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Barriers and facilitators of research in Cameroon (Part II) - an e-survey of medical students

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Abstract

Introduction: *research fosters critical thinking and prepares students for a career in academic medicine. This study aimed to identify the facilitators and barriers to research among Cameroonian medical students.* ***Methods:*** *an electronic survey was distributed between May 23, 2020, and June 07, 2020. The survey was made of closed-, opened-, and Likert scale questions. A Preference Score (PS) was used to quantify the medical students' perception of barriers and facilitators to research. The Kruskal-Wallis H and Fisher's exact tests were used to evaluate bivariate relationships.* ***Results:*** *one hundred and eighty-eight (188) students with a mean age of 24.1 ± 2.3 years were enrolled. Most respondents were male (56.9%), francophone (69.1%), and in their final year of medical school (46.8%). Twenty-one students (11.1%) had a peer-reviewed article, and all the published students were in their sixth- or seventh-year of undergraduate medical studies. Barriers to research included lack of funding (PS=203), obsolete patient information management systems (PS=198), and limited understanding of biostatistics (PS=197). Facilitators to research included research focused on the student's interests (PS=255), the study's capacity to improve practice (PS=247), and scientific recognition (PS=198).* ***Conclusion:*** *barriers to research among Cameroonian medical students are mainly institutional. However, facilitators are primarily linked to career goals. To improve research activities among these undergraduates, initiatives must target institutional barriers and incentives that foster career development.*

Introduction

Low-and middle-income countries (LMICs) bear huge burdens of disease but lack the resources to reduce these burdens [1]. The high mortality rate in LMICs has been attributed to the inadequate health care systems and suboptimal quality of healthcare services compounded by a lack of research [2]. Improvements in healthcare delivery in LMICs can only be successful if they are based on high-quality and context-specific research [3]. Moreover, the data generated from local research should be made available for health policy-makers so they can formulate effective and sustainable measures. Only then, will these measures curb the considerable burden of disease in LMICs. Research training nurtures interest early on, increases research productivity, and conveys trainees with the skills that are essential for an academic career [4,5]. Encouraging medical students to pursue an academic career is beneficial to them, their institutions, and science [6,7]. The evidence generated by academicians is used to create guidelines that improve clinical practice [8]. Therefore, research courses are integral to the academic curriculum of medical schools. High-income countries (HICs) [6,9-11] tend to have these courses more consistently than LMICs [12,13]. The lack of compulsory research modules in the course curriculum of medical schools in LMICs is responsible for suboptimal knowledge, attitudes, and practices that are not based on evidence [14,15]. Cameroon, an LMIC, has a low research output in part due to the numerous barriers that healthcare professionals face during their training. In an editorial, Ngeh EN highlighted a few barriers to the involvement of Cameroonian medical students in research: inadequate research facilities (such as outdated libraries, lack of computers, low internet accessibility, lack of e-libraries and poorly equipped research laboratories), lack of proper mentorship, delayed

involvement in research, lack of funding, and limited access to journals [5]. However, they subjectively described barriers to research among Cameroonian medical undergraduates and did not comment on its facilitators [5]. We must identify and rank the barriers and facilitators of research among medical students to develop policies that increase interest and involvement. To the best of our knowledge, there is no comprehensive study assessing the barriers and facilitators of research among Cameroonian medical students. This study aimed to identify the deterrents and attractants of research involvement among Cameroonian medical students.

Methods

Data collection tool: this cross-sectional study was performed using an online survey designed on Google Forms (Google, USA) by an author (USK). The items of the survey were developed from informal qualitative research and previous publications [5,16]. The face validity of the survey was then established by five Cameroonian researchers (JNT, MT, AM, JRN, and FTE). Following this, the validated survey was piloted among 20 Cameroonian medical students to ensure usability and technical functionality. Then, the feedback from the pilot was used to improve the survey. The final survey had 33 open- and closed-questions presented in seven sections: general demographic data, student demographic, physician demographic, research training and experience, challenges, intrinsic facilitators, and extrinsic facilitators (Annex 1). Informed consent was obtained in the first section of the survey, and the respondents were given information on the investigators and data storage.

