



RESEARCH ARTICLE

REVISED **Volunteering among pre-clinical medical students:
Study of its association with academic performance using
institutional data [version 2; peer review: 2 approved]**

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Abstract

Background: Participating in volunteering activities during students' higher education experience is becoming more commonplace. Studies have noted that volunteering has a positive impact on the academic performance of undergraduate medical students. However, most of these studies rely on self-reported data like surveys, interviews, and journals. In this study, we leverage actual institutional data to examine the relationship between volunteering and academic performance among medical students in the pre-clinical phases of the Bachelor of Medicine and Bachelor of Surgery (MBBS) program. The current study also explores the factors that might influence students' volunteering behaviours.

Methods: Analysis based on retrospective data was conducted in the College of Medicine at the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU) in Dubai, United Arab Emirates. Three years of volunteering records for three cohorts of undergraduate medical students enrolled in the MBBS program between 2016 – 2018 were reviewed and analyzed to complete this study. The correlation between the annual Grade Point Average (GPA) and volunteering was studied across the three cohorts in each study year.

Results: Analysis of 153 undergraduate medical students' volunteering records revealed a significant positive relationship between the annual GPA and the number of volunteering in year two. The correlation was insignificant in year one, year three, and across the three cohorts.

Conclusions: The association between academic performance and volunteering among undergraduate medical students appeared to be

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Any reports and responses or comments on the article can be found at the end of the article.

positive. However, this relationship differs across the pre-clinical study years and is likely influenced by factors associated with volunteering that might influence GPA.

Keywords

Student volunteering, service-learning, academic performance, medical education

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REVISED Amendments from Version 1

We are attaching the latest version of the manuscript that has meticulously considered the reviewers' constructive feedback. We have reviewed the introduction section and added the relevant supporting references and more literature to explain why volunteering would impact academic performance. The second question of the study has been modified and reads "What factors influence students' volunteering behaviours?".

We added to the Methods section the justification for using GPA as an indicator of academic performance and clarified how GPA was calculated. Also, we elaborated on the classification of the annual GPA and why the optimal performance in the mid-range of annual GPA. Additionally, the Data collection and analysis sub-section was revised, and we added statement to clarify that the analysis in our study was based on retrospective data. We also described the analysis of the volunteering among different gender and UAE/non-UAE nationals.

In the results section, we inserted the number of students in each GPA category. Figure 3 was amended to present the average number of volunteering activities instead of the total number of volunteering activities. The manuscript was amended to describe the Scatter plotting not regression. In Table 4 the data normality was tested using Shapiro-Wilk test followed by Mann-Whitney non-parametric test to compare between the two administered groups. We reviewed the table and added the analysis name.

We have reviewed the Discussion section to address the comments related to the repetition of the results presentation. The gender aspect of volunteering has been elaborated further and we added some interpretation to discussion section considering the reviewer's comments related to the statistically significant correlation between annual GPA and the number of volunteering activities.

The conclusion statement has been revised to reflect the study's outcome in more cautious approach. References were also amended as required.

Any further responses from the reviewers can be found at the end of the article

Introduction

Participating in volunteering activities during students' higher education experience is becoming more commonplace. Volunteering has been defined as "an intentional behavior, carried out without being a professional obligation and aimed at supporting, preserving and promoting social values, without waiting for any moral or material rewards from others"¹. While opportunities for students to volunteer may come from places within the community; many volunteering opportunities are offered as part of the university setting itself. In their study of 2,309 undergraduate students, Astin and Sax noted that the majority (51.8%) of students who volunteered did so within their university². Students volunteer for a variety of reasons, motives, and benefits. These can include a desire to acquire knowledge, develop new skills, participate in experiences that benefit their education and/or careers, and enhance their academic learning^{1,2}.

Volunteering has been shown to positively impact undergraduate medical students, contributing to better psychological

health, wellness, and personal development³⁻⁷. Medical students may participate in various volunteering activities such as providing direct clinical service in public health interventions, holding awareness sessions for the public, providing administrative support for local health authorities, or even volunteering for crisis response^{8,9}. In return, students gain distance from the many stressors of medical school. Studies noted that students' involvement in leading and organizing extracurricular activities resulted in lower burnout levels and helped develop stress management skills^{4,10-12}. Participating in volunteer community service projects has been noted to promote leadership and teaching skills, and helps to build student awareness of health needs in their community⁵. Volunteering has also been shown to promote the development of competencies related to soft skills, such as improved communication, decision-making, social skills, and higher levels of empathy^{5,10,13}.

Within the formal academic environment, students studying to become health professionals must meet specific competencies based on skills, traits, and behaviors required to be an effective health professional¹⁴. In early 1990s the term evidence-based medicine was first developed in the field of medicine which then expanded to include other health disciplines (nurses and allied health professionals) and became known as evidence-based practice (EBP)^{14,15}. Evidence-based practice offers a framework for the integration of patients' preferences and research evidence into the delivery of health care^{15,16}. Competency-based frameworks, such as those laid out by the American Council for Graduate Medical Education (ACGME) and the CanMEDS framework from Royal College of Physicians and Surgeons of Canada, assess competencies that take a holistic look at practice, focusing not just on medical knowledge and skills but also interpersonal communication, data literacy, professionalism, leadership, and advocacy^{6,7}. Health professions programs have the challenge of integrating learning opportunities to help build these diverse competencies into an already packed curriculum. There exists the potential for volunteering activities to supplement the learning of competencies to enable students to put their professional skills and knowledge to work for the community good while simultaneously promoting the development of competencies.

