

The impact of integrating a compulsory community-oriented research program within undergraduate medical curriculum on graduates' scientific publications: perspectives from Arabian Gulf University

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Abstract

Purpose – Medical schools aspire to graduate doctors who are competent in interpreting, conducting and publishing scientific research. Hence, the purpose of the paper is explore the impact of a structured compulsory community-oriented, project-based research program in the undergraduate medical curriculum on medical graduates' future careers, publications and motivation for scientific research.

Design/methodology/approach – An online questionnaire was sent through the Alumni Association of the Arabian Gulf University (AGU) to medical graduates who have valid email addresses, seeking information on their scientific productivity along with demographic and current employment data. Responses were collated and analyzed using a standard statistical software package. The chi-square test and p-value were calculated. P-value <0.05 was considered statistically significant.

Findings – Completed forms were received from 91 medical graduates. In this sample, almost a quarter of the respondents have published a research paper out of their undergraduate research project, and about 50% have published at least one paper (as main or co-author) after graduation. Both demographic and medical specialty was not related to the doctor's perception of the benefits they have attained from the compulsory undergraduate research program. However, medical graduates who are at senior levels in their medical careers and those who are employed in secondary healthcare are significantly more likely to publish research papers.



Originality/value – The compulsory community-oriented, project-based research program in AGU has positively contributed to the research productivity of graduates, and it would be worthwhile to include such programs as an integral part of the undergraduate medical curriculum.

Keywords Medical curriculum, Medical school, Publications, Research, Undergraduate

Paper type Research paper

Introduction

Medical schools around the world aspire to graduate global doctors who are not only competent in their curative and diagnostic skills but are also able to interpret, conduct and publish scientific research. Training in research skills is required to ensure that students are prepared as future doctors and lifelong learners. Therefore, it is recommended to have clear research-related learning outcomes in the undergraduate curriculum and to provide engaging opportunities for students to develop research skills (Laidlaw, Aiton, Struthers, & Guild, 2012). The best modality to achieve this can be independent research projects (Colmenares, Bierer, & Graham, 2013; Green *et al.*, 2010), where the medical curriculum is consolidated by authentic learning experiences, gained through conducting “hands-on” research projects, under the supervision of experienced academic faculty (Colmenares *et al.*, 2013).

Many Schools around the world apply compulsory or elective community-oriented or community-based research projects. A pre-post study to evaluate the self-perceived research experiences of medical students in community placements reported improved research capability among medical students. The results suggest that the research capability of medical students can be positively influenced by the provision of a research-based integrated medical curriculum and further consolidated by authentic learning experiences, gained through conducting “hands-on” research projects, under the supervision and mentoring of research-qualified academics (Mullan, Weston, Rich, & McLennan, 2014). During their community placement, medical students conduct a research project of their choice over several months. Students work on a research project of their own choice that deals with real-world problems helps students to be more engaged and have ownership of the project (Harden & Laidlaw, 2013).

Introducing student-conducted research projects at the required depth to modern medical education programs is challenging and requires innovative structures involving faculty and resources in parallel with traditionally required biomedical coursework. However, unlike medical school electives, programs like scholarly concentration focus on the creation and sharing of new knowledge (Green *et al.*, 2010).

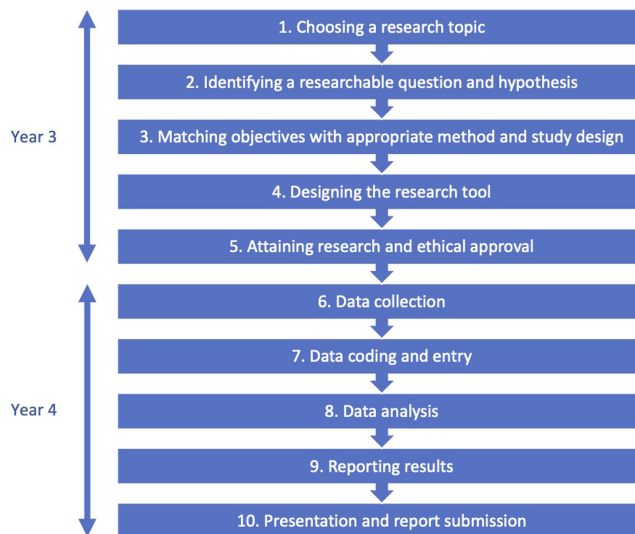
Since its inception in 1982, the College of Medicine and Medical Sciences (CMMS) at the AGU has adopted an innovative approach to have a community-oriented research project program as an integral part of the medical curriculum. Successful completion of this program is mandatory to attain the medical degree (Hamdy & Anderson, 2006; Noorelahi, Soubhanneyaz, & Kasim, 2015). Further, recent revisions and modifications of medical residency programs globally have made familiarization with the research methodology and demonstrating publication skills an essential requirement for acceptance in the residency training programs (Cheung, 2018; Ommering, Wijnen-Meijer, Dolmans, Dekker, & van Blankenstein, 2020).