Data collection: the minimal sample size needed to be obtained through a free online sample size calculator [17] was 94 medical students assuming a target population of 3500 medical students and a 95% confidence interval. The survey was distributed via social media (WhatsApp and Facebook) to Cameroonian medical students from May 23, 2020, to June 07, 2020. The sampling was convenient, and the survey was anonymous. Respondents could choose to drop out or decline to answer a question whenever they chose except for their profession. The survey data was stored on Google Drive (Google, USA) in a password-protected account, and access to the data was limited to the investigators. The anonymized data is available on the Open Science Framework.

Data analysis: the responses to the Likert scale questions (barriers and facilitators) were summed up after coding and used to calculate a Preference Score (PS). *Preference Score (PS) = ((-2 x number of strongly disagree responses) + (-1 x number of disagreements) + (0 x number of neutral responses) + (1 x number of agree responses) + (2 x number of strongly agree responses))*. Based on the median Preference Scores (PS) for each item, the barriers and facilitators were divided into three categories: weak (median PS<0), moderate (median PS=0), and strong (median PS>0). The barriers and facilitators in each category were then ranked based on their total PS. Univariate, bivariate, and multivariate data analyses were done using SPSS v26 (IBM, USA). First, quantitative variables were expressed as means and standard deviations, while qualitative variables were expressed as frequencies and percentages. Next, unadjusted and adjusted bivariate data analyses (Kruskal-Wallis and Fisher's exact tests) were done with a threshold of significance of 0.05. Ethics approval was sought and waived by the institutional review board of the Higher Institute of Health Sciences, Cameroon.

Results

Respondent demographics: we registered 189 responses and excluded one because the respondent was enrolled out of Cameroon. Out of the 188 responses, 66 (35.1%) were from the Faculty of Medicine and Biomedical Sciences (FMSB) of the University of Yaoundé I and, 25 (13.3%) were from the Faculty of Medicine and Pharmaceutical Sciences (FMSP) of the University of Douala, Cameroon. Moreover, 88 (46.8%) were

in the seventh year/final year of undergraduate medical studies, 32 (17.0%) were in the sixth year of medical school, and 38 (20.2%) were in the fifth year (Figure 1). The mean age of the students was 24.1 ± 2.3 years. Also, the majority of respondents were male (107, 56.9%), French speakers (130, 69.1%), and lived in the Centre region of Cameroon (102, 54.2%) (Table 1).

Academic output and research experience: few students (21, 11.1%) had published articles (mean=0.2 ± 1.9) peer-reviewed articles and no first author articles). All the published students were in their sixth or seventh year of medical school. Students of the Faculty of Health Sciences of Buea (31 articles) and FMSB (5 articles) published the most. When accounting for the number of students, the Faculties of Health Sciences in Buea (0.74) and Bamenda (0.23) had the greatest number of articles per student (Table 2). However, the differences were not statistically significant (P=0.34) (Figure 2). A similar difference was observed between the French (mean=0.01 ± 0.3 articles) and English (mean=0.6 ± 3.4 articles) speaking students (P=0.65). The students who had published had started recently (median=2.5, IQR=2.5-4.5 years), most had taken biostatistics (178, 94.7%) and research methodology (137, 72.9%) courses in medical school. However, few (41, 21.8%) had taken supplementary research online courses. While the students felt the biostatistics course was useful (147, 78.2%), few understood it entirely (48, 25.5%). A minority (17, 9.0%) had a graduate degree, 78 (41.4%) had a research mentor, and 83 (44.4%) had attended a medical conference.

Barriers and facilitators of research: the students reported the following as major barriers: lack of grants, article paywalls, lack of financial incentives, data collection, and difficulties getting ethical clearance (Figure 2). The top five facilitators of research were interested in the research topic, the potential of the research to improve practice, availability of mentorship, financial support, and scientific recognition (Figure 3). Cameroonian medical students identified 17 strong barriers, 1 moderate barrier, and 8 strong facilitators. Lack of funding (median=1, IQR=1-2, total=203), obsolete patient information management systems (median=1, IQR=0-2, total=198), and limited understanding of biostatistics (median=1, IQR=1-2, total=197) as the three most important barriers to research. On the other hand, they identified the following as important facilitators of their involvement in medical research: studies aligning with their research interests (median=2, IQR=1-2, total=255), the study's capacity to improve practice (median=1, IQR=1-2, total=247), and scientific recognition (median=1, IQR=1-2, total=198) (Table 3).

