ORIGINAL ARTICLE

Research productivity of the medical faculty at the American University of Beirut

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Objective: To analyse the quality and quantity of scientific publications of the medical faculty at the American University of Beirut (AUB) during a six year period (1996–2001)

Methods: The study included all faculty members in the medical school of AUB in the year 2001. A Medline search inclusive of the years 1996–2001 was done for each faculty member and a total number of 881 publications was obtained.

Results: The faculty consisted of 203 members. Their average productivity rate (mean (SD)) was 1.24 (1.38) publications/faculty member/year (PFY), with a mean impact factor of 2.69 (4.63). Eighteen per cent of the faculty did not have any publication in the six year study period, and only 20% had two or more publications per year. There was a significantly higher publication rate among newly recruited faculty members (0.93 (1.40) PFY for those appointed before 1990, 1.45 (1.24) PFY for those appointed during 1990–1995, and 1.67 (1.43) for those appointed after 1995, $p=0.007$), and among those who are younger in age ($p<0.01$). Collaboration with international investigators resulted in more original publications than work done only at AUB (65% v 35%, $p<0.001$), and a higher journal impact factor for the publications (3.20 (3.85) v 1.71 (2.36), $p<0.05$).

Conclusions: This is one of the first studies that analyse the research productivity of the medical faculty in a university setting in a developing country. It shows a wide variation in the research productivity of the faculty members that seems to be related to individual as well as institutional characteristics. Further analysis is needed to define and characterise these factors.

Scientific research is one of the essential missions of university medical centres. High quality research, however, requires faculty members with established research track records, protected time for faculty members, and adequate funding. While these factors are largely available in most medical schools and centres in the developed world, this is not the case in many developing countries. The research productivity of medical faculty has been well studied in the developed world,^{1–10} but limited data on this subject are available from developing countries. Such data are important in these countries where funding for research is limited and where senior administrators have to decide whether to invest their limited resources in research or in support of the educational goals of these institutions. The volume, quality, and impact of research publications become, therefore, essential elements in defining the research mission of these medical schools.

The American University of Beirut (AUB) is a tertiary referral medical centre and is one of the first institutions of higher education in the Middle East. This study analyses the research productivity of the medical faculty at AUB during a six year period (1996–2001). It has two main objectives: (1) to describe and characterise the research output of the faculty during this time period, and (2) to compare the quality of the research output of the faculty before and after they joined AUB.

METHODS

The study population consisted of all the medical faculty members at AUB in the year 2001. A Medline search inclusive of the years 1996–2001 was conducted for each faculty member, and two lists were prepared: one by faculty member and the other by publication. The first list was used to analyse productivity per faculty member, according to age, rank, type, and date of appointment, etc. The second list analysed productivity according to the characteristics of the publication (impact factor, whether it was an original article, etc).

The impact factors of the journals where manuscripts were published were obtained from the 1998 figures provided by the Institute of Scientific Information. Each publication was categorised as being an original research contribution, a case report, a letter to the editor, a review, or other (historical article, editorial, etc). Each manuscript was also categorised as: (1) AUB, if it originated from work done completely at the AUB, (2) pre-AUB, for work done before a faculty member joined AUB but that was published afterwards, and (3) collaboration, for work done at the AUB in collaboration with other international investigators.

Statistical analysis

Values are presented as percentages or as mean (SD). Comparison of mean values between two groups was conducted using Student's unpaired *t* test. When there were more than two groups, one way analysis of variance was used for this comparison followed by Student-Newman-Keuls test for comparisons between any two groups. A *p* value of 0.05 or less was considered significant.

RESULTS

The study population consisted of 203 faculty members, 115 of whom (57%) were full time clinical faculty, 70 (34%) were part time clinical faculty, and 18 (9%) were in the basic science departments. The mean age of the faculty was 51 (11) years, and most of them were males (85%). The majority were associate professors (40%), with 21% professors, 25% assistant professors, and 14% instructors or lecturers. Most of the faculty members held a MD degree (89%). Nineteen members (9%) had a PhD degree and four members had combined MD and PhD degrees.

Abbreviations: PFY, publications/faculty member/year; AUB, American University of Beirut

Figure 1 Distribution of the journal impact factors of AUB and pre-AUB publications.

