of institution support, e.g., paid time off	16 (45.7)	18 (75.0)	0.020
Lack of administrative support	13 (37.1)	17 (70.8)	0.010
Lack of access to biostatisticians	11 (31.4)	14 (58.3)	0.040
Lack of access to tools, e.g., referencing software	9 (25.7)	15 (62.5)	0.004
Helpful support to encourage research participation: make self-learning material available	8 (22.9)	13 (54.2)	0.010
Helpful support to encourage research participation: career advancement reward	5 (14.3)	11 (45.8)	0.007
Useful topic for research training: grant writing	15 (42.9)	17 (73.9)	0.020

SR – Senior Residents; R – Residents

residents expressed some interest in performing research. Clinically relevant fields of research such as clinical and medical education research were the top areas of research interest. These two fields are in strategic alignment with the focus of the organisation in academic medicine. There was also some indication of interest in Medical Technology research. The low interest in basic science/translational research could be due to limited exposure to such projects. The results of areas of research interest also reflected the strength of SingHealth Anaesthesia research in medical technology and clinical studies.

This study found that a majority of Anaesthesiology residents expressed some interest in research, and the obstacles they faced were not unique to the specialty of Anaesthesiology. Lack of time has been reported in other residency programmes such as psychiatry, dentistry and internal medicine.[7-11] In July 2003, the ACGME announced the restriction on the number of duty hours, commonly known as 'the 80-hour work week rule'.[12] The rules were meant to ensure patient safety, resident wellness and education. In the United States, a review of 2363 programmes in one academic year revealed 187 duty-hour citations for violation of the duty hour. Among these, three were from the core anaesthesiology programmes.[12] Another study from Singapore found that though a majority of residents reported lack of time as an impediment to research activities during residency, there was still about a third of medicine residents engaging in research-related activities.[4] The study found that research work at residency level is often performed on a voluntary basis and often without financial incentive. Other obstacles perceived by the residents such as the lack of access to research tools, scientific journal and access to laboratory were also reported. Research tools such as biostatistics software and referencing software were actually available in the departments on request. The e-library provides access to most major scientific journals. Residents might not be aware of such existing resources, even though this is broadcasted to all the residents during the Residency Onboard Briefing. The information on research resource is available in the residency intranet system.

SR who completed the final postgraduate examinations had higher research interest. This is not surprising as the completion of examinations probably allowed more time for research activities.[4] Furthermore, there is no formal training in research, and only basic statistics knowledge is incorporated in the Anaesthesiology examinations. The current curriculum has, however, incorporated completion of a research project with mentorship to encourage resident research.[13] The presence of research-related elective modules offered within the Anaesthesiology programme allows SR to develop an academic interest, to increase resident research publications and allows SR to consider research in their career progression.[14,15]

There are several research support needs by the residents found in this study. Protected time was understandably helpful for the residents to do research. Many of the activities required an uninterrupted stretch of time to complete, thus having preallocated time for research might be useful and productive. Research protected time requires strong support from the departments where the residents are rotated to. This has to be planned carefully to ensure clinical responsibilities and education activities are not affected. With adequate protected time, residents could be able to plan the project early, meet the mentor and programme director more frequently to discuss the progression of their project and essentially conduct the research activities in an appropriate setting. In terms of manpower resources, some of the needs for research could involve a statistician, clinical research coordinator and research administrators. The availability of these forms of support varied among the departments. The residents should be encouraged to inform their research mentor, the programme director or head of department if they needed such help. This will allow appropriate arrangements and allocation of resources. The lack of dedicated research mentorship was reported by two-thirds of the survey participants. To overcome this, better matching scheme for mentor–mentee, co-mentoring and incentives programme for faculty involvement could be explored. Examples of compensation for faculty agreeing to be mentors were reported to be awarding time for conferences and monetary incentives.[16] Effective research mentoring could lead to higher willingness in research participations among residents.[17]

One limitation of the study was the relatively small sample size for a survey. However, all residents in SHARP were engaged in the study resulting in a good response rate of 84.8%. Furthermore, SHARP is the largest Anaesthesiology Residency programme in Singapore, thus this study optimised the participation rate for purpose intended. The results of the survey reflected only the opinions of those who completed the survey. The study did not request information

on research training the respondents received during medical school and the origin country of medical degree they obtained. Thus, it was not clear whether the eight holders of Doctor of Medicine (MD) degree received academic research training during their course. In addition, the effectiveness of research training was not investigated further to explore anaesthesia-specific focus areas for residents.