Discussion

In this e-survey, we identified facilitators and barriers to research among Cameroonian medical students. We found that medical students had little to no peer-reviewed articles corresponding to only 11.1% of students with an article. Students published late during their undergraduate studies and were mainly from the University of Buea. Almost every published student had taken biostatistics, and most had taken research methodology courses. Only 21.8% had taken additional research-related online classes. Barriers to research included lack of funding, obsolete patient information management systems, limited understanding of biostatistics, and prohibitive publication charges. Facilitators to research were studies aligning with their research interests, the study's capacity to improve practice, scientific recognition, and career advancement.

Barriers: respondents felt the methodology and statistics courses they had received were involved and they found it challenging to apply what they had learned to research. This is significant because most students had taken the courses, yet the most common barrier to research were difficulties with research design and statistics. Medical students in Iran, Pakistan, and India face the same difficulties in research involvement [18-20]. This difficulty could exist because the courses are complex, the time

allocated is insufficient, or the method of delivery is not appropriate. Courses that use clinically relevant topics and interactive problem solving tend to be more efficacious [21,22]. Biostatistics and methodology courses should have practical sessions that focus on contextually-relevant questions. For example, students would discuss designing research that investigates the effects of the COVID-19 pandemic on medical rotations. Students could be asked to identify the most appropriate methodologies and potential biases. Journal clubs can equally be used to increase interactions, retention, and skill among medical students [23]. Medical educators should choose recent articles that use different methodologies and critically appraise the articles with their students. The low involvement of Cameroonian medical students in scientific research should prompt action on the part of the medical schools. Students' interests and motivations for research should be cultivated, and they should be exposed to research frequently. The earlier medical students are exposed to research, the more likely they are to pursue a career in academic medicine and to have a successful career [18,19]. Medical schools should reduce the "activation energy" for research involvement by promoting the creation of student interest groups and the introduction of research courses that are better adapted to the students' needs [20]. Lack of financial resources was a major deterrent to research involvement among our respondents. Kumar *et al*. and Pallamparthy *et al*. have described similar findings in Pakistan and India [19,20-23]. Funding is a critical component of health research [24], and the more funding a researcher has, the more research they can initiate [25]. However, there is a limit to the beneficial effect of research [26]. Hence, students should seek grants but equally learn to do more with the funding they have at their disposal. Some projects do not need much funding. These include cross-sectional studies, letters to the editor, and commentaries.

Additionally, students can access subscription articles through the HINARI Access to Research for Health Programme [27]. Next, students should use free research tools like free software for statistical analysis (R, Epidata, and Epi Info), article review (Rayyan), and visualization (Table Public). Moreover, the students should submit their articles to journals that have no or small article processing charges. Some publishers, for example, will waive charges for low- and middle-income country authors [28]. In Iran, medical students with research experience face more institutional barriers than students who have no research experience while those without experience face personal barriers mostly [18]. In our study, there was no statistically significant difference between the two groups. The most common institutional barrier was limited access to information (articles, patient data, and the Internet). Similarly to our study, limited access to information sources was the most common institutional barrier in Pakistan [19]. Article paywalls can be overcome by using HINARI as mentioned above, but access to patient data and the Internet is more complex to solve. Access to patient data is often tricky because hospitals use paper records, but it can also be made difficult by slow and complicated administrative procedures [29]. Medical schools and health institutions can streamline the processes if they create application templates and frequently asked questions documents for medical students. Concerning internet access, medical schools, internet service providers, and local governments must design projects that will increase internet connectivity among medical students [30]. These might be student subscriptions that are co-financed by the industry and the government. Other studies have identified the lack of protected time and lack interest in research as substantial barriers among medical students [1,2]. In our study, time constraint was a moderate barrier. Medical educators feel the schools do not allocate enough time and importance to research, so the students are not motivated to do research [31,32]. Also, in most African countries, research is not a prerequisite for admission into residency. As a result, medical students in these countries cannot afford to spend time on an activity that is not graded or will not contribute to their admission in residency. If

medical schools allocate more time and credits to research, they should be able to increase the involvement of students. Similarly, if residency programs in low- and middle-income countries make research involvement a prerequisite for admission, then, medical students might be more inclined to be involved.

