Original Article

Addressing research barriers and facilitators in medical residency

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Abstract

Objective: To develop and implement an instrument to identify contributing factors and obstacles to resident research participation. **Materials and Methods:** Clinical Research Excellence Development in Innovation and Technology (CREDIT-20), a 20-point questionnaire, was developed through a four-stage methodology to measure opportunities and challenges to enhance participation of medical residents in research. The study was distributed to all medical residents at three Joint Commission–accredited academic medical centers in the emirate of Abu Dhabi between March 2017 and July 2018. Participant responses were analyzed and represented as mean ± standard error of mean, and subgroup analysis was conducted using Fisher's exact test. **Results:** In all, 314 of 380 residents completed the survey (83% response rate). Resident interest in research was high, with the majority of trainees responding that research will enhance their critical thinking (93%) and add to their knowledge of medicine (92%). Lack of protected time and lack of research methodology training were the most significant barriers. Over half of the residents cited the lack of a dedicated research budget as a program organization challenge. Age significantly correlated with resident perceptions of the benefits for conducting research, with trainees age 27 years or less indicating that they would be more likely to benefit from conducting research than their older counterparts (164 vs 128, $P < 0.05$). **Conclusion:** Improving research methodology training and dedicating structured-protected time for the scholarship are strategies to increase research output in international academic medical centers. The CREDIT-20 survey can identify specific barriers faced by trainees and assist medical educational leaders in implementing targeted interventions.

Keywords: Accreditation, CREDIT-20, medical education, scholarly activity, survey

Introduction

Postgraduate medical education provides medical school graduates with the knowledge and skills to become competent, independently practicing clinicians. A major goal of postgraduate training is to teach and inspire residents to pursue a career that contributes to their medical knowledge, through research. Medical research stimulates intellectual curiosity and promotes critical thinking.[1] Studies have shown that resident participation in research increases their appreciation for evidence-based medicine, correlates with improved clinical competence scores, encourages future careers as academics and physician-scientists, and can ultimately lead to improved patient care.[1-4] Regulatory bodies throughout the world, including the Accreditation Council for Graduate Medical Education (ACGME) in the United States, the Royal College of Physicians and Surgeons of Canada, the Arab Board of Medical Specialties, and the United Kingdom's Royal College of General Practitioners, all emphasize scholarly activity as a core educational competency.[5]

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However, residents face significant personal, logistical, and organizational barriers to conducting high-quality medical research. Often cited challenges include lack of personal interest, lack of faculty support, and unavailability of mentorship.[6,7] Other hurdles include lack of knowledge and skills in statistics and research methodology, along with limited time in a schedule with heavy clinical duties.[8] In addition, institutions offer few, if any, rewards or incentives for resident research participation and funding is usually scarce.[6-10]

The United Arab Emirates (UAE), a small nation bordering the Arabian Gulf, have advanced as a political and economic leader in the Arab world and is a rapidly developing region for medical education and biomedical research.[11,12] Over the past decade, hospitals in Abu Dhabi, the UAE's capital, have transformed from clinical institutions to academic medical centers. The ACGME-International (ACGME-I) accredited nearly all the emirate's teaching hospitals and the majority of their residency programs.[11,12] Despite the focus on academic excellence, quality improvement, and evidence-based medicine, resident research productivity remains low. There have been several initiatives to increase scholarly activity, including research rotations, resident research days, and institution-wide multipronged programs.[13,14] But without accurate data on barriers and facilitators to resident research activity, educators and administrators are unable to target meaningful interventions. The purpose of this study is to develop and implement an instrument to identify contributing factors and obstacles to resident research participation, to better inform educational leadership in an effort to develop strategies to increase resident scholarship.

Materials and Methods

Clinical Research Excellence Development in Innovation and Technology (CREDIT-20), a 20-point questionnaire, was developed to measure facilitators and barriers, to enhance the participation of medical residents in research. The study was approved by the Al Ain Medical District Research Ethics Committee.