Three factors were identified as mechanisms to improve student research outcomes. These factors are organizational research culture that values research, protected time for research activities and choice of experience by students. Adequately supported and structured experiences where students can see the value of research and quality supervision that builds student’s self-efficacy were identified as mechanisms leading to increased research skills and attitudes, scholarly outputs (e.g., publications, conference presentations) and future interest in research or other scholarly endeavors (Cornett, Palermo, Wallace, Diug, & Ward, 2021).

The medical program at AGU comprises of three phases: pre-medical (Year 1), pre-clerkship (Years 2 - 4) and clerkship (Year 5 and 6) (Hamdy & Anderson, 2006).

The community-oriented research project program is conducted over two academic years during the pre-clerkship phase as shown in Figure 1. The main goal of the community-oriented research project program is to build the research competencies of future physicians and equip them with skills to understand and practice evidence-based health care as well as to undertake and publish their own research projects. To achieve the optimal benefit from this research experience, medical students work in small groups under the supervision of faculty supervisors to develop their own research projects in an incremental manner. While achieving the pedagogic objectives of the program, they choose research questions on community health issues that can be addressed by epidemiologic research design within the proper public health contexts of their countries and gain other competencies such as collaboration, communication, teamwork and leadership. Thus, all the scientific publications which are a result of this program would be community-based research. This approach to achieving research-related competencies is revolutionary as described by Boninger *et al.*, who emphasized the challenges of conducting a complex activity that is fundamentally different than traditional medical school courses and clerkships (Boninger *et al.*, 2010).

Literature on follow-up of medical graduates from North American and European universities that adopt mandatory research projects shows that about one-third of doctors have published a paper or gave a presentation of a research project of their own at a scientific event (den Bakker, Ommering, van Leeuwen, Dekker, & De Beaufort, 2022; Möller & Shoshan, 2017). The scientific yield from teaching research skills at AGU within the medical curriculum presents a rewarding experience with many medical students having published their undergraduate research projects in peer-reviewed journals, for example (Al Dharman *et al.*, 2022; AlAwadhi *et al.*, 2020; Bubshait *et al.*, 2021; Rasool *et al.*, 2015) to mention some. However, while there is credible feedback from the respective employers of AGU graduates indicating that they are competent clinicians (Arabian Gulf University, 2022), there is no such evidence regarding the typical benefits that such research programs confer. The study aims to explore the impact of a structured compulsory community-oriented, project-based research program in the undergraduate medical curriculum on medical graduates' future careers, publications and motivation for scientific research.



Source(s): Author's own work

Figure 1.
Components of
community-oriented
research project
program, Arabian Gulf
University

Methods

Study sample and research instrument

A descriptive cross-sectional study design was employed based on an online questionnaire that was sent through the Alumni Association of the Arabian Gulf University to Doctor of Medicine (M.D.) graduates with registered valid email addresses. The questionnaire sought information on the medical graduates' scientific productivity defined as having published a scientific research paper. In addition, data was obtained on demographic, education and current employment status. The data was collected based on a sample of convenience of whoever responded with a completed questionnaire.

Inclusion and exclusion criteria

Inclusion criteria: medical graduates with registered email addresses in the Alumni Association records. Exclusion criteria: those graduates who do not have a current valid email address on the Alumni Association's records.