Facilitators: the most important research facilitators were mentorship, the prospect of scientific recognition and academic careers, and capacity building. These have been identified in previous studies [19,20,33]. It is noteworthy that some of the facilitators were solutions to major barriers. Evidently, the respondents were conscious of the barriers to research and were thinking about solutions to the barriers. The role of mentorship in guiding medical students cannot be overstated. However, mentorship is only useful if it is done right. A successful mentor-mentee relationship is bidirectional, built on mutual respect, has clear objectives, and the individuals share the same values [34]. Conversely, unsuccessful relationships lack communication, commitment, are competitive, and the mentor lacks experience [34]. If medical schools can create mentor-mentee research pairs based on this information, they will create environments in which their students can grow.

Limitations: the interpretation of our results must take into account certain limitations, namely the heterogeneity of our sample, the sampling method, which was not representative of all the cohorts of medical students. Also, the total preference score depends on the number of respondents, so it cannot be directly compared between studies. However, the median is less variable, so the strength of a determinant can be compared between studies.

Conclusion

In this survey, we investigated the deterrents and attractants to research among Cameroonian medical students. Also, we measured the strength and ranked the deterrents to research involvement. Future research should focus on the impact of the proposed strategies on research involvement among medical students.

What is known about this topic

- *Research fosters critical thinking and prepares students for a career in academic medicine;*
- *Barriers to research among medical students subjectively identified are inadequate research facilities, lack of proper mentorship, delayed involvement in research, lack of funding, and limited access to journals. Nothing is known about facilitators subjectively or objectively.*

What this study adds

- *This is the first study to objectively identify the facilitators and barriers to research among Cameroonian medical students. Additional merits of the study include its high response rate and sample size, which was representative of the different medical schools in Cameroon;*
- *Barriers to research included lack of funding, obsolete patient information management systems, limited understanding of biostatistics, and prohibitive publication charges;*
- *Facilitators to research were studies aligning with their research interests, the study's capacity to improve practice, scientific recognition, and career advancement.*

Competing interests

The authors declare no competing interests.

Authors' contributions

USK: conceptualization, data curation, formal analysis, investigation, methodology, project administration, visualization, writing - original draft, writing - review, and editing. JNT, MT, AM,

FTE, and JRN: investigation, methodology, project administration, writing - original draft, writing - review and editing. CW and FNT: investigation, writing - original draft, writing - review, and editing. DJ: Conceptualization, investigation, project administration, validation, investigation, writing - original draft, writing - review, and editing. All the authors read and approved the final version of the manuscript.

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Figure 2: stacked bar chart of the perceived barriers to research according to young Cameroonian physicians. The red circles represent the average response

Figure 3: stacked bar chart of the perceived facilitators of research according to young Cameroonian physicians. The red circles represent the average response

Annex

Annex 1: barriers and facilitators of medical research in Cameroon

References

1. Langer A, Díaz-Olavarrieta C, Berdichevsky K, Villar J. Why is research from developing countries underrepresented in international health literature, and what can be done about it. Bull World Health Organ. 2004;82(10): 802-803. **PubMed**| **Google Scholar**
2. Kramer B, Libhaber E. Closing the barrier between disease and health outcomes in Africa through research and capacity development. Glob Health Action. 2018;11(1): 1425597. **PubMed**| **Google Scholar**
3. Kyaw Soe HH, Than NN, Lwin H, Nu Htay MNN, Phyu KL, Abas AL. Knowledge, attitudes, and barriers toward research: the perspectives of undergraduate medical and dental students. J Educ Health Promot. 2018 Feb 9;7: 23. **PubMed**| **Google Scholar**
4. Munabi IG, Katabira ET, Konde-Lule J. Early undergraduate research experience at Makerere University Faculty of Medicine: a tool for promoting medical research. Afr Health Sci. 2006;6(3): 182-186. **PubMed**| **Google Scholar**
5. Ngeh EN. Research among undergraduate biomedical students in Cameroon: contextual barriers, room for improvement. Pan Afr Med J. 2019 Jun 27;33: 149. **PubMed**| **Google Scholar**
6. Solomon SS, Tom SC, Pichert J, Wasserman D, Powers AC. Impact of medical student research in the development of physician-scientists. J Investig Med Off Publ Am Fed Clin Res. 2003;51(3): 149-156. **PubMed**| **Google Scholar**
7. Straus SE, Straus C, Tzanetos K, International Campaign to Revitalise Academic Medicine. Career choice in academic medicine: systematic review. J Gen Intern Med. 2006;21(12): 1222-1229. **PubMed**| **Google Scholar**