Survey development

A four-stage methodology was used to develop the questionnaire. In the first stage, an extensive literature search was conducted by the authors. An expert panel, comprising a purposive group of five members representing the fields of medical education (n = 1), public health (n = 1), biomedical research (n = 1), and two medical residents, drafted a comprehensive list of potential content areas for inclusion in the questionnaire. Delphi technique, a group consensus gathering methodology, was used to reach agreement among the expert panel.[15]

In the second stage, a focus group, consisting of a convenience sample of medical residents (n = 2), program directors (n = 2), research director (n = 1), and a physician member (n = 1), was conducted to further refine the items of the survey proposed by the expert panel.[15] Content validity index (CVI), a rating method to rank the shortlisted survey items based on the relevance and importance of the content,[14] was applied to the list. Accordingly, each member of the focus group independently scored each item of the survey instrument between 0 and 10, with higher CVI scores representing greater relevance and importance of the survey item. Items obtaining a mean score of less than 80% were eliminated.[15,16] The revised survey was then administered to a volunteer group of medical residents (N = 20) for pilot testing after obtaining informed consent. No personal identifiers were collected from the survey respondents to link them to their responses. Participant responses from pilot testing were obtained using a 5-point Likert scale. Response options included the following: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, and 5 = Strongly Agree. Residents were asked to assess the survey length, readability, comprehension, completion time, layout, ease of administration, and to eliminate repetitive or duplicate items. Finally, the resulting survey construct, CREDIT-20, was subjected to factor analysis to arrange the survey questions into their respective domains. The items relevant to the "facilitators" perceived by the residents to conduct research were categorized under the "Interest" and the "Benefits" domains, whereas the survey items related to the "barriers" perceived by the residents were distributed to the "Structure" and "Organization" domains. The maximum score expected for the Interest, Benefits, Structure, and Organization domains were 30, 25, 25, and 20, respectively. The minimum scores expected were 6, 5, 5, and 4 for each of the above domains, respectively.

Survey administration

The study was conducted at three Joint Commission–accredited academic medical centers in the emirate of Abu Dhabi between March 2017 and July 2018. CREDIT-20 was administered to medical residents during their classroom training sessions throughout the course of an academic year. The researchers obtained written informed consent from all participants prior to survey administration. Participants included all medical residents in all training specialties who agreed to participate in the study and signed the consent, irrespective of their postgraduate training year. Residents unwilling to provide written consent were excluded from participation.

Data analysis

Data were analyzed using SPSS Statistical Software Version 22 (SPSS Inc., Chicago, IL, USA).[15] The domains were identified using factor analysis.[17] The widely used principal component analysis (PCA) was used as the extraction method to undertake factor analysis and Varimax rotation was used to rotate the factors to better fit the data.[15-17] Convergent validity, to assess whether the survey items converged to measure a construct, was also conducted using the correlation coefficient matrix method.[15-17] The percentage of total variance by each factor was calculated, and the pattern matrix was used to identify the domains. Kaiser–Meyer–Olkin (KMO) sampling adequacy and Bartlett's tests (to assess the strength of the relationship between

the variables) were also applied to the questionnaire.[16-18] The reliability of the inventory and its subscales were tabulated using Cronbach's alpha.[15-18] The demographics of the study participants were recorded. Responses from the residents following administration of the CREDIT-20 survey instrument were expressed as mean ± standard error of mean, and the scales (agree/strongly agree) and (disagree/strongly disagree) were combined[19] and represented as percentage of total (N = 314) response. For the subgroup analysis, Fisher's exact test was adopted (many cell values less than 5) to determine any statistically significant demographic association with different domains. A P value of ≤0.05 was considered as statistically significant.

Results

Following the literature search, the expert panel generated a 30-item survey questionnaire to assess opportunities and challenges encountered by the medical residents to conduct research in their residency program.[20] The focus group then eliminated survey items that obtained the average content validity score of less than 80%, based on relevance and importance to the residency program (data not shown). The pilot testing further refined the survey for clarity and length and ease of completion. The final construct (CREDIT-20), designed and developed by SCN at Tawam hospital, consisted of a 20-point survey that was then categorized into four domains following factor analysis. Thirty percent (6/20) of the total survey items was confined to the "Interest" domain, whereas 20% (4/20) was allocated the "Organization" domain and 25% (5/20), each for the "Benefits and Structure" domains, respectively. The average time required to complete the 20-item, CREDIT-20, questionnaire was 7 min.

CREDIT-20 survey validation

The consistency and sampling adequacy of CREDIT-20, measured using PCA, yielded a KMO measure of 0.77, indicating that the items correlated and are compact and that factor analysis will yield reliable factors. Bartlett's test of sphericity was significant and showed P values <0.001. Cronbach's α reliability assessment of each of the four domains ranged between 0.71 and 0.89. Cronbach's α for the "Interest," "Benefits," "Structure," and "Organization" domains was 0.89, 0.89, 0.71, and 0.81, respectively. The overall Cronbach's α reliability score for all 20 items for the final construct was high at 0.86.

