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PubMed as an Altar of Science: Status of Current Evidence through a Quantitative Synthesis of Articles from 1970-2010

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Abstract

Background: PubMed is not only the single largest archive of indexed articles' and abstracts, but also the most widely searched database for use by researchers and professional bodies in all systematic reviews used for framing evidence-based clinical consensus statements and practice guidelines. **Objective:** The objective of this study was to explore the evidence base provided by PubMed descriptively report the current state of published articles indexed in PubMed. **Methods:** Descriptive exploratory study through a literature search was done to identify nine time-points in the timeline from 1970-2010, with five-year intervals in order to identify the scientific trend. The number of obtained citations were classified and analyzed under the names of search filters of PubMed namely- text availability, publication date, species, article type, language, gender and subject areas. The numbers for categories and subcategories of search filters were considered for comparison and analysis. Descriptive analysis using frequencies on Microsoft Excel 2010 worksheet was done. **Results:** There is an exponential increase in number of articles in general over the 40 years. Abstracts and free full text articles were equal in number. Human studies were more than animal studies. Case reports and reviews were more than other article types. More articles were of English language, with equal gender representation. There were more number of articles on cancer than on toxicology and veterinary science. **Conclusion:** This study found an overall observation that the largest number of articles prevalent in a particular category was also the fastest to increase in number in a 40-year trend.

Keywords: Evidence-based healthcare; Medical informatics; Medline/PubMed; Literature search.

Introduction

Evidence-based practice (EBP)[1] or evidence-informed practice (EIP)[2] involves professionals to formulate a clinically relevant research question, search for available literature, critical appraisal of available literature, application of research findings integrated with client preferences and personal expertise, and evaluation of outcomes followed by explicit documentation. Amongst many available sources of evidence,[3] journals rank as the most comprehensive and widely recognized resources, and librarians and professionals tend to search journals in their indexing databases which list the abstracts and provide a searchable platform.[4]

There are many resources for evidence search as PubMed, Google scholar, Scopus, Web of Science, EMBASE, Cochrane library and its CENTRAL.[5,6] PubMed is a service provided by National library of Medicine under National Institutes of Health, USA and is the largest available database with more than 22 million citations of importance to biomedical informatics and science.[7]

PubMed is not only the single largest archive of indexed articles' and abstracts, but also the most widely searched database for use by researchers and professional bodies in all systematic reviews used for framing evidence-based clinical consensus statementsand practice guidelines.[8] The advantage of using PubMed is users can retrieve abstracts free of

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charge and some of the full text content from PubMed central is also included in PubMed, making dissemination of evidence current and updated.[9]

The contribution and role played by PubMed could not be surpassed by any other database, and it will continue to be the 'gold standard' search resource for researchers in evidence-based/evidence-informed paradigm.[10] The objective of this study was to explore the evidence base provided by PubMed through its advanced search methods and search filters, and descriptively report the current state of published articles indexed in PubMed.

Methodology

Study Design

Descriptive exploratory study

Search Methods

Two reviewers performed an independent blinded search of PubMed using specific search strategy and they independently extracted and synthesized the data from the selected studies using a structured checklist. At all stages of the review process, all disagreements were solved by mutual consensus before proceeding to the subsequent stages of the review.

Search Strategy

A combination of using search filters in PubMed was used as per descriptions in previous studies.[11-4] A thorough literature search was done to identify nine time-points in the timeline from 1970-2010 40-year period, with five-year intervals in order to identify the scientific trend. The search was performed in the month of October 2012, and retrieved numbers of citations were then used as data for extraction and synthesis.

Data Extraction and Synthesis

The number of obtained citations were classified and analyzed under the names of search filters of PubMed namely- text availability, publication date, species, article type, language, gender and subject areas. The numbers for categories and subcategories of search filters were considered for comparison and analysis.

Data Analysis

All data were entered in Microsoft Excel 2010 worksheet and computed descriptively using their respective frequencies- numbers and percentiles. All comparisons were done visually in order to obtain an overall appearance and trend.

Results: Main Findings

Total number of articles in the specific time period (1970-2010) was 17,445,795 which were identified by searching through publication dates in search filters.

Evidence for Text Availability

The overall prevalence of sub-categories for text availability is shown in Figure 1 and the comparison of 40-year trend between the three subcategories is shown in Figure 2. The number of 'abstract available' articles was greater than the 'free full-text' articles. The 40-year trend for number of articles in PubMed is shown in Figure 3 where there is an exponential increase in number of articles for both 'abstract available' articles and 'free full-text' articles compared to 'full-text available' articles.

The relative prevalence for studies on sub-categories for species and their respective reporting trends is shown in Figure 4 and Figure 5 respectively.The relative prevalence for studies on sub-categories for article types and their respective reporting trends is shown in Figure 6 and Figure 7 respectively.The relative prevalence for studies on sub-categories for language and their respective reporting trends is shown in Figure 8 and Figure 9