8. Houlden RL, Raja JB, Collier CP, Clark AF, Waugh JM. Medical students' perceptions of an undergraduate research elective. Med Teach. 2004;26(7): 659-661. **PubMed**| **Google Scholar**
9. Hunskaar S, Breivik J, Siebke M, Tømmerås K, Figenschau K, Hansen J-B. Evaluation of the medical student research programme in Norwegian medical schools. A survey of students and supervisors. BMC Med Educ. 2009;9: 43. **PubMed**| **Google Scholar**
10. Hren D, Lukic IK, Marusic A, Vodopivec I, Vujaklija A, Hrabak M *et al*. Teaching research methodology in medical schools: students' attitudes towards and knowledge about science. Med Educ. 2004;38(1): 81-86. **PubMed**| **Google Scholar**
11. Jacobs CD, Cross PC. The value of medical student research: the experience at Stanford University School of Medicine. Med Educ. 1995;29(5): 342-346. **PubMed**| **Google Scholar**
12. Althubaiti A, Al Muqbil B, Al Buraikan D. Assessment of Medical Students' Attitudes Towards Research and Perceived Barriers. Int J Med Stud. 2017;5(3): 95-98. **Google Scholar**
13. Ibrahim Abushouk A, Nazmy Hatata A, Mahmoud Omran I, Mahmoud Youniss M, Fayez Elmansy K, Gad Meawad A. Attitudes and perceived barriers among medical students towards clinical research: a cross-sectional study in an Egyptian Medical School. Journal of Biomedical Education. 2016;2016: e5490575. **Google Scholar**
14. Ibrahim NKR, Fetyani DM, Bashwari J. Assessment of the research-oriented knowledge, attitude and practice of medical students and interns of the King Abdulaziz University. Jeddah and the adoption of a research-intervention educational program. 2013;38(4): 8. **Google Scholar**
15. Al-Hilali SM, Al-Kahtani E, Zaman B, Khandekar R, Al-Shahri A, Edward DP. Attitudes of Saudi Arabian Undergraduate Medical Students towards Health Research. Sultan Qaboos Univ Med J. 2016;16(1): e68-73. **PubMed**| **Google Scholar**
16. Dhalla KA, Guirguis M. Barriers and incentives for conducting research amongst the ophthalmologists in Sub-Sahara Africa. PLOS ONE. 2018;13(10): e0197945. **PubMed**| **Google Scholar**
17. SurveyMonkey. Sample size calculator: understanding sample sizes. Accessed June 27 2020.
18. Dadipoor S, Ramezankhani A, Aghamolaei T, Safari-Moradabadi A. Barriers to research activities as perceived by medical university students: a cross-sectional study. Avicenna J Med. 2019;9(1): 8-14. **PubMed**| **Google Scholar**
19. Kumar J, Memon A, Kumar A, Kumari R, Kumar B, Fareed S. Barriers experienced by medical students in conducting research at undergraduate level. Cureus. 2019 Apr; 11(4): e4452. **PubMed**
20. Pallamparthy S, Basavareddy A. Knowledge, attitude, practice, and barriers toward research among medical students: a cross-sectional questionnaire-based survey. Perspect Clin Res. 2019;10(2): 73-78. **PubMed**| **Google Scholar**
21. Knapp RG, Miller MC. Clinical relevance: an issue in biostatistical training of medical students. Med Educ. 1987;21(1): 32-37. **PubMed**| **Google Scholar**
22. Dutton CB, Wing P, Eaton CB. Teaching epidemiology and biostatistics through interactive problem solving. J Cancer Educ Off J Am Assoc Cancer Educ. 1991;6(3): 129-132. **PubMed**| **Google Scholar**
23. Letterie GS, Morgenstern LS. The journal club; teaching critical evaluation of clinical literature in an evidence-based environment. J Reprod Med. 2000;45(4): 299-304. **PubMed**| **Google Scholar**