During the six year study period (1996–2001), there were 881 publications by the medical faculty at AUB. Eighteen per cent of the faculty did not have any publication throughout the six year study period, and 20% had two or more publications per year. When only original publications were considered, 32% of the faculty did not have any publication in the six year study period, 50% had less than one publication per year, and 18% had one or more publication per year.

The research productivity of faculty members increased with their academic rank. The average publication rate was 0.42 (0.59) paper/faculty/year (PFY) for instructors/lecturers, and it increased to 1.12 (0.87) for assistant professors, 1.26 (1.25) for associate professors, and 1.64 (2.03) for professors ($p = 0.002$). The research productivity of full time faculty members was higher than that of part time faculty members (1.54 (1.45) PFY v 0.67 (1.04) PFY, $p < 0.001$). There was a significantly higher publication rate among recently recruited faculty members (0.93 (1.40) PFY for those appointed before 1990, 1.45 (1.24) PFY for those appointed during 1990–1995, and 1.67 (1.43) PFY for those appointed after 1995, $p = 0.007$), and among those who are younger in age (1.59 (1.40) PFY for 40–49 year age group, 0.92 (1.32) PFY for 50–59 year age group, and 0.63 (0.81) PFY for 60–69 year age group, $p < 0.01$). No significant difference was seen between the productivity rates of men (1.28 (1.47) PFY) and women (1.03 (0.73) PFY).

Of the total 881 manuscripts, 545 (62%) were from work conducted at AUB, 255 (29%) were from work performed before joining AUB (pre-AUB), and 81 papers (9%) were from collaborative work with international investigators (table 1). Forty seven per cent of the publications were original contributions, 28% were case reports, 10% letters to the editor, and 13% were review articles. The mean journal impact factor of AUB publications was significantly lower than that of pre-AUB (1.71 (2.36) v 4.07 (6.69), $p < 0.05$) or

collaborative publications (1.71 (2.36) v 3.20 (3.85), $p < 0.05$). However, there was no significant difference between the pre-AUB and collaborative publications. Furthermore, the type of the publications differed among these groups: while 66% and 65% of the pre-AUB and collaboration papers, respectively, were original research contributions, only 35% of the AUB articles were as such ($p < 0.001$). Figure 1 shows the distribution of the impact factors of these manuscripts. Thirty one per cent of manuscripts published from work done at AUB were published in journals with no impact factor. Eighteen per cent had an impact factor ≥ 2.0 and only 1.6% had an impact factor ≥ 5 . As mentioned earlier, the impact factor of the pre-AUB manuscripts was higher than the AUB papers, which is illustrated in the shift to the right of the distribution curve of this group compared with the AUB group (fig 1).

We further analysed the publications of the 35 new faculty members who joined AUB in the years 1995 and 1996, and compared their AUB, pre-AUB, and collaboration manuscripts during 1996–2001. Here again, the impact factor decreased from 4.24 (6.94) in the pre-AUB work to 1.95 (3.78) in the AUB papers ($p < 0.001$). Also the percentage of papers that were original contributions decreased from 67% among the pre-AUB papers to 29% among the AUB manuscripts ($p < 0.01$).

A positive trend in the quantity and quality of AUB publications ($n = 545$) was seen over the six year study period. There was an increase in the number of publications from 55 in 1996 to 121 in 2001, as well as an increase in the percentage of original research publications (from 24% in 1996 to 40% in 2001). There was also a steady increase in the mean impact factor of the journals in which the papers were published from 1.50 (1.05) in 1996 to 1.97 (3.40) in 2000.

The total funds expended on research grants (excluding infrastructure and equipment) in the faculty of medicine at AUB during the period 1996–2001, from both university and extramural sources, amounted to \$2 332 119, of which \$1 177 149 (51%) were from university sources. The Lebanese Council for Scientific Research, the governmental organisation that supports academic research in the country, provided only \$151 755 (6.5% of the total). The remaining funds were obtained from international organisations such as pharmaceutical companies, the World Health Organisation, the European Commission, and the National Institutes of Health of the USA. The amount of \$2 332 119 was actually received by 73 faculty members and represented a funding of about \$5325 per faculty member per year. If the total faculty is considered, this figure represents an average of \$1915 per faculty member per year.

