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## ORIGINAL RESEARCH PAPER

# Scientific Publication Productivity of Libyan Medical Schools: A Bibliometric Study of Papers Listed in PubMed, 1988-2007

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## ABSTRACT

**Background:** Scientific publication is a vital mission of medical schools and it is important to periodically document how well schools fulfil this mission.

**Aims:** This study aimed to analyse the publication record of Libyan medical schools in international journals indexed in PubMed between 1988 and 2007.

**Methods:** Medline was searched using PubMed for publications affiliated to Libya during 1988-2007.

**Results:** Out of 417 papers related to Libya, 348 (84%) are affiliated to the medical schools and related hospitals. More than 60% of the 348 papers are affiliated to Al-Arab Medical University, Benghazi, while Al-Fateh Medical University, Tripoli, contributed 103 papers (30%). The rest of the papers (n=25, 7%) were published by medical schools in other parts of the country. The publication rate declined by 3% annually between 1988 and 2007. The decline was mainly due to a decrease in the publication rate by Al-Arab Medical University, Benghazi. Overall, nine departments produced 10 or more papers each. Out of about 1675 staff members, there are only 148 first authors and 207 last authors. The estimated annual publication rate is 0.7 papers per 100 academic staff members.



**Conclusion:** This study reveals that published scholarship of the Libyan medical schools is extremely low, that the publication rate has declined, and that most academic staff have no publications listed in PubMed. This issue needs urgent attention.

**Keywords:** Libya, Medical schools, Medline, PubMed, Biomedical Publications, Research

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## Introduction

Libya is a North African Arab country with an estimated surface area of 1,775,500 km<sup>2</sup> and a population of 5.3 millions (Eastern Mediterranean Regional Health Systems Observatory, 2007). Most of the population live in the main coastal cities, namely the capital Tripoli and Benghazi, the second largest city (Eastern Mediterranean Regional Health Systems Observatory, 2007). Since the discovery of oil in the 1960s, undergraduate and postgraduate medical institutes have been set up and expanded over the years. The first medical school was established in Benghazi in 1970, followed by the school in Tripoli in 1973. With the help of expatriate academic staff, the foundation of medical education was put in place (Benamer et al., 2009). Between 1987 and 2001 the country experienced an explosion in the number of medical students, as seven new medical schools were established in different parts of Libya: Sebha, Sirte, Misurata, Zawia, Khums, Bayda, and Ghayran (Benamer, 2007). These medical schools together have more than 15,000 students (Eastern Mediterranean Regional Health Systems Observatory, 2007). Twenty-seven specialised hospitals and 36 general hospitals dotting the country provide secondary and tertiary care and act as teaching hospitals (Eastern Mediterranean Regional Health Systems Observatory, 2007).

Bibliometric analyses are used to evaluate research output and scientific publication globally for different regions, particular medical schools, and even for individual scientists (Rahman & Fukui, 2003; Uthman & Uthman, 2007; Thompson, 1999; Hefler et al., 1999). These analyses rely on identifying and then assessing articles published in bibliographic databases, which are principally designed for use by clinicians, academics and others to search for and retrieve articles. Bibliometric analyses, therefore, represent a secondary use of these databases and are faced by some technical and interpretative issues (Wallin, 2005). Bibliometric methods provide quantitative measures that serve, as Wallin puts it, "to transform something intangible (scientific quality) into a manageable entity" (Wallin, 2005). Various databases can be used to search and analyse the published literature in the biomedical field. PubMed, Science Citation Index Expanded (SCI-expanded) and Embase are well-known and widely used. These databases are neither identical nor mutually exclusive, and there is much overlap between them. PubMed, which is published by the United States National Library of Medicine of the National Institutes of Health, has a major advantage over the other databases in being freely available on the World Wide Web and therefore it is probably the most widely used database. PubMed covers around 19 million records dating from 1949 to the present time ([http://www.nlm.nih.gov/bsd/revup/revup\\_pub.html#med\\_update](http://www.nlm.nih.gov/bsd/revup/revup_pub.html#med_update), update of 15 June 2009) from 5,200 biomedical journals in 37 languages (Bissar-Tadmouri & Tadmouri, 2009).