24. Ioannidis JPA. Research needs grants, funding and money--missing something. Eur J Clin Invest. 2012;42(4): 349-351. **PubMed**| **Google Scholar**
25. Pagel PS, Hudetz JA. Scholarly productivity and national institutes of health funding of foundation for anesthesia education and research grant recipients insights from a bibliometric analysis. Anesthesiol J Am Soc Anesthesiol. 2015;123(3): 683-691. **PubMed**| **Google Scholar**
26. Jacob BA, Lefgren L. The Impact of Research Grant Funding on Scientific Productivity. J Public Econ. 2011;95(9-10): 1168-1177. **PubMed**| **Google Scholar**
27. World Health Organization. Hinari Eligibility. WHO. Accessed June 28 2020.
28. Lawson S. Fee Waivers for Open Access Journals. Publications. 2015;3(3): 155-167.. **PubMed**| **Google Scholar**
29. Conradie A, Duys R, Forget P, Biccard BM. Barriers to clinical research in Africa: a quantitative and qualitative survey of clinical researchers in 27 African countries. Br J Anaesth. 2018;121(4): 813-821. **PubMed**| **Google Scholar**
30. Williams CD, Pitchforth EL, O'Callaghan C. Computers, the Internet and medical education in Africa. Med Educ. 2010;44(5): 485-488. **PubMed**| **Google Scholar**
31. Amgad M, Man Kin Tsui M, Liptrott SJ, Shash E. Medical Student Research: an integrated mixed-methods systematic review and meta-analysis. PloS One. 2015;10(6): e0127470. **PubMed**| **Google Scholar**
32. Boyle SE, Cotton SC, Myint PK, Hold GL. The influence of early research experience in medical school on the decision to intercalate and future career in clinical academia: a questionnaire study. BMC Med Educ. 2017 Dec 11;17(1): 245. **PubMed**| **Google Scholar**
33. Curran MA, Black M, Depp CA, Iglewicz A, Reichstadt J, Palinkas L *et al*. Perceived barriers and facilitators for an academic career in geriatrics: medical students' perspectives. Acad Psychiatry J Am Assoc Dir Psychiatr Resid Train Assoc Acad Psychiatry. 2015;39(3): 253-258. **PubMed**| **Google Scholar**
34. Straus SE, Johnson MO, Marquez C, Feldman MD. Characteristics of successful and failed mentoring relationships: a qualitative study across two academic health centers. Acad Med J Assoc Am Med Coll. 2013;88(1): 82-89. **PubMed**| **Google Scholar**

Table 1: sociodemographic characteristics of Cameroonian medical students	
Characteristics	**Frequency (N=188, %)**
Gender	
Female	81 (43.1)
Male	107 (56.9)
First language	
English	58 (30.9)
French	130 (69.1)
Permanent address	
Adamawa	2 (1.1)
Centre	102 (54.2)
Far North	3 (1.6)
Littoral	34 (18.1)
North West	5 (2.7)
South	2 (1.1)
South West	27 (14.4)
West	13 (6.9)

Table 2: research experience of Cameroonian medical students	
Experience	**Frequency (N=188, %)**
Research training in medical school	
Took a biostatistics course	178 (94.7)
Understood the biostatistics course	48 (25.5)
Found the biostatistics course useful	147 (78.2)
Took a research methodology course	137 (72.9)
Found the research methodology course useful	128 (68.1)
Understood the research methodology course	49 (26.1)
Took online research classes	41 (21.8)
Non-medical school degree	
Total graduate school degree (other than MD)	17 (9.0)
MSc	1 (0.5)
BSc	15 (8.0)
BA	1 (0.5)
Mentorship and non-medical school research opportunities	
Research mentor	78 (41.4)
Attendance at a conference	83 (44.4)
Abstract presentation	13 (6.9)
Grant application	75 (39.9)
BA: Bachelor of Arts, BSc: Bachelor of Science, MD: Doctor of Medicine, MSc: Master of Science	

Table 3: barriers and facilitators of research for Cameroonian medical students		
Item	**Preference Score (PS)**	
	Median (IQR)	**Total**
Barriers		
Lack of funding	1 (1-2)	203
Obsolete health information management systems	1 (0-2)	198
Limited understanding of biostatistics	1 (1-2)	197
Prohibitive publication charges	1 (0-2)	182
Limited understanding of research design	1 (0-1)	154
Workload	1 (0-1)	149
Time constraints	1 (0-2)	127
Lack of internet access	1 (0-1)	127
Lack of mentorship	1 (0-2)	127
Difficulties using research software	1 (0-2)	116
Difficulties getting data collection authorizations	1 (0-2)	109
Limited access to scientific publications	1 (0-2)	106
Lack of financial incentives	1 (0-1)	97
Lack of electricity	1 (0-1)	86
Lack of research team	1 (0-1)	83
Difficulties getting ethical approval	1 (0-1)	77
Limited access to statisticians	1 (-1-1)	54
Language barrier (English)	0 (-1-1)	-31
Facilitators		
Interest in the research subject	2 (1-2)	255
Potential of the research to improve practice	1 (1-2)	247
Scientific recognition	1 (1-2)	198
Career advancement	1 (1-2)	172
Potential to publish in a high impact journal	1 (0-2)	162
Potential funding for the study	1 (0-1)	135
Previous research experience	1 (0-1)	120
Study robustness	1 (0-1)	100