While volunteering has been shown to have positive benefits for students, it is essential to understand how volunteering may impact academic performance. Studies have noted that volunteering positively impacts academic performance, as indicated by improved overall Grade Point Average (GPA) and student success^{12,13,17}. Evidence from research demonstrates that volunteers attained a higher level of academic achievement than their non-volunteering counterparts as volunteering can enhance intrinsic motivation, which is an important component of the learning process^{4,18-20}. Studies show that volunteering can expose medical students to core competencies that are underrepresented in some formal curriculum^{21,22}. Further, researchers highly recommend that preclinical students be exposed to real life clinical scenarios, thus improving their pattern recognition skills, and reinforcing conceptualization rather than memorization²³. It may be that volunteering involvement fosters aspects of professional development, such as altruism, dutifulness, and awareness of systems-based practice issues, that are carried forward

into residency and enhances the graduates' overall internship abilities⁴. Community service could serve as an important measure of noncognitive traits that also predicted better academic performance⁴. As success in educational performance significantly affects students' self-esteem and motivation in higher education, educators and researchers need to identify and understand what factors impact academic performance^{4,18}.

This study will help to inform the literature on volunteering and how it affects undergraduate medical students' academic performance. While preceding studies have reported findings in this area, most rely on self-reported data like surveys, interviews, and journals. This study is unique in that it leverages actual, institutional data to take a quantitative approach in examining the relationship between volunteering and academic performance across three cohorts of medical students in pre-clinical phases of the Bachelor of Medicine and Bachelor of Surgery (MBBS) program.

This research study aims to examine the association between volunteering and the academic performance of undergraduate medical students. Accordingly, our research questions are:

- What is the relationship between annual Grade Point Average (GPA) and student volunteering?
- What Factors influence students' volunteering behaviours?

Methods

Ethics approval and consent to participate

Ethical approval for the study was granted by the Mohammed Bin Rashid University of Medicine and Health Sciences (MBRU) Institutional Review Board (Reference #: MBRU-IRB-2017-003). Further clarification can be obtained from the MBRU-IRB at irb@mbru.ac.ae.

All methods were performed following the relevant guidelines and regulations (Declaration of Helsinki). No students were enrolled for this study hence informed consent was waived off by the MBRU-IRB. No questionnaire or survey was separately created or designed for this study. This was indicated in the IRB application that was submitted to MBRU-IRB, which approved the waiver.

Study context

During the five years in which the College of Medicine at the MBRU in Dubai has been in existence, there has been a steady increase in the number and variety of volunteering activities offered to students studying in its Bachelor of Medicine and Bachelor of Surgery (MBBS) program. The MBRU, six-year MBBS program is divided into a one-year basic sciences phase (year one), a two-year organ system phase (years two and three), and a three-year clinical sciences phase (years four, five, and six). Student progression to the next phase is subject to successful completion of the progression requirements and a minimum cumulative GPA at the end of the preceding phase. Although volunteering is not required for graduation and not embedded in the curriculum, the university holds students' volunteering record to address student's notable characteristics such as leadership, teamwork and self-motivation.

These information are usually contribute to the Medical School Performance Evaluation (MSPE), which could be an incentive for the students to document and share the volunteering record with the university. To examine how volunteering activities might be used to supplement the curriculum, it is first essential to understand the relationship between academic performance and volunteering and explore the factors that associated with the volunteering and possibly influence the academic performance.

Study design

A retrospective analysis was conducted in the College of Medicine at the MBRU in Dubai, United Arab Emirates. The study population includes three cohorts of medical students enrolled in the MBBS program between 2016 – 2018. Since the study was intended to investigate the relationship between the medical students' academic performance and their level of engagement in volunteering, the study was conducted using a correlation research design. The measure of volunteering activities is the number of volunteering events recorded for each student, and the measure of academic performance is annual GPA. Medical school GPA was used as an indicator of the academic performance since it is known measure of the students' academic performance that has continuous and reliable record.

Data collection and analysis

Three years of the volunteering records for the three MBBS cohorts were used to complete this study. The volunteering activities were retrieved from the students' volunteering record as documented by the university. The recorded information include student's identification number, gender, number of volunteering, and activity's name and date. The annual GPA for each student was retrieved from the Student Information Self-Service (SIS) where the grade point for each course was calculated using the grade achieved end of the course and the course's credit. The GPA for the whole term based on the calculation of the GPA of all credited courses in the term. The cumulative GPA for two terms constitutes the annual GPA. The confidentiality of information gathered from the participants' records was preserved.

In this study the analysis was based on retrospective data. A quantitative approach was adopted as the study was established on variables measured with numbers and analyzed with statistical procedures. The measure of volunteering activities is based on the number of volunteering events that each student participated in as recorded by the university, and the measure for academic performance is annual GPA. Spearman's rho non-parametric test was used to test the strength of association between the two variables, where the value $r = 1$ means a perfect positive correlation and the value $r = -1$ means a perfect negative correlation. We used the minimum GPA required for progression in the program to define 3 GPA categories; optimal performance (annual GPA 2.5 - 3.5), suboptimal performance (annual GPA < 2.5) or high-performance (annual GPA > 3.5). Mann-Whitney test used to compare whether there is a difference in volunteering among different gender and between UAE/ non-UAE nationals, and Exact Fischer chi-test used for testing dependency between categorical variables. All data from these records were transferred to Microsoft Excel. Standard

data entry and quality control procedures were used, including double entry, range and consistency checks, and manual review of outliers. All statistical analyses were performed using IBM-SPSS software (version 25.0). We also used scatter plots to demonstrate the relationships between the two variables across the three cohorts and in each study year.