Statistical analysis

Responses were collated and analyzed using SPSS version 28.0. All variables were described using frequencies, percentages and cross-tabulations. The chi-square test and p-value were calculated. P-value <0.05 was considered statistically significant.

Ethical considerations

This study was approved by the Research and Ethics Committees of the College of Medicine and medical science at AGU (approval number: E54-PI-3-22). The names of medical graduates who answered the questionnaire were kept anonymous. All data were kept confidential.

Results

Completed questionnaires were received from 91 medical graduates, the majority of whom were females (64.8%) which is in line with the higher proportion of female graduates from CMMS-AGU. Most of the respondents (79.2%) were 25 to 40-year-old. The proportion of respondents who were working in advance level at secondary healthcare was 76.2% (Table 1).

Characteristic	Category	n	Percent
Gender	Male	32	35.2
	Female	59	64.8
Age	25-30	39	42.9
	31-40	33	36.3
	41 or More	19	20.9
Nationality	Bahrain	39	42.9
	Kuwait	17	18.7
	Saudi Arabia	26	28.6
	Other	9	9.9
Current position	Entry Level	35	38.5
	Intermediate Level	14	15.3
	Advanced Level	42	46.2
Specialty	Primary Healthcare and Community Medicine	20	23.8
	Secondary Healthcare	64	76.2
Total		91	100.0

Source(s): Author's own work

Table 1.
Demographic characteristics of the respondents

Regarding the research productivity of the study population (Table 2), a quarter (25.3%) of the participants reported having published at least one paper out of their undergraduate research project as students, while more than half (54.9%) of them have published in peer-reviewed journals after graduation. The number of publications is two or more in most of the studied population (60.9%). It is gratifying that 59.1% (50 out of 91) of the graduates have at least published one research paper during their career – Table 2.

Table 3 shows that publishing research papers from the undergraduate research projects have no significant differences with respect to graduates' demographic characteristics or their chosen specialty after graduation.

Further, the perception of the medical graduates of the research activity as helpful was higher among the respondents who reported publishing out of their undergraduate research projects (40 out of 69 = 31.0%) compared to those who did not (4 out of 22 = 12.1%), p-value = 0.043.

Figure 2 presents the perception of graduates who considered the compulsory research program as useful. The most frequently described reason was improving their life-long learning skills (27%), improving teamwork and collaboration skills (20%) and facilitated their understanding of published research in their specialty (17%). Most respondents perceived that the research program helped them in publication (63.7%) with no statistical difference of any demographic or other characteristics (Table 4).

Table 2.
Research productivity
of the medical
graduates

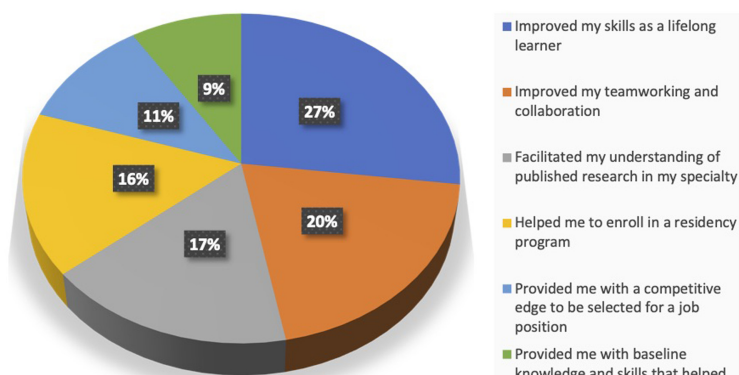
Variable	Category	n	Percent
Published a paper out of research project as Student	Yes	23	25.3
	No	68	74.7
Published papers in peer-reviewed journals after graduation from AGU	Yes	50	54.9
	No	41	45.1
Number of Publications	One	18	39.1
	Two	12	26.1
	Three and more	16	34.8

Source(s): Author's own work

Table 3.
Population
characteristics and
publication from the
research project as
medical students