DISCUSSION

This study, to our knowledge, is the first detailed analysis of the research publication output of an institution of higher education in a developing country. Several important findings are apparent: (1) there was a wide variability in the research productivity among the faculty members; (2) there was a significant decrease in the quality of publications of the

Table 1 Number and impact factor of publications by the medical faculty at AUB (1996–2001)

	Number of publications (%)	Impact factor of publications (mean (SD))	Number of original publications (%)	Impact factor of original publications
AUB	545 (62)	1.71 (2.36)	193 (46)	1.63 (1.15)
Pre-AUB	255 (29)	4.07 (6.69)*	169 (41)	4.88 (7.63)*
Collaboration	81 (9)	3.20 (3.85)*	53 (13)	3.34 (2.43)*
Total	881 (100)	2.69 (4.63)	415 (100)	3.34 (5.49)

* $p < 0.05$ compared with AUB.

faculty from their work done at AUB compared with their work done before joining AUB; and (3) collaboration with international investigators and institutions seems to improve the quality of research output of the faculty.

The wide variability of research productivity among faculty members is similar to what Petrak *et al* have reported from Zagreb University in Croatia.¹¹ This variability reflects the importance of the individual characteristics of each faculty member, which have been well characterised by Bland *et al*,² in defining their research productivity. The average publication rate of AUB faculty members was 1.24 (1.38) PFY in journals with a mean impact factor of 2.69 (4.63). When only full time faculty were considered (who constitute 66% of the whole faculty), the publication rate increased to 1.54 (1.45) PFY. In an earlier study from the University of Nebraska College of Medicine,¹ the average publication rate of full time faculty members was 1.95 PFY with a mean impact factor of 1.96. In that report, 25% of the faculty did not have any publication during the three year study period (compared with 18% in our study) and 30% of the faculty had two or more publications per year (compared with 20% in our study). Thus it seems that although a higher percentage of our faculty members are publishing, the percentage of those who have a high publication rate is less. Interestingly, female and male productivity rates were comparable at our institution, in contrast with reports from the USA showing a higher productivity rate among men.¹² This is probably because of the fact that a substantial percentage of the women faculty at AUB are comparatively young and have been just recently recruited from programmes in the USA/Europe with strong research background.

The decrease in the quality of research output of the faculty members at AUB compared with their work before joining AUB, as measured by the journal impact factor, underscores the importance of the institutional characteristics in promoting the research productivity of faculty members. Bland *et al* and Brocato *et al*²⁻³ have done extensive analysis to define the factors that predict the research productivity of faculty members. In addition to individual characteristics, institutional characteristics were important in predicting the research productivity. Some of these institutional characteristics include the availability and amount of protected time for research, the presence of tenure tracks, the size of the faculty, the presence of mentors, etc. We have not conducted in this study an analysis to see how these factors are associated with research productivity at AUB. However, two important institutional factors that probably have an important effect on research productivity at AUB and need to be studied in the future are: (1) the limited research funding available at AUB and in Lebanon, and (2) the fact that at AUB, faculty members have to spend most of their time attending on clinical services to support their salaries and therefore, they have less available protected time for research.

One important positive finding in this analysis was that work done at AUB in collaboration with international researchers significantly improved the quality of the research publications as judged by the impact factor of the journals where the work was published. The importance of collaboration between institutions in developing and developed countries has been previously shown by Halstead *et al* and Chandiwana *et al*.¹³⁻¹⁴ Both of these studies have clearly shown that collaboration with institutions in the developed world significantly improved the quantity and quality of research output in developing countries.

Study limitations

Our study has several limitations. This report is the result of the first phase of analysis of biomedical research at AUB. Although several important observations were made regarding the wide

variability of research productivity of the faculty and the possible association of individual and institutional factors with this variability, further more sophisticated analysis needs to be done to better define these factors based on previously published and well established models such as those of Bland *et al* and Brocato *et al*.²⁻³ Another limitation relates to the definition of research productivity. We have focused in this report on the number and impact factor of publications as a measure of research output. Obviously, there are other variables that also describe research productivity such as citation index, conference presentations, grants, etc, that need to be studied in any future phases of this study.

CONCLUSIONS

This is one of the first studies that analyse the research productivity of the medical faculty in a university setting in a developing country. It shows a wide variation in the research productivity of the faculty members suggesting that there are significant individual characteristics that define this productivity. It also shows that there was significant change in the quality of the research output of the faculty between their work at AUB and their work before joining AUB suggesting that there are also important institutional factors that affect the research productivity of the faculty. Further analysis is needed to better characterise these individual and institutional factors.

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