Results

In this study we reviewed the volunteering records of 153 medical students. The studied population includes more females (n = 117 out of 153, 76.5%) than males (n = 36 out of 153, 23.5%) and reflected that the majority of students participated in volunteering activities (n=132 out of 153, 86.3%). Participants’ characteristics are presented in Table 1. Most of the offered volunteer activities were directed to develop interpersonal and communication skills of the participants, they primarily encourage the students to use their knowledge and skills. Volunteered students played different roles in the activities including; collaborator, leader, health advocate, professional, and communicator.

Relationship between GPA and volunteering

Table 2 and Table 3 display the statistical analysis performed to measure the strength of the relationship between volunteering and academic performance using Spearman’s rho non-parametric test.

The results in Table 2 revealed a significant positive relation between the annual GPA and the number of volunteering

in year 2 (r = 0.209; p-value is 0.047). In year 3 (r = 0.194; p-value is 0.159) the correlation was positive but insignificant and in year 1 (r = - 0.024; p-value is 0.769) the result shows negative insignificant association. Furthermore, the correlation coefficient between the annual GPA and number of volunteering activities was tested across the three cohorts, reflecting a positive insignificant correlation in cohort 2 (r = 0.236; p-value is 0.430) and cohort 3 (r = 0.160; p-value is 0.215), while in cohort 1 there was negative insignificant correlation (r = - 0.062; p-value is 0.654) (Table 3).

The correlation between the annual GPA and the number of volunteering activities across the three cohorts and within different study years is demonstrated in the scatter plots. (Figure 1 and Figure 2) The average number of volunteering activities in different annual GPA category is illustrated in Figure 3. The results show insignificant increase in the average number of volunteering across the three categories of annual GPA (p-value is > 0.05). Students with high-performance (annual GPA > 3.5; 64 students) had 226 volunteering (Avg. 3.53), students with optimal performance (annual GPA 2.5 - 3.5; 186 students) has 620 volunteering (Avg. 3.33), and students with suboptimal performance (annual GPA < 2.5; 48) has 149 volunteering (Avg. 3.10).

Factors that influence the relationship between volunteering and AGPA

The results in Table 4 show a statistically significant difference (p-value = 0.009) in volunteering practices between students

Table 1. Description of the study sample by study year and cohort, n=153.

Study year	Cohort	Male	Female	UAE	Non-UAE	Non-volunteering	Volunteering	Total
Year 1	Total	36 (23.5%)	117 (76.5%)	50 (32.7%)	103 (67.3%)	21 (13.7%)	132 (86.3%)	153 (100%)
	First cohort	15 (27.8%)	39 (72.2%)	11 (20.4%)	43 (79.6%)	0 (0%)	54 (100%)	54 (100%)
	Second cohort	8 (21.6%)	29 (78.4%)	15 (40.5%)	22 (59.5%)	11 (29.7%)	26 (70.3%)	37 (100%)
	Third cohort	13 (21.0%)	49 (79.0%)	24 (38.7%)	38 (61.3%)	10 (16.1%)	52 (83.9%)	62 (100%)
Year 2	Total	23 (25.3%)	68 (74.7%)	26 (28.6%)	65 (71.4%)	24 (26.4%)	67 (73.6%)	91 (100%)
	First cohort	15 (27.8%)	39 (72.2%)	11 (20.4%)	43 (79.6%)	10 (18.5%)	44 (81.5%)	54 (100%)
	Second cohort	8 (21.6%)	29 (78.4%)	15 (40.5%)	22 (59.5%)	14 (37.8%)	23 (62.2%)	37 (100%)
Year 3	Total	15 (27.8%)	39 (72.2%)	11 (20.4%)	43 (79.6%)	5 (9.3%)	49 (90.7%)	54 (100%)
	First cohort	15 (27.8%)	39 (72.2%)	11 (20.4%)	43 (79.6%)	5 (9.3%)	49 (90.7%)	54 (100%)

Table 2. Statistical analysis of the annual grade point and number of volunteering non-parametric correlations per study year.

Study year	Spearman’s rho non-parametric test	Correlation Coefficient	*Sig. (2-tailed)	Number of students	Number of offered activities
Year1	AGPA/ Event	-0.024	0.769	153	87
Year2	AGPA/ Event	0.209	0.047	91	69
Year3	AGPA/ Event	0.194	0.159	54	47

Table 3. Statistical analysis of the annual grade point and the number of volunteering non-parametric correlations per cohort.

Cohort	Spearman's rho non-parametric test	Correlation Coefficient	*Sig. (2-tailed)	Number of students	Number of offered activities
Cohort 1	AGPA/ Event	-0.062	0.654	54	87
Cohort 2	AGPA/ Event	0.236	0.430	37	69
Cohort 3	AGPA/ Event	0.160	0.215	62	47

AGPA: annual grade point average; Event: number of volunteering per student.