Characteristic	Category	Publication a paper out of research project as student				Total	p-value
		Yes		No			
		n	%	n	%		
Gender	Male	10	31.3	22	68.8	32	0.334
	Female	13	22.0	46	78.0		
Age	25-30	13	33.3	26	66.7	39	0.066
	31-40	9	27.3	24	72.7		
	41 or More	1	5.3	18	94.7		
Nationality	Bahrain	13	33.3	26	66.7	39	0.419
	Kuwait	4	23.5	13	76.5		
	Saudi Arabia	5	19.2	21	80.8		
	Other	1	11.1	8	88.9		
Specialty	Primary Healthcare and Community Medicine	7	35.0	13	65.0	20	0.237
	Secondary Healthcare	14	21.9	50	78.1		

Source(s): Author's own work



Source(s): Author's own work

Figure 2. Population perceived causes of research activity usefulness

Characteristic	Category	Research program helped graduates in publication				Total	p-value
		Yes		No			
		n	%	n	%		
Gender	Male	17	54.8	14	45.2	31	0.168
	Female	41	69.5	18	30.5	59	
Age	25-30	25	65.8	13	34.2	38	0.492
	31-40	19	57.6	14	42.4	33	
	41 or More	14	73.7	5	26.3	19	
Nationality	Bahrain	24	63.2	14	36.8	38	0.667
	Kuwait	12	70.6	5	29.4	17	
	Saudi Arabia	15	57.7	11	42.3	26	
	Other	7	77.8	2	22.2	9	
Current position	Entry Level	19	55.9	15	44.1	34	0.087
	Intermediate Level	7	50.0	7	50.0	14	
	Advanced Level	32	76.2	10	23.8	42	
Specialty	Primary Healthcare and Community Medicine	13	65.0	7	35.0	20	0.856
	Secondary Healthcare	43	67.2	21	32.8	64	

Source(s): Author's own work

Table 4. Population characteristics and the perceived views of the medical graduates on how helpful the research program was

The association between the participants characteristics and the research productivity of the medical graduates after graduation is presented in Table 5. A significant relationship was observed between the scientific productivity and the medical graduates' specialty (p-value = 0.042). In addition, trends were observed between the scientific productivity of the medical graduates with their gender and the current employment position with p-values of 0.051 and 0.063, respectively. However, there was no statistically significant difference between medical graduates' perception of the research activity being helpful and their research productivity after graduation (p-value = 0.485).

Table 5.
Demographic
characteristics and
publications of at least
one paper after
graduation

Characteristic	Category	Published papers in scientific journals after graduation				Total	p-value
		Yes		No			
		n	%	n	%		
Gender	Male	22	68.8	10	31.3	32	0.051
	Female	28	47.5	31	52.5	59	
Age	25-30	18	46.2	21	53.8	39	0.339
	31-40	20	60.6	13	39.4	33	
	41 or More	12	63.2	7	36.8	19	
Nationality	Bahrain	25	64.1	14	35.9	39	0.118
	Kuwait	5	29.4	12	70.6	17	
	Saudi Arabia	15	57.7	11	42.3	26	
	Others GCC	5	55.6	4	44.4	9	
Current position	Entry Level	14	40.0	21	60.0	35	0.063
	Intermediate Level	10	71.4	4	28.6	14	
	Advanced Level	26	61.9	16	38.1	42	
Specialty	Primary Healthcare and Community Medicine	7	35.0	13	65.0	20	0.042
	Secondary Healthcare	39	60.9	25	39.1	64	
Research activity helped graduates	Yes	30	51.7	28	48.3	58	0.485
	No	19	59.4	13	40.6	32	

Source(s): Author's own work

Discussion

This study provides an insight into the potential impact of the mandatory research program within the undergraduate medical curriculum on publications which is an indicator of scientific productivity. Overall, the community-oriented research project program at AGU has had a positive impact on the research capabilities and skills of the graduates. Moreover, around one quarter of the graduates were found to have published at least one research paper during their undergraduate course and over half of them being the main or a co-author of scientific publications later during their medical career. These short- and long-term benefits from this study indicate that including research programs as part of undergraduate medical curriculum is fundamental for competency-based medical curriculum.

The objective evaluation of the value of instituting such training programs in terms of providing productive, rewarding research experiences remains unclear and difficult to evaluate. A measurable outcome of such undergraduate research experiences may be the long-term promotion and enhancement of scholarly research engagement during later stages of the careers of the medical graduates (Laskowitz, Drucker, Parsonnet, Cross, & Gesundheit, 2010). This is consistent with the finding of the current study as more than half of the graduates have published at least one paper in a peer-reviewed journal.