It has been documented that Libya has fallen behind other Arab and African countries in biomedical publication (Tadmouri & Bissar-Tadmouri, 2002; Bakoush et al., 2007; Shaban & Abu-Zidan, 2003; Uthman & Uthman, 2007). Also, the Libyan publication rate has been showing a negative trend (Rahman & Fukui, 2003; Benamer et al., 2009). However, data about the publication activities of medical schools in particular are scarce in Arab countries (Ben Abdelaziz et al., 2006; Dakik et al., 2006). Hence, our aim was to quantitatively analyse the publication records of the Libyan medical schools in the international journals indexed in PubMed over a 20-year period, from 1988 to 2007.



## Methods

PubMed was searched within one hour on 7 September 2008. In the search field, Libya was queried using author affiliation Liby\* OR Lybia OR Jamah\* (equivalent to Liby\*[ad] OR Lybia[ad] OR Jamah\*[ad]). Articles were limited to those published from calendar years 1988 through 2007. Identified articles were imported into an Excel data base for hand searching and further analysis.

We used the PubMed database because it is freely available, covers a large number of journals, and most researchers target the journals indexed in PubMed for publishing their work. PubMed includes journals published in other languages provided that an abstract in English is included. We identified scientific publications within PubMed, which included original works, reviews, case reports, editorials and letters. Meeting abstracts, corrections, news items, biographical items and book reviews were excluded. We subsequently reviewed and excluded articles that fell outside the biomedical field, which was defined as any article reporting issues related to medical, biological or chemical research that is conducted to increase knowledge of medicine.

To calculate the annual publication rate per 100 academic staff of the medical schools from 2003 to 2007, information on the number of staff as of 2008 was obtained through direct contacts with the universities. Academic staff were defined as persons holding a faculty position at the medical schools. We did not differentiate between full-time and part-time staff.

In our analyses we identified first authors as those who are listed first on the published paper. We assessed first authors because they are generally responsible for collecting and analysing the data, interpreting the results, and writing the paper. We also assessed individuals listed last on published papers, because they are usually team leaders responsible for supervising the other authors.

We investigated the “quality” of publications from Libya by assessing the impact factors of the journals in which Libyan papers are published. Impact factors are calculated annually by the Institute of Scientific Information (ISI) in the U.S. and published in the Journal Citation (Wallin, 2005). The impact factor for a journal is calculated by dividing the number of all current citations to articles published in the journal over the preceding two years by the number of articles published in the same period by that journal (Wallin, 2005).

Statistical analysis was performed using SPSS statistical software version 10. Linear regression was used to analyse the yearly changes (the trend) in the number of publications for each region over the study years 1988-2007.

## Results

Search of PubMed for publications affiliated to Libya produced 451 hits. Those published earlier than 1988 or in 2008 were excluded. The remaining 428 papers were hand searched, and 11 papers were excluded because they were not associated with Libya (false positives) or their subject was not biomedical. This left 417 biomedical papers affiliated with Libya and published between 1988 and 2007.