*. Correlation is significant at the 0.05 level (2-tailed).

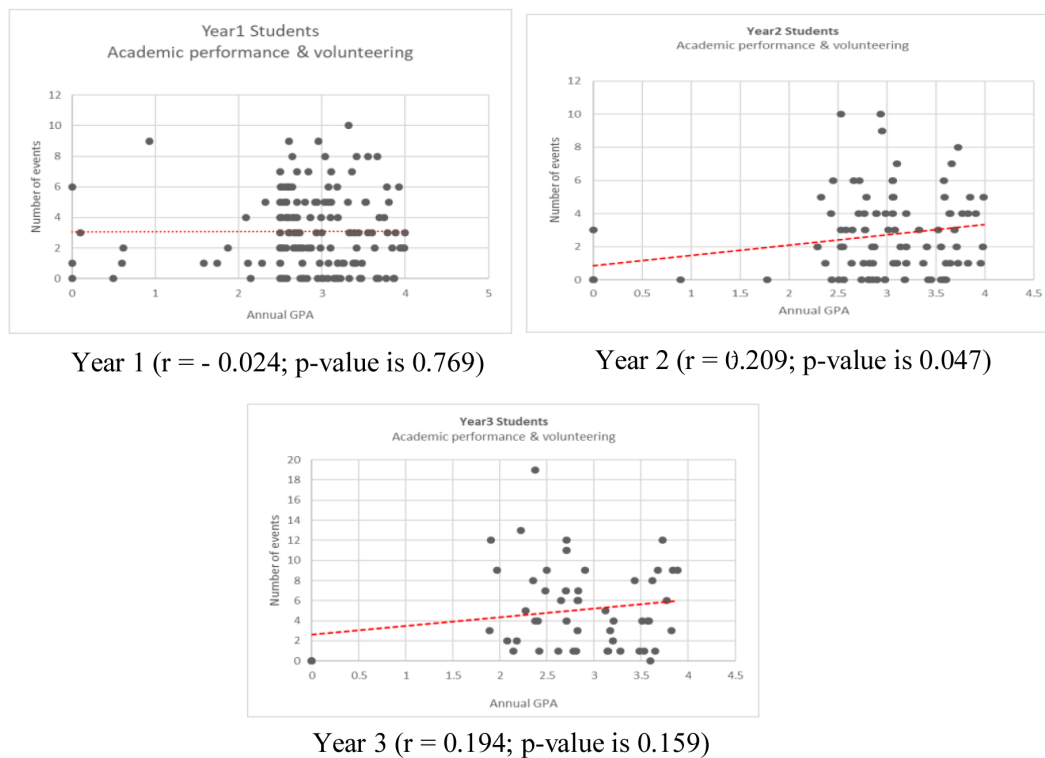


Figure 1. Correlation of annual grade point and number of volunteering for year 1, year 2, and year 3 students.

who are UAE Nationals ($4.64 (\pm 0.79)$) and students who are non-UAE Nationals $7.41 (\pm 0.68)$. The analysis also shows that the mean for the female and male number of volunteering was $6.41 (\pm 0.62)$ and $6.81 (\pm 1.06)$, respectively. This was statistically insignificant (p-value = 0.756).

Discussion

This study quantitatively examined the relationship between volunteering and academic performance in the pre-clinical phase of undergraduate medical education. Unlike many previous studies that rely on student self-reported data, our study was able to use actual institutional data to understand this relationship. This research also contributes to the growing pool of research being conducted in the UAE, a unique

factor given that much of the research on this topic reports findings from North America and Europe.

Relationship between volunteering and GPA

The results in the current study suggested a positive correlation between annual GPA and volunteering among medical students. The positive correlation was only found significant in year two (p-value is 0.047). Positive correlation between annual GPA and volunteering was also reported by Blue *et al.* (2006) and Tinto (1993)^{4,24}.

Notably, the relationship differs across the three pre-clinical study years. Insignificant negative correlation was described in Cohort 1, which is in agreement with previous study that