Despite the observed greater impact of the mandatory research program at AGU on future medical graduates' scientific publications (54.9%) than those reported from similar studies in the USA (15.5%) and the Netherlands (27.7%) (den Bakker *et al.*, 2022; Möller & Shoshan, 2017), it would be difficult to relate this difference to the effectiveness of these research programs since the sample sizes and the follow up periods are not similar. However, collective evidence from multiple studies suggests that those with some research experience during their undergraduate education are more likely to publish than graduates who had no research experience as students (SCOTT SEGAL, Lloyd, Houts, Stillman, & Jungas, 1990). There were no differences in the research productivity detected in this study according to the gender of the alumni which agrees with findings from other studies (Möller & Shoshan, 2017).

Physicians who are practicing in the secondary healthcare facilities have significantly reported a higher number of publications compared to their peers in primary healthcare. While this difference maybe partly attributed to the higher number of respondents from secondary healthcare compared to their counterparts in primary healthcare, it would be plausible to suggest that the nature of the practice in secondary healthcare facilities is team-based comprising of the consultant (Team leader) and his/her residents (usually around 8–10 per team), while the practice of primary healthcare in Arab Gulf countries is usually solo-based with family physicians providing healthcare individually to patients. Thus, it would not be surprising to find that the scientific productivity of the secondary healthcare physicians was higher since an estimated range of 35% to 50% of published medical literature is reported to be produced by the medical residents (Perez-Villadóniga, Rodriguez-Alvarez, & Roibas, 2022).

Those graduates who perceived the compulsory research activity as useful viewed the life-long learning, teamwork and being a scholar with critical appraisal as the most valued benefits from the program. These perceptions are similar to those reported from students who were interviewed by Moller and Shoshan who reported that the highest valued components of a compulsory research course were skills for future career as the ability to follow the development and critically integrate knowledge (Möller & Shoshan, 2019). AGU graduates like those from other medical schools appreciated the link between research and learning as well as teamwork and collaboration (Imafuku, Saiki, Kawakami, & Suzuki, 2015). Working in a protected environment on an independent research project encourages students to gain important transitional skills (Sawarynski, Baxa, & Folberg, 2019).

The research project has allowed the graduates to experience and develop both interpersonal and research-specific skills which improve their ability to critically appraise scientific articles and apply the new knowledge in their specialty. This is an agreement with other studies which found that the doctors' positive attitudes towards research did not only increase their interest in research but also encouraged them to continue their scholarly activities after graduation (Chang & Ramnanan, 2015; Solomon, Tom, Pichert, Wasserman, & Powers, 2003).

It is worth noting that a small number of AGU graduates gave negative feedback on the community-oriented research project program and questioned the effectiveness of their research supervisors. Similar concerns were raised from other studies with 13% of respondents from University College Cork did not find research appealing (Burgoyne, O'Flynn, & Boylan, 2010). In other studies, students cited limited time, unreasonably high expectations, a paucity of mentors or faculty guidance, lacking appropriate structure, as factors negatively affecting their research experience in medical school (Bierer & Chen, 2010).

There are some shortcomings in this study that must be considered before generalizing the results. Firstly, the information was collected from the university alumni graduates who are expected to have low response rates in view of their heavy clinical work commitments. Second, the data was obtained through a sample of convenience of whoever responded which would greatly limit the generalizability of the findings. However, the results are valid and applicable to the medical graduates who were included in this sample. Third, it would not be appropriate in a cross-sectional study design to ascertain a relationship between the undergraduate research activity and the subsequent scientific publications. However, since 25.3% of the respondents have reported publishing research papers from their undergraduate compulsory research program, which accounts for around half of the total number of graduates who produced papers (59.1%), it would be plausible to suggest that this program has positively contributed to medical graduates' scientific publications.

In conclusion, the mandatory teaching of research skills competencies within the medical curriculum has positively contributed to the research productivity of medical graduates.

Accordingly, it would be worthwhile to include such programs as an integral part of undergraduate medical programs. In addition, more in-depth studies are needed to ascertain the impact of research programs on the future career of medical graduates.

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