Figure 1: Relative Prevalence of Sub-Categories for Text Availability

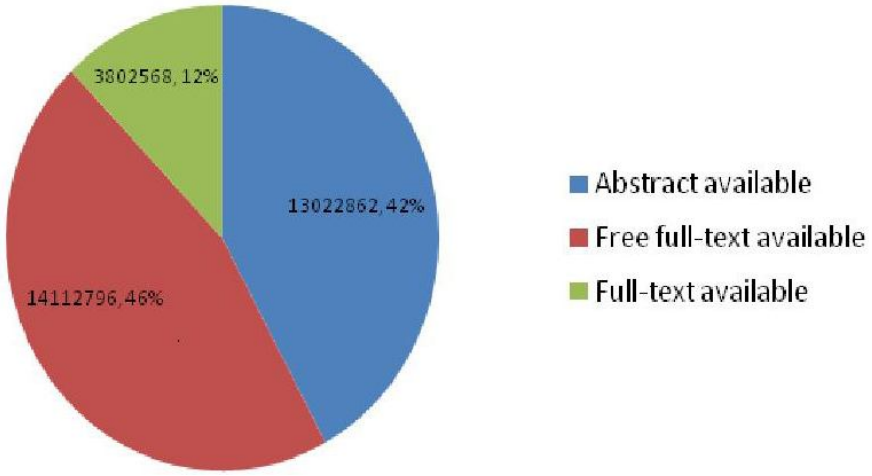


Figure 2: Comparison of 40-Year Trend between the Three Subcategories of Text Availability

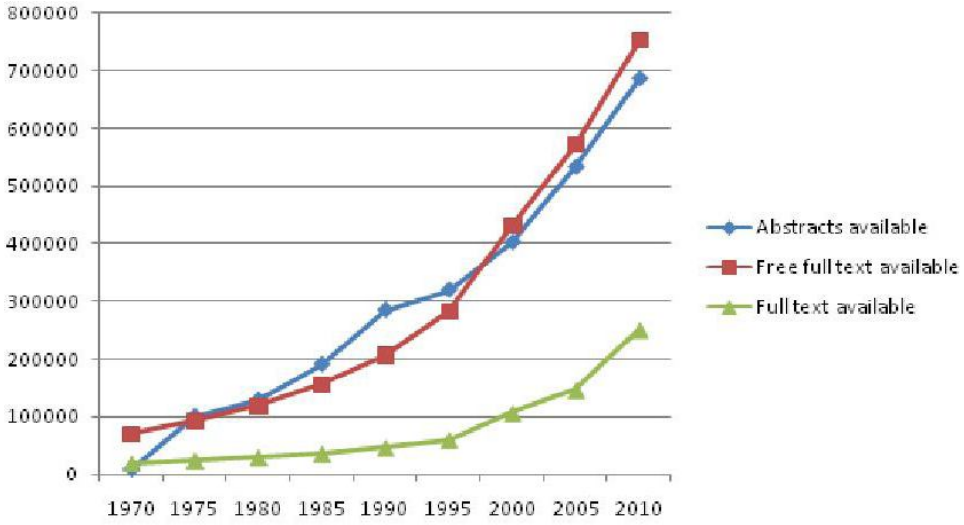


Figure 3: 40-Year Trend for Number of Articles Based upon Publication Year

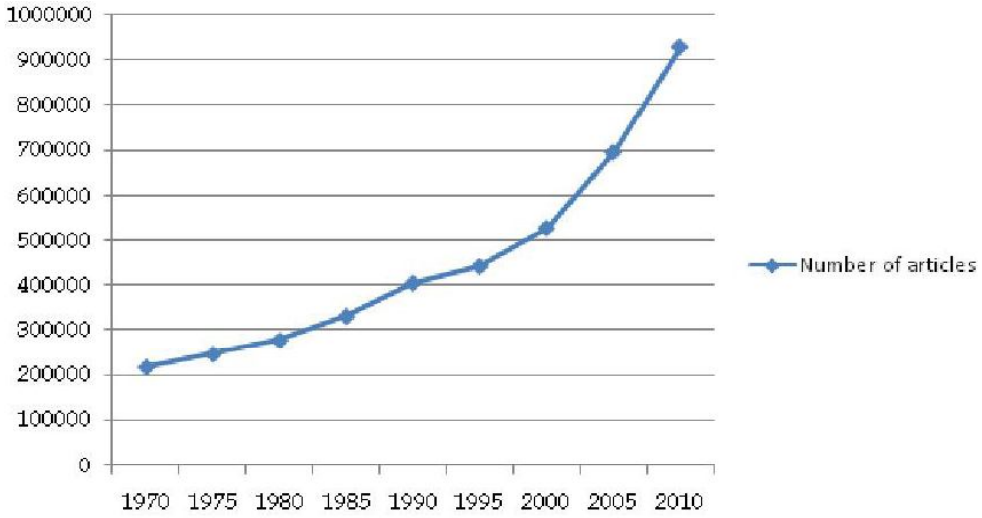
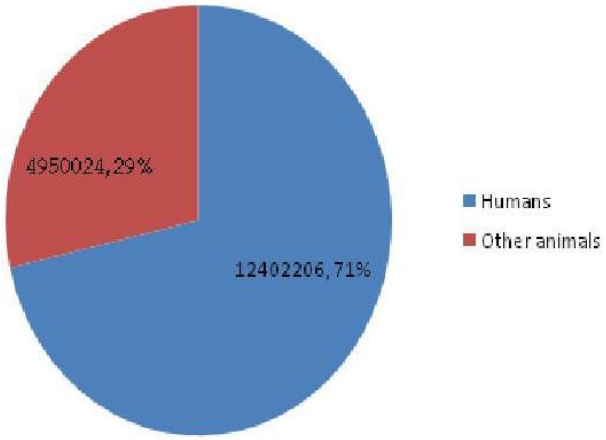


Figure 4: Relative Prevalence of Sub-Categories for Species



respectively. The relative prevalence for studies on sub-categories for gender and their respective reporting trends is shown in Figure 10 and Figure 11 respectively. The relative prevalence for studies on sub-categories for subject areas and their respective reporting trends is shown in Figure 12 and Figure 13 respectively.

Discussion

This study aimed at exploring the evidence base of PubMed in the nature and

Figure 5: Comparison of 40-Year Trend between the Two Subcategories of Species