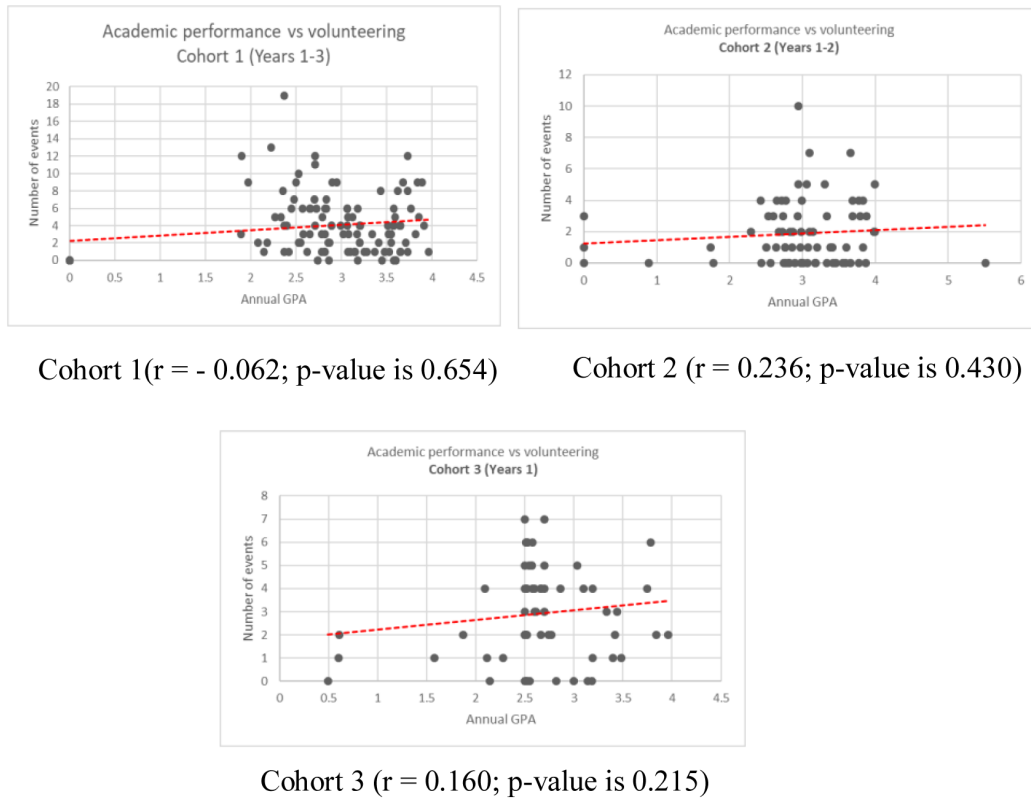


Figure 2. Correlation of annual grade point and number of volunteering for Cohort 1, Cohort 2, and Cohort 3 students.

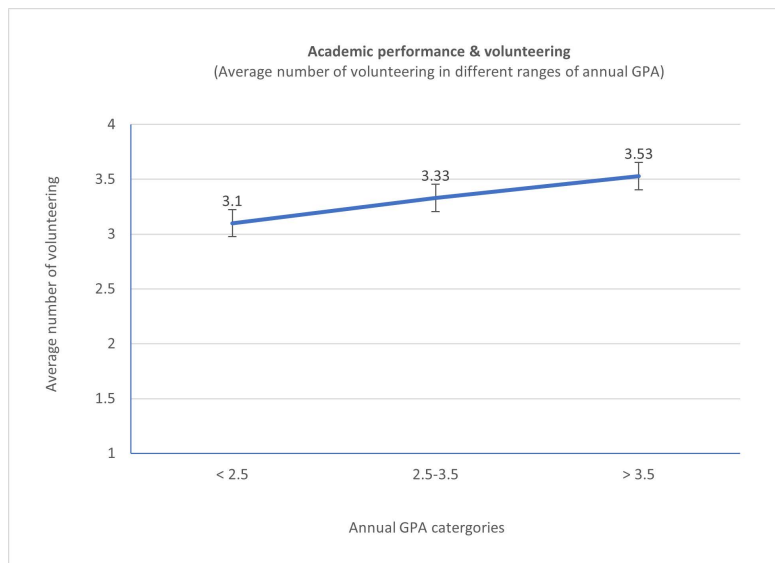


Figure 3. Line chart illustrates the spread of the three cohorts' data between three annual Average Grade Point categories.

reported no difference in academic performance between volunteers and their non-volunteering counterparts¹⁹. Usually students in first year in a medical college are marked by a transition

phase from high school to college where the uncertainty level among the students is elevated as they may not be immediately aware of how to strike a balance between academics and

Table 4. Cross-sectional analytical association of the nationality/gender and number of volunteering.

a. Volunteering vs. gender						
Mann-Whitney non-parametric test	Gender	N	Mean	Std. Deviation	Std. Error Mean	*Sig.
Num. Volunteering	Female	117	6.4103	6.73277	.62245	p-value = 0.756
	Male	36	6.8056	6.37773	1.06295	
b. Volunteering vs. nationality						
Mann-Whitney non-parametric test	Nationality	N	Mean	Std. Deviation	Std. Error Mean	*Sig.
Num. Volunteering	UAE	50	4.6400	5.60889	.79322	p-value = 0.009
	Non-UAE	103	7.4078	6.92174	.68202	

*P-value of 0.05 was used as a level of significant

non-academics in order to maintain academic standing²⁵. First year students also have the added pressure of ensuring they fulfill the progression requirement of a minimum annual GPA mandated in the degree plan of the MBBS program hence, there may be a greater reluctance to volunteer. In this study, the students in Cohort 1 are unique in that they were the first cohort of students in the newly founded university who are nicknamed “The Pioneers”. There is a high likelihood that these students had the same degree, or even greater degree, of uncertainty, which could have reduced students’ motivation to volunteer. This may aid to elucidate the obtained negative correlation between the two variables in year one and first cohort students. Cohort 1 also had access to a limited number of volunteering activities in the early years, with more competition over these limited slots, which could also explain the insignificant negative relationship between the two variables.

A positive insignificant correlation was observed across Cohort 2 and Cohort 3. This positive relationship in later cohorts could support the claim that students are more assured of their environment after year one and feel more empowered to volunteer while maintaining achieved annual GPA. Despite the assuring environment, the positive relationship was not significant, except in year two. Holdsworth (2010) explored how student motives to volunteer change over time, noting “opportunity” as one motivation contributing to whether or not a student would volunteer their time²⁶. Opportunity is defined as “captur(ing) circumstances that students find themselves in”, which may include things like commitments to external activities and having more spare time²⁶. It is quite possible that students in Year 2 find themselves with more opportunities to volunteer because it is the only year out of the first three that does not have high stakes and a high-pressure end-of-year bar exam.