Medical resident responses

A total of 314 medical resident participants returned the completed questionnaires out of 380 trainees in the three academic medical centers, yielding a response rate of approximately 83%. Table 1 shows participant demographics. Residents surveyed were predominantly male [56% (n = 175], with female forming 44% (n = 139). The majority of participants were under 27 years of age (172/314, 54.7%), single (197/314, 62.7%), and UAE citizens (196/314, 62.4%) [Table 1]. Participant responses to the survey items are shown in Table 2. Responses were high, between 4.2 and 4.5 (mean 4.39 ± 0.04), for the "Interest" domain. The residents perceived that research will enhance their critical thinking (93%) and add to their knowledge of medicine (92%). The mean response for the "Benefit" domain was 3.93 ± 0.05, with the majority of residents (96%) indicating that research will enable recognition among their peers and help them publish scientific papers. Less than half of respondents felt that the current research structure adopted by their institution contributed to the complexity of generating a research protocol (40.7%), lacked clarity in the process of research ethics review (43.3%), and caused ethics approval delays (28.9%). A majority (85.9%) of the residents indicated that having an in-house research ethics committee, as opposed to a centralized ethics committee, and the lack of continuous learning opportunities (73.5%) for research were the barriers to conducting research during residency [Table 2]. In terms of organizational challenges, residents indicated that lack of protected time (97.1%) and lack of research methodology emphasis during journal clubs (86.9) were significant barriers. The lack of a dedicated research budget (56.3%) was also considered by over half of the residents surveyed to be a program organization challenge. Over 40% of residents felt strongly about linking research productivity to their annual performance appraisals. Age significantly correlated with resident perceptions of the benefits for conducting research, with trainees age 27 years or less (164/314) indicating that they would be more likely to benefit from conducting research than their older counterparts (164 vs 128, $P < 0.05$). There was no significant correlation between resident gender, nationality, and marital status with any of the four domains.

Discussion

Academic medical centers worldwide are encouraging residents and faculty to engage in high-quality research.[21] Yet, few studies have examined the perspectives of international residents in research activity.[22,23] Existing survey instruments aimed to enhance research in medical residency have limited applications for international residency programs, given the distinctiveness of the structure of international medical education.[20-24] CREDIT-20 is a quick, easy-to-administer survey tool to help educational leaders understand the specific barriers that their residents face and help guide targeted interventions to increase trainee research productivity.

Studies have consistently shown that residents appreciate research training.[25] Accordingly, our residents showed a high personal interest in participating in research activities, with the majority agreeing that research enhances clinical knowledge and promotes critical thinking. Consistent with other studies, residents surveyed cited the lack of research methodology training as a significant obstacle to scholarly activity.[1,6] Numerous studies have determined that a strong research curriculum is a major determinant in the success of resident research projects.[26] As such, the implementation of a longitudinal research methodology-curriculum starting early in residency, with sessions that focus on developing research skills,

may have a positive impact on resident research productivity. However, it has been documented that simple existence of a research curriculum does not necessarily increase scholarship.[26,27] A multifaceted approach is necessary to optimize resident skills and research productivity.[28] It is interesting to note that younger age correlated with increased perceived benefits of scholarship, further stressing that exposure to research should take place early in residency training, and likely even during undergraduate medical education.

Table 1: Demographics of the medical resident participants

Categories		*n* (%)
Gender	Male	175 (55.7)
	Female	139 (44.3)
Age	< =27 years	172 (54.7)
	>28 years	142 (45.3)
Social Status	Single	197 (62.7)
	Married	112 (35.7)
	Others	5 (1.6)
Nationality	UAE	196 (62.4)
	Middle-East/GCC	85 (27.0)
	Others	33 (10.4)
Year of Residency	PGY-1	114 (36.3)
	PGY-2-5	200 (63.6)
Medical School Graduation	UAE	231 (73.5)
	Others	83 (26.5)

Multiple studies have confirmed that insufficient time is the primary barrier to resident scholarly activity, with one study reporting that only a minority of resident research projects are completed to publication.[6] Residents in our study also cited the lack of protected time as a challenge to research participation. Many programs in our hospitals have implemented a mandatory scholarly project and dedicated research blocks, with variable results. Rather than provide unsupervised block time for residents to independently pursue scholarly projects, flexibility in protected time is likely to be more beneficial. It may also be more practical to dedicate protected time for a research curriculum, with focused and in-depth skills training in statistics and research methodology.[27]

Resident respondents did not feel that a committed research budget was a significant barrier to research productivity. This is in contrast to several studies that have documented increases in resident publications after hiring of research coordinators.[27-29] It is possible that residents are not aware of the increased support and opportunities made available through a devoted statistician or research coordinator.