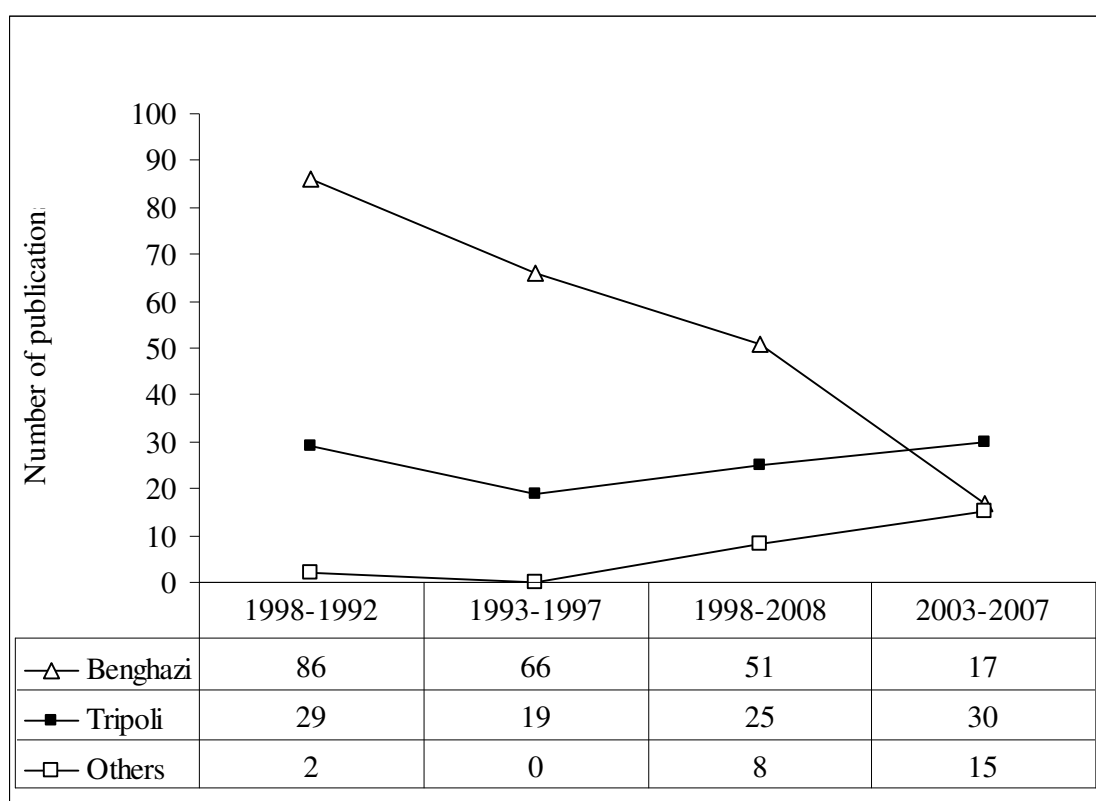
We began by examining the relative contributions of the different types of institutions. Medical schools contributed 268 papers (64%), teaching hospitals 54 papers (13%), and hospitals not explicitly affiliated to medical schools 26 papers (6%). Fifty-two papers (13%) were affiliated to non-medical faculties, such as those in dentistry, pharmacy, basic sciences and veterinary medicine,



and the remaining 17 papers (4%) were affiliated to various research institutes. The 69 papers (17%) not affiliated with medical schools or hospitals were excluded from further analysis, leaving a sample size of 348 papers.

Because the medical schools in Benghazi and Tripoli were the first to be established in Libya, their publication rates were compared to each other and to those of the other, more recent medical schools combined. Almost two-thirds of the publications (n=220, 63%) were affiliated to Al-Arab Medical University, Benghazi, while Al-Fateh Medical University, Tripoli, contributed substantially less (n=103, 30%). The rest of the papers (n=25, 7%) were published by other medical schools and hospitals in other parts of the country.

The next step was to determine how the overall productivity of the medical schools and hospitals varied over time. Due to the small number of papers, we grouped them into periods of five years. The number of publications was highest during 1988-1992 (n=117; 34% of total). Thereafter, the publication rate declined continuously: 85 papers (24%) were published in 1993-1997, 84 papers (24%) in 1998-2002, and 62 papers (18%) in 2003-2007 (Figure 1). The overall trend in publication volume for Libya as a whole was estimated by regression analysis as a decline of 3% annually (95% CI: 3.9 to 1.4%) ( $r^2=0.51$ ,  $p<0.001$ ).



**Figure 1: The number of biomedical publications affiliated to Libyan medical schools and related hospitals, 1988-2007. “y-axis: years of publications”**



In an attempt to narrow the possible sources of the decline in the number of publications, we assessed whether the decline was a general phenomenon or situated at particular institutions. While in the Al-Fateh Medical University, Tripoli, the publication rate fluctuated without any clear trend, with 19 to 30 papers in each five-year period, ( $r^2=0.03$ , ns), the publication rate of the Al-Arab Medical University, Benghazi, declined dramatically from 86 papers in 1988-1992 to 17 papers in 2003-2007. The number of publications from the Al-Arab Medical University declined, on average, by 4% per year, (95% CI: 5.6 to 3.2%) ( $r^2=0.78$ ,  $p<0.001$ ). The other, newer medical schools and hospitals in other parts of the country together published 15 papers from 2003 to 2007 (Figure 1). From these results we conclude that the decline in publication rate is situated at the Al-Arab Medical University, Benghazi, which initially had been responsible for about two-thirds of the publications, and we also conclude that productivity has not increased in the Al-Fateh Medical University, Tripoli.