The types of volunteering activities on offer could also be a factor. It is noteworthy that most activities available across the three study years were primarily focused on interpersonal and

communication skills. Year three students may not find these activities of great interest as their motives for volunteering may shift towards activities that build hands-on skills in preparation for clinical placements. Skills building was noted as a motive for students volunteer. Previous studies described that initial motives for students to volunteer is often as a way to contribute to the development of their resume^{19,26,27}. Shifting more focus on the kinds of volunteering activities the university provides may help to see greater gains in terms of volunteering and its impact on students. Medical students can be provided with experiential learning opportunities beyond the traditional medical school curriculum⁶. These experiences enhance essential communication skills and promote an increased awareness of the contextual health problems faced by community members^{6,28}.

Influencing factors

Whilst the correlations between annual GPA and volunteering among year 2 students were statistically significant, the rho values were trivial to low (r=0.21), which suggests that approximately 4% of the annual GPA was accounted for by the number of activities participated in. This possibly indicates the impact of other potential factors, other than the number of activities that students participated in, which might be associated with volunteering and influence GPA.

The current study suggested that students on the lowers end of academic performance, as expressed by annual GPA, volunteered less frequently than students with high performance. The increase in the average number of volunteering across the three categories of annual GPA and towards the higher annual GPA group was trivial. Yet, our observations support the findings of previous literature, which suggested that students with higher levels of service/service-learning performed better in several important measures of academic success, including class rank (GPA), measure of clinical knowledge, and residency director ratings^{23,29}. There are many factors which could contribute to this finding. For example, students may not have had equal

opportunities to build skills or personality traits conducive to creating the harmonious work-life integration critical to improving physical, emotional, and mental well-being and ultimately improvement of their career^{30,31}. It is also possible that students on the lowest ends of academic performance have differing priorities when it comes to volunteer as they may be more concerned about using time to improve academic standing.

Characteristics of students who volunteer

The results of this study show that there is equal participation in volunteering from a gender perspective, with both female and male students exhibiting a similar level of involvement in volunteering activities, though the percentage of females (76.5%) among the studied population is far more than that of the males (23.5%). Our results concur with other studies suggesting that medical students' gender is not statistically different between volunteers vs. non-volunteers yet, there may be tendencies for volunteers to be female²³. Additionally, the level of participation in volunteering activities among non-UAE nationals was significantly higher than that of the UAE nationals. Given the limited amount of research in this area using the UAE as a context, it is difficult to account for why non-UAE nationals volunteer more than UAE nationals. Studies found that the predisposing factor for volunteering was that the student had volunteered while in high school². The UAE has a unique cultural landscape featuring a diversity of high school curriculum, with many attending private schools and some UAE nationals attending government schools. A further area of exploration could include taking a deeper look at students' high school context to determine better if the student had previous volunteering experience or if certain high school curriculums promote volunteering more than others. It is also possible that connections to home, such as a social and familial support structures, might play a role in a student's willingness or availability to volunteer. Further study could examine this more closely to understand the demographics of non-UAE nationals who grew up in the region versus those who re-located for university.

Limitations

This study has several limitations. Any volunteering activities students might have participated in outside of the university are not necessarily reflected in the students record, unless directly reported, and so are not factored into the records used for this study. Additionally, the data in this study constitutes a sample from a single medical school in the UAE. It would be worthwhile to conduct follow-up studies that compare several programs across multiple institutions, both in the UAE and out, as well as to extend the research to include the clinical phases of the medical program. Finally, the volunteering opportunities themselves should be look at more closely to understand how they support the student and the curriculum. A case study of students in the UK suggests that both students and stakeholders recognize that the promotion of volunteering should seek to align institutional practices to promote and support volunteering with young people's expectations and aspirations³². Volunteering is a long-term commitment that should be approached through a motivational orientation⁹. It has been described that work values and community culture as well as the dispositional factors of a student, such as

personality traits, beliefs, and values are those which influence a student's decision to volunteer^{33,34}.

Future work

Further research directed to test students' personality traits related to volunteering motivation and motivational orientation (extrinsic/ intrinsic) are required to provide an indication of the functional motives that are most salient to students and inform in the design of a rewards system that could motivate students to volunteer further. Moreover, medical schools can seek to explore how volunteering opportunities can promote the development of competencies and values, such as encouraging intergenerational volunteerism by emphasizing a culture of community involvement; connecting students with volunteer opportunities that are in alignment with the phase of their educational development; and providing the guidance necessary to create new volunteer initiatives, including financial and promotional support. Exploring the development of an institutional infrastructure to promote student volunteerism would benefit the community population and help to empower and provide learning experiences for a vulnerable student population during times of extraordinary uncertainty, such as with the COVID-19 pandemic. More studies can inductively explore the extent of alignment between volunteering and degree plans to understand antecedents to academic performance (e.g., volunteering variables) that could play a moderating or mediating role in the correlation studied in this research.

Conclusion

In conclusion, volunteering among undergraduate medical students appeared to be associated with the academic performance. This study reported a positive association between the two parameters, however, the relationship differs across the pre-clinical study years and is likely influenced by factors associated with volunteering that might influence GPA. We need to understand other possible factors that impact students' motivation towards volunteering. Research directed to test students' personality traits related to volunteering motivation could be beneficial.