It is notable that nearly half of the residents surveyed felt that scholarly productivity should be linked to annual performance appraisals. Several studies have documented increased research output after a scholarly point system was implemented for residents.[30,31] In the programs described, "points" were given for multiple types of scholarship, with higher points provided

Table 2: Determination of medical resident perceptions regarding the facilitators (interest & benefit) and barriers (structure & organization), for enhancing research participation, using a targeted survey questionnaire CREDIT-20

Domain	Items	Responses Mean±SEM	Disagree/Strongly Disagree *n* (%)	Agree/Strongly Agree *n* (%)	*P*
Interest	My interest in research is to help me:				
	Better understand disease management	4.3±0.0.4	6 (1.9)	276 (87.8)	0.001
	Use critical thinking	4.4±0.03	3 (1.0)	293 (93.3)	
	Enhance my knowledge of medicine	4.5±0.04	8 (2.5)	291 (92.6)	
	Enhance my professional status in society	4.4±0.04	3 (1.0)	280 (89.1)	
	Towards career advancement	4.4±0.04	3 (1.0)	288 (91.7)	
	For collaboration and networking opportunities	4.2±0.03	3 (1.0)	282 (89.8)	
Benefits	The benefits of doing research are to:				
	Be a trainer in the future for the residency program	3.7±0.04	22 (7.0)	237 (75.4)	0.001
	Practice evidence based medical care	3.8±0.05	20 (6.3)	246 (78.3)	
	Develop critical skills early in my residency career	3.7±0.04	17 (5.4)	218 (69.4)	
	Be an ambassador for research in the residency program	3.9±0.05	16 (5.0)	244 (77.7)	
	Be recognized by my peers and to publish scientific papers	4.4±0.03	3 (1.0)	302 (96.1)	
Structure	The research systems adopted by the institution:				
	To generate a research protocol is complicated for a resident	3.3±0.05	55 (17.5)	128 (40.7)	0.001
	Causes delays in the ethics approval of a research proposal	3.3±0.04	23 (7.3)	91 (28.9)	
	Lacks clarity in the process of ethics review of research	3.2±0.06	91 (28.9)	136 (43.3)	
	Do not periodically provide continious learning opportunities for research	3.9±0.04	11 (3.1)	231 (73.5)	
	Will benefit from having a in-house research ethics committee rather than a centralized research ethics committee	4.0±0.03	3 (1.0)	270 (85.9)	
Organization	Participation in research is affected by the lack of:				
	Protected time to conduct research	4.6±0.03	3 (1.0)	305 (97.1)	0.001
	Importance for research methodology given during journal clubs	4.3±0.04	3 (1.0)	273 (86.9)	
	Dedicated research budget	2.7±0.05	137 (43.6)	177 (56.3)	
	Linking research productivity with annual performance appraisal	3.3±0.04	39 (12.4)	137 (43.6)	

for peer-reviewed publications or conference presentations. The flexibility of the point system relieved resident anxiety around clinical research and encouraged trainees to collaborate and increase scholarly activity. The implementation of a similar reward system, and potentially linking it to yearly performance reviews, is a feasible method of encouraging scholarly output that our programs could adopt.

Our results should be viewed in light of some limitations. First, only three institutions in Abu Dhabi participated, although we believe our findings can help guide strategies to increase resident research productivity in academic medical centers worldwide. Second, a limited number of residents participated. However, residency programs in the UAE are small and this sample represents the majority of residents in training in Abu Dhabi emirate. The high response rate of 83% is reassuring that our findings accurately represent resident perceptions in these institutions. Finally, inherent to any self-report of complex issues, such as participating in research projects, are influencing factors that may not have been fully addressed by the survey, such as institutional and training program culture, faculty support and resident individual personality.

Conclusion

Resident participation in high-quality research is an important objective for postgraduate training programs worldwide. Improving research methodology training, dedicating a structured-protected time for scholarship, increasing organizational support through the hiring of statisticians and research coordinators, and implementing a scholarly activity award system are strategies that could lead to increased research output in international academic medical centers. The CREDIT-20 survey can identify specific barriers faced by trainees and assist medical educational leaders in implementing targeted interventions.

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Conflicts of interest

There are no conflicts of interest.

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