CONCLUSION

This study found the research barriers and research needs of selected anaesthesiology residents. The main barriers were lack of time and lack of mentorship. The residents' chief needs were supervised research protected time, better mentorship and research manpower support. The information from this survey could help target resources to enable research among residents.

Acknowledgements

The authors would like to acknowledge the Sing Health Anaesthesiology Residency Program (SHARP) and Anaesthesiology and Perioperative Sciences Academic Clinical Program for the administrative support. They are also grateful for Associate Professor Soh Chai Rick for his advice and suggestions to the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Accreditation Council for Graduate Medical Education. ACGME Common Program Requirements. Available from: http://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/CPRs_2017-07-01.pdf. [Last updated on 2017 Jul 01; Last accessed on 2018 Apr 03].
2. Papasavas P, Filippa D, Reilly P, Chandawarkar R, Kirton O. Effect of a mandatory research requirement on categorical resident academic productivity in a university-based general surgery residency. J Surg Educ 2013;70:715-9.
3. Rothberg MB. Overcoming the obstacles to research during residency: What does it take? JAMA 2012;308:2191-2.
4. Chan JY, Narasimhalu K, Goh O, Xin X, Wong TY, Thumboo J, *et al*. Resident research: Why some do and others don't. Singapore Med J 2017;58:212-7.
5. Hsieh H, Paquette F, Fraser SA, Feldman LS, Meterissian S, Fried GM, *et al*. Formal research training during surgical residency: Scaffolding for academic success. Am J Surg 2014;207:141-5.
6. Torous J, Padmanabhan J. Research by residents: Obstacles and opportunities. Asian J Psychiatry 2015;13:81-2.
7. Blacker CJ, Morgan RJ. Research tracks during psychiatry residency training. Acad Psychiatry 2018;42:698-704.
8. Aslam A, Khan DA, Hassan SH, Bashir H. Research challenges for postgraduate residents in dentistry. Pak Oral Dent J 2016;36:4.
9. Alguire PC, Anderson WA, Albrecht RR, Poland GA. Resident research in internal medicine training programs. Ann Intern Med 1996;124:321-8.
10. Rivera JA, Levine RB, Wright SM. Completing a scholarly project during residency training. Perspectives of residents who have been successful. JGIM 2005;20:366-9.
11. Gill S, Levin A, Djurdjev O, Yoshida EM. Obstacles to residents' conducting research and predictors of publication. Acad Med 2001;76:477.
12. Swide CE, Kirsch JR. Duty hours restriction and their effect on resident education and academic departments: The American perspective. Curr Opin Anaesthesiol 2007;20:580-4.
13. Takahashi O, Ohde S, Jacobs JL, Tokuda Y, Omata F, Fukui T. Residents' experience of scholarly activities is associated with higher satisfaction with residency training. JGIM 2009;24:716-20.
14. Ahmad S, De Oliveira GS, Jr., McCarthy RJ. Status of anesthesiology resident research education in the United States: Structured education programs increase resident research productivity. Anesth Analg 2013;116:205-10.
15. Namdari S, Baldwin KD, Weinraub B, Mehta S. Changes in the number of resident publications after inception of the 80-hour work week. Clin Orthop 2010;468:2278-83.
16. Panchal AR, Denninghoff KR, Munger B, Keim SM. Scholar quest: A residency research program aligned with faculty goals. West J Emerg Med 2014;15:299-305.
17. Taylor CS, Vijayakumar V. Effective research mentoring of radiology residents. JACR 2018;15:667-8.