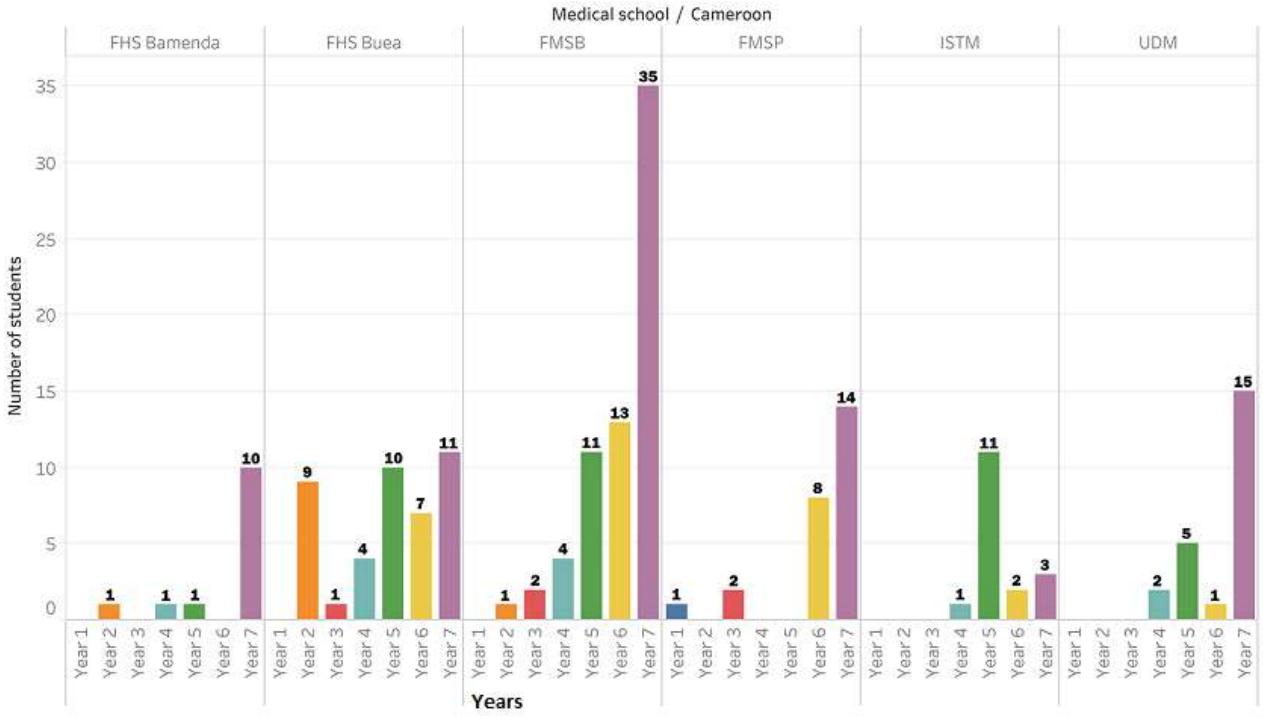

Figure 1: medical school affiliations and academic year of Cameroonian medical students who responded to the survey