Another important issue is the scholarly contribution of different departments and clinical specialties. Each Libyan medical school is comprised of about 16 departments covering both pre-clinical and clinical subjects. Therefore, there are about 144 departments in the nine medical schools. Only nine departments produced 10 or more papers in the 20-year study period; seven of these departments are affiliated to the Benghazi medical school (Departments of Pharmacology, Paediatrics, Biochemistry, Paediatric Surgery, Laboratory Medicine, Pathology and Neurology). The other two high-producing departments are the Department of Microbiology in Al-Fateh Medical University, Tripoli and the Department of Radiology of the Misurata Teaching Hospital. These nine departments together produced 173 papers, accounting for almost half (49%) of all papers affiliated to medical schools and hospitals. Sixty-nine (52%) departments produced no papers.

Al-Arab Medical University, Benghazi, has 570 staff members, while Al-Fateh Medical University, Tripoli, has 678. The other seven medical schools together have 427 staff members. Thus, the number of staff in all Libyan medical schools combined is about 1675. There are 148 individuals listed as first authors on at least one paper; these individuals represent 9% of the total academic staff in Libyan medical schools. Only two individuals (0.1% of all academic staff) published 10 or more papers as first authors and 19 (1%) produced five or more papers as first authors. There are 207 last authors, who represent 12% of the total academic staff of Libyan schools. No individual published 10 or more papers as a last author and only eight (0.5%) produced five or more papers as a last author. Only one individual appears near the top of the lists of both first and last authors, with six publications as first and nine as last author.

Using academic staff figures for 2008 as the denominator, the annual publication rate of the academic staff during 2003-2007 was 0.7 papers per 100 staff members per year in the Al-Arab Medical University, Benghazi, 0.9 papers per 100 staff per year in Al-Fateh Medical University, Tripoli, and 0.6 papers per 100 staff per year for all other medical schools. The overall rate is 0.7 papers per 100 staff members per year during 2003-2007.

The 348 articles affiliated to Libyan medical schools and related hospitals were published in 143 distinct journals. Saudi Medical Journal, which has an impact factor of 0.33, published the largest number of articles from the Libyan medical schools (23 articles; 7%), followed by East Mediterranean Health Journal, which does not have an impact factor calculated (22 articles; 6%). Over one-third of the papers (141; 41%) were published in journals with no impact factor, and another 42% (148) in journals with impact factor less than 2.0. Only two papers were published in journals with impact factors greater than 5.0 (Table 1). From this we conclude that the rule is publication in journals without a calculated impact factor or with a low impact factor, and that publication in high impact-factor journals is almost non-existent.



**Table 1: The impact factor of the journals that published the 348 articles affiliated to Libyan medical institutions, 1988-2007.**

Journal's impact factor	Number of articles (%)
No impact factor	141 (41)
< 1	79 (23)
1-2	69 (20)
2-3	37 (11)
3-4	12 (3)
4-5	8 (2)
5-6	2 (0.6)
>7	0 (0.0)

## Discussion

This study found that the medical schools in Libya have made a very limited contribution to international medical publications. Most publications are a consequence of the work of a very small cohort of medical academics and have been published in low impact journals. Even more worrisome is that publication activity has been declining over the past two decades despite the expansion in the size of the two major medical schools in Benghazi and Tripoli and the remarkable increase in the number of medical schools. The annual publication rate per 100 staff members is extremely low, even when compared with peer countries. Ben Abdelaziz and co-workers counted the Tunisian Medline publications during 2000-2003 and reported 27 articles per 100 teachers per year (Ben Abdelaziz et al., 2006). In addition, they found that 97% of the Tunisian medical publications were produced by universities and their affiliated hospitals (Ben Abdelaziz et al., 2006), which is higher than in Libya (83%). Another study looked at the published scholarship of the medical faculty at the American University of Beirut in Lebanon over the six-year period from 1996 to 2001 and found that 203 staff members published 545 papers listed in Medline, corresponding to 45 publications per 100 staff members per year (Dakik et al., 2006). Therefore, it is clear that Libyan medical schools are lagging far behind the medical schools of other Arab countries.