Data availability

The datasets generated and/or analyzed during the current study are not publicly available as they form a part of the student academic performance record at MBRU. For the purpose of participants' privacy protection and data confidentiality, it is stated in the MBRU-IRB that all information obtained from the participants during this study will be maintained confidentially and only accessible to the principal investigator and co-investigators of the study. However, to allow verification of published findings and to enable other researchers to build on published results, the data will be available for reviewers and other researchers by request to be sent via e-mail to the corresponding author (Laila.Alsuwaidi@mbru.ac.ae).

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 **Yan Chen** 

Centre for Medical and Health Sciences Education, School of Medicine, University of Auckland, Auckland, New Zealand

I believe the authors have addressed my concerns and the article can be indexed as it is now.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Quantitative research methods, assessment and evaluation, wellbeing

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 29 June 2022

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 **Brett Vaughan** 

¹ Department of Medical Education, The University of Melbourne, Melbourne, VIC, Australia

² Faculty of Health, Southern Cross University, Lismore, NSW, Australia

Thanks to the authors for the opportunity to review the revised manuscript. The changes made to the manuscript have improved the work. Further, the changes are a more tempered reflection of the results.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health professions assessment & evaluation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 12 May 2022

<https://doi.org/10.21956/mep.20463.r31826>

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Brett Vaughan 

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² Faculty of Health, Southern Cross University, Lismore, NSW, Australia

Thank you for the opportunity to review this work. Volunteering is an under-researched area in health professions education so work in this area is welcome.

The Introduction largely covers the relevant literature. In the third paragraph, it would be helpful to clarify whether this is different from other health professions programs or specific to medicine. The sentence also needs to be referenced to support the assertion. At the end of this paragraph, is it specific competencies being developed by volunteering or more broadly? There should also be an element that addresses whether the volume or quality (or both) of volunteering activities is associated with improved performance.

In the data collection, please clarify that the data were not retrospectively collected, rather the analysis was based on retrospective data. As per the comment about the Introduction above, the study appears to be undertaken on the basis of the volume of activity. Spearman's rho provides an indication of the association between the two variables of interest but there is no indication as to how the coefficient was interpreted by the authors. This would be helpful to develop an understanding of the interpretation of the data in the Discussion.

There are a number of analyses that are not described in the Methods (gender, UAE/non-UAE) and these should be included along with effect size calculations where appropriate. Linear regression is mentioned in the last part of the paragraph, however, there are no analyses presented that indicate it was undertaken.

In the Results, in Tables 2 and 3, the header refers to the 'number of activities offered'. Please clarify if this means the number of activities the students participated in. Whilst the correlations were statistically significant, the rho values were trivial to low. For example, AGPA and volunteering number per year was $r=0.21$ - this suggests that approximately 4% of the AGPA was

accounted for by the number of activities participated in.

As mentioned in the Methods section, effect size calculations should be presented for p values that are significant. The classification of AGPA was interesting and will need to be described in the Methods along with references to support the categorisation - why was the optimal performance in the mid-range of AGPA scores?

In the Discussion, there is a little bit of repetition with respect to the presentation of results. Further, there are only a few references to the literature throughout and this is an aspect that could be strengthened. Probably one of the more interesting elements of the study is the gender aspect of volunteering - this should be more prominent in the manuscript, although I appreciate this is not the research question.

The Conclusions likely need to be redrawn. There was a positive association between performance and volunteering but the association was weak. Whilst I agree that "students' motivating factors towards volunteerism should receive more attention from educational institutions" the conclusion per se is not from the study. It may be better to add that we need to understand other factors associated with volunteering that might influence GPA. Further, the authors suggest that "More emphasis should be placed on the quality of involvement in extracurricular activities." Again, I agree with the statement, however, this is the opposite of what was presented in the work and could be clarified by stating where the 'emphasis' should be rather than the quantity.

For the references, the Holdsworth reference on page 7 needs to be amended to be consistent with the guidelines.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Partly

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Have any limitations of the research been acknowledged?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Health professions assessment & evaluation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 30 May 2022

Laila Alsuwaidi, Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, United Arab Emirates

We would like to extend sincere gratitude for your time and efforts in reviewing the manuscript. We are grateful for your constructive feedback and are delighted with your interest in this manuscript. We have addressed the comments/suggestions and believe that it has strengthened our manuscript. To facilitate tracing the edits, we are attaching the latest version of the manuscript with track changes, along with providing below response to the raised comments. We genuinely hope the revised version will meet your expectations.

Introduction: We have reviewed the introduction section and added the relevant supporting references. According to the literatures, the competencies being developed by volunteering are those with a holistic look at practice, focusing on interpersonal communication, data literacy, professionalism, leadership, and advocacy, this is in addition to the medical knowledge and skills. We believe that quality is just as important as quantity in volunteering activities, any or both could be associated with improved performance, but we have no reference to clearly address the subject. Our current study focused on volunteering activities' volume to explore its possible association with improved performance.