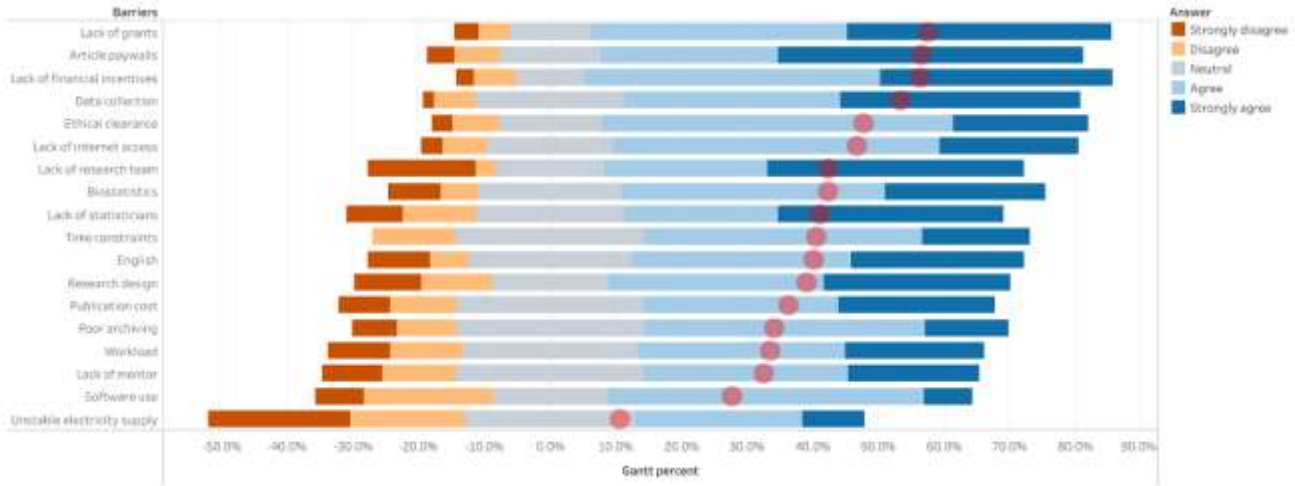

Figure 2: stacked bar chart of the perceived barriers to research according to young Cameroonian physicians. The red circles represent the average response

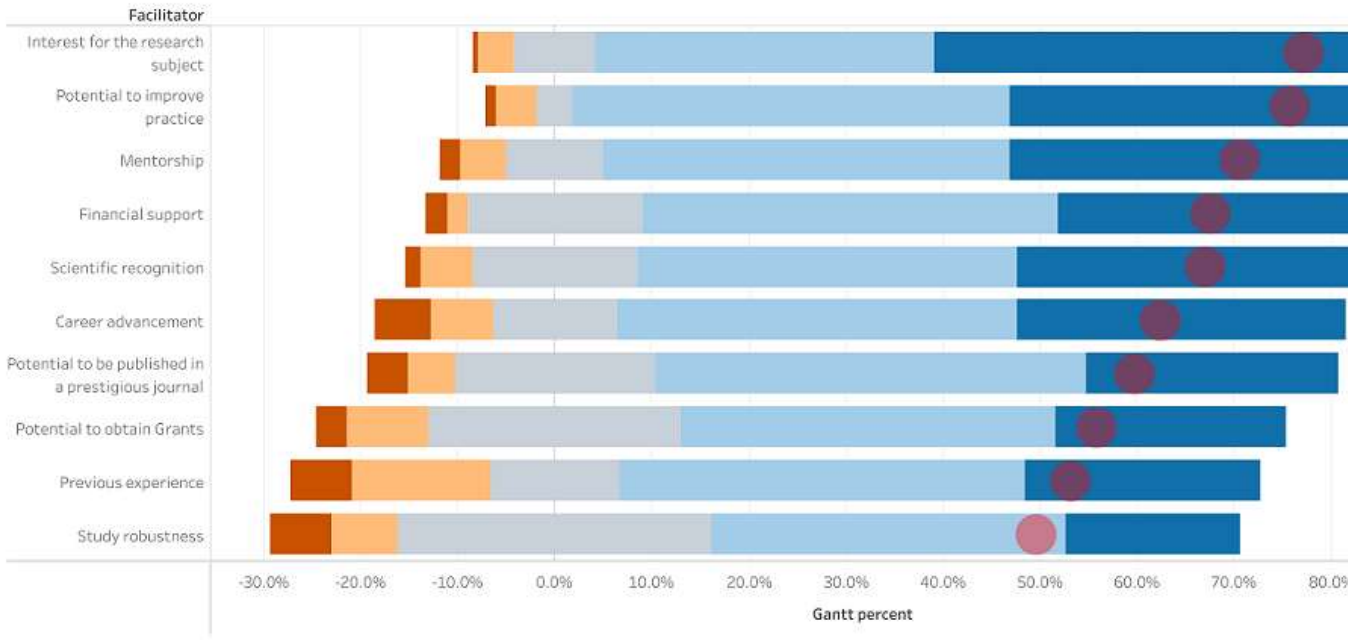

Figure 3: stacked bar chart of the perceived facilitators of research according to young Cameroonian physicians. The red circles represent the average response