This study confirms the findings of previous studies showing that Libya has fallen behind its peers in biomedical publication. Libya contributed only 1.2% of papers published by authors from 23 Arab states between 1966 and 2000 (Tadmouri & Bissar-Tadmouri, 2002). When the number of PubMed publications from Arab countries from 2002 through 2006 was normalised to gross domestic product (GDP), Libya was placed behind Morocco, Tunisia and Yemen (Bakoush et al., 2007). In another study of 20 countries, Libya was ranked 12th in the average annual publication rate, 10th when the data were normalised to the population, and 15th when normalised to GDP (Shaban & Abu-Zidan, 2003). When compared with other African nations, Libya did not appear in the list of top 20 countries when the total number and the average annual number of biomedical publications were counted for each nation from 1996 to 2005 (Uthman & Uthman, 2007). Also, Libya was not ranked among the top 20 countries in Africa when the number of biomedical publications was normalised to the annual publication rate per million inhabitants (Uthman & Uthman, 2007). Rahman and Fukui reported the global trend of biomedical publication between 1990 and 2000 and found that Libya is one of the very few countries in the world that have a negative trend ( $p < 0.01$ ) (Rahman & Fukui, 2003), a finding that is confirmed in our study. Our study makes it clear that this negative trend is due to a large decline in publication rate in the Al-Arab Medical University, Benghazi, coupled with stagnation in publication rate in the Al-Fateh Medical University, Tripoli.



Several reasons have been attributed for the low medical publication activities in Libya. A recent study suggested that replacement of the expatriate academic staff by local staff, coupled with the absence of a research culture among the native Libyan medical professionals, was one of the reasons causing the decline in biomedical research publications since the early 1990s (Benamer et al., 2009). Tadmouri & Bissar-Tadmouri suggested that the international embargo that was imposed on Libya from 1992 to 1999 was a contributory factor (Tadmouri & Bissar-Tadmouri, 2003). Moreover, the medical school curricula of Libyan schools contain no research component, which means that students finish their medical course without having been involved in any research projects or understanding the basic concepts of research (Daw & Elkhmmas, 2008). Further, the mechanism of academic staff appointments and promotions in Libyan medical schools has never been transparent (Daw & Elkhmmas, 2008). The infrastructures needed for conducting research in basic and clinical sciences are inadequate and there are no well-established bodies and systems for awarding research grants (Benamer, 2007). Libya spends 3.4% of its gross domestic product on health and less than 4% on education (Eastern Mediterranean regional health Systems Observatory, 2007). Thus, the budget for research is modest and the majority of the capital is consumed in providing basic services. Also, the establishment of new medical schools has not been matched with adequate resources, leading to inadequacies in laboratories, libraries, and information technology facilities (Sagher, 2006). With the large increase in the number of medical students, the academic staff spend all their time in teaching activities, leaving little if any time for research. Any attempt to improve the research status in the Libyan medical schools should address all these issues. Furthermore, our findings suggest that publications from the Libyan medical schools are sometimes the result of the individual initiative of a small number of academic staff; it could be helpful to understand what motivates these individuals to publish and how they differ from their colleagues.

This study found that in the earlier years studied, most publications were from Al-Arab Medical University, Benghazi, and that the overall decline in publication rate was due to a remarkable decline in publications from that university. During the same period, publications from Al-Fateh Medical University, Tripoli remained at a low level. These findings are rather difficult to explain. However, it is possible that as the Benghazi medical school was the first in the country, considerable effort and enthusiasm was invested in it and a culture of research was initiated. Unfortunately, it was short-lived. This may not have been the case in the Tripoli medical school. Also, it has been suggested that the number of publications in Libya declined in the 1990s and later as a result of replacing the expatriate academic staff with Libyan personnel (Benamer et al., 2009). Perhaps that took longer to have an effect in the Benghazi medical school as the native Libyans tend to find settling in the capital Tripoli more attractive than Benghazi leading to slower departure of expatriates from Benghazi. Further studies to understand the causes of the remarkable decline in publications in the Benghazi medical school would contribute much to understanding the low performance of Libyan medical schools in general and should be taken into consideration when designing programmes to promote research and publication in Libya.