Methods: We have reviewed the data collection and analysis sub-section and added a statement to clarify that the analysis in our study was based on retrospective data. We also described the analysis of the volunteering among different gender and UAE/non-UAE nationals. Mann-Whitney test was used to test the means and Exact Fischer chi-test for testing dependency between categorical variables. The effect size calculation is not applicable as the selected test for analysis (Exact Fischer chi-test) remains valid for small sample sizes. Thank you for bringing the subject of the regression coefficients to our attention. In fact, we have revised the results sections and noticed that there is a discrepancy in the statement; accordingly, the manuscript has been amended to describe the scatter plotting not regression.

Results: The header in Tables 2 and 3 refers to the activities made available for the students and they participated in. The noted observation related to the statistically significant correlation, and trivial to low rho, highlights the impact of other possible factors (other than the number of activities that students participated in) that might be associated with volunteering and influence GPA. We found this comment very useful to improve the discussion section. Regarding the sample size calculation, it was not conducted as we used the whole number of students in the batches. To attend to your inquiry, we elaborated on the classification of the annual GPA and why the optimal performance in the mid-range of

annual GPA in the methods section.

Discussion: We have reviewed the manuscript to address the comments related to the repetition of the results presentation in the discussion section and we expand the referencing as recommended. The gender aspect of volunteering has been elaborated on further and we added some interpretation to the discussion section considering the reviewer's comments related to the statistically significant correlation between annual GPA and the number of volunteering activities.

Conclusion & References: The conclusion statement has been revised to reflect the study's outcome in more judicious approach. References were also amended as required.

Competing Interests: No competing interests were disclosed.

Reviewer Report 12 April 2022

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Yan Chen 

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This paper examines the relationship between medical students' volunteering activities and their academic performance. The authors provided a synthesis of relevant literature on the positive impact that volunteering could have on medical students. The study utilised official volunteering records held by the university, thus minimising recording bias. Details were given on the research design and analysis.

In the introduction, I would have liked to see more literature to explain why volunteering would impact academic performance. It would have been beneficial to justify using GPA as an indicator of academic performance. It is also essential for the authors to explain how GPA was calculated (e.g., was it based on their end-of-year examinations, what subjects the GPA covers, etc.). The second research question, 'What are the factors that possibly influence the relationship between volunteering and AGPA?', implies a moderation analysis. However, this was not the case in the current paper. This research question might be better phrased as 'What factors influence students' volunteering behaviours?'

More information is required in the methods and the results sections to allow future replication of the study and better interpretation of the results:

- For instance, why does the university hold students' volunteering record if it is not already embedded in the curriculum? What information is registered, and whether students have

received any incentives to provide such information to the university? It would have been very interesting to see the types of volunteering work students engaged in if such information was already being recorded.

- The authors conducted separate analyses for each year level and each cohort. It would have been beneficial to rule out potential differences in student characteristics between each cohort before collapsing them to conduct the year-level analysis. When it comes to cohort-based analyses, it is unclear how the authors treated data that had multiple time points (i.e., how did they collapse cohort 1's data across three years?). I think the authors might have missed the opportunity to analyse the longitudinal trend of students' engagement in volunteering, especially for the first cohort which had three years' worth of data.
- How many students were included in each GPA category, as shown in Figure 3? The average number of volunteering activities could be a better measure than the total number of volunteering activities. The authors proposed regression analysis in the methods, however, they did not report the regression coefficients.
- What analysis was performed for Table 4?

The authors speculated on the non-significant relationships between volunteering and academic performance, and the current study does not provide robust evidence to support a link between volunteering and medical students' academic performance. Therefore, more caution is needed to interpret the null findings.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Have any limitations of the research been acknowledged?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Quantitative research methods, assessment and evaluation, wellbeing

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 30 May 2022

Laila Alsuwaidi, Mohammed Bin Rashid University of Medicine and Health Sciences, Dubai, United Arab Emirates

Thank you very much for the thorough review and the important comments and suggestions. We trust that by meticulously considering your valuable feedback and incorporating the necessary changes in the manuscript, we were able to raise the coherence of the synthesis and better leverage the value of our contribution. To facilitate tracing the edits, we are attaching the latest version of the manuscript with track changes, along with providing the below response to the received comments. We do hope the revised version will meet your expectations.

We have reviewed the manuscript and added to the introduction some literature to explain why volunteering would impact academic performance. The second question of the current study has now been modified in the manuscript and reads “What factors influence students’ volunteering behaviours?”.

We also added to the methods section the justification for using GPA as an indicator of academic performance and we clarified the principle for GPA calculation. More information was added to the methods and results sections to address the points raised by the reviewer.

Student characteristics across cohorts are presented in Table 3 and Figure 2. Data that had multiple time points were treated individually, each entry point recorded and merged with the relevant year group. Example X student has 3 entries across 3 years, each entry will be added to the relevant academic year.

As advised, we inserted the number of students in each GPA category in the results section.

Figure 3 was amended to present the average number of volunteering activities instead of the total number of volunteering activities.

Thank you for bringing the subject of the regression coefficients to our attention. In fact, we have revised the methods and the results sections and noticed that there is a discrepancy in the statement; accordingly, the manuscript has been amended to describe the scatter plotting not regression.

In Table 4, the data normality was tested using Shapiro-Wilk test followed by Mann-Whitney non-parametric test to compare the two administered groups. We reviewed the table and added the analysis name.

In response to the received comment, the conclusion statement has been revised to reflect the study’s outcome in a more cautious approach.

Thank you again for the valuable comments.

Competing Interests: No competing interests were disclosed.