Another finding of this study is the failure of the new medical schools collectively to produce a substantial number of biomedical publications. It could be argued that the newer schools were created principally to train more health workers and provide clinical service to their local population. However, we believe that any medical school should engage in research. In a country such as Libya, where epidemiological data about diseases are scanty, clinical research becomes even more important in order to improve the service to the local communities. Also, the promotion of academic staff in Libya is based, at least in the written regulations, on the number of publications in peer reviewed journals, indicating that research and publication, at least in theory, are considered part of the missions of the Libyan medical schools, both old and new.

The distribution of papers from the various departments was rather surprising. There was no evident pattern to the distribution, and so it is difficult to explain this finding on the basis that those working in certain fields or specialties find it easier to do research,



e.g. because of the feasibility of undertaking projects with minimal resources. On top of that, these data clearly show that only a small fraction of the total staff in Libyan medical schools have published papers as first or last authors. This leads us to conclude that the differences observed between the departments did not and do not lie in the departments per se, but in individuals. In other words, the principal factor driving publication rates for a given department is likely whether it has one or more highly motivated individuals. Beyond motivation, another factor might be involved, namely differences in the research atmosphere scientists and doctors were exposed to during their years of specialisation.

Our study has some limitations. The number of publications from medical schools is limited, and so we could not analyse productivity of the staff according to variables such as age, gender, faculty position and date of appointment. Also, we could not characterise the individual universities, departments or members of staff in terms of the impact factors of the journals in which they published their work. Therefore, the study is limited to a general view of the publication record of Libyan medical schools. Also, we have not differentiated between full-time and part-time staff when calculating the annual publication rate of the academic body. However, even if we allow for the possibility that, hypothetically, half of the academic staff has been working part-time, which is very likely a high estimate, the annual production rate would remain extremely low compared with other Arab countries; our main findings remain unaltered.

Some errors in searching scientific bibliographic databases are inevitable in this type of work, but we tried to avoid false positive results by adopting the hand searching method. Moreover, we investigated only the medical papers published in journals indexed in PubMed, and so we did not include papers published in local journals and other periodicals, none of which are indexed by PubMed. Also, PubMed uses the first author's affiliation as the country of the publication's origin, which means that collaborative publications in which the first author is not affiliated to a Libyan medical school were missed. It has been estimated that using PubMed leads to underreporting by about 15% (Deleu et al., 2001; Lammers & Tahir, 1996). Even if that is the case, the increase in the number of publications of the Libyan medical schools will only be about 50 articles, and that will have a negligible effect on the principal findings of this study.

We used journal impact factors to give a sense of the quality of the Libyan medical schools' publications. Impact factors are generally easy to compute but whether they reflect the true quality of a journal is a matter of debate. Some authors advocate the use of impact factors as an indication of the quality of publications (Deleu et al., 2001; Garfield, 1972). Others point out the shortfalls of such an approach (Baylis et al., 1999; Gallagher & Barnaby, 1998). It is also important to stress that the impact factor or the count of the number of publications does not indicate the value of these publications to the local community (Rosselli, 1999). Consequently, the results of this study should be interpreted in the context of all these limitations.

In conclusion, this study finds that Libyan medical schools are not actively engaged in medical research. Most pre-clinical and clinical departments have produced very few or no publications. More disturbing is the decline in the number of the biomedical publications by the medical schools. Urgent attention to this issue is needed to increase the research output of Libyan medical schools at least to the level of peer countries in the Arab world and Africa. It is the duty of the Libyan academics to set strategic objectives for research, including training, and most importantly to press the government to allocate adequate and sustained funding for this crucial activity. Both short-term and long-term targets should be set, and achievements should be regularly monitored and assessed. Advancing medical research and publication represents a major challenge to the Libyan academic establishment, which should confront it rather sooner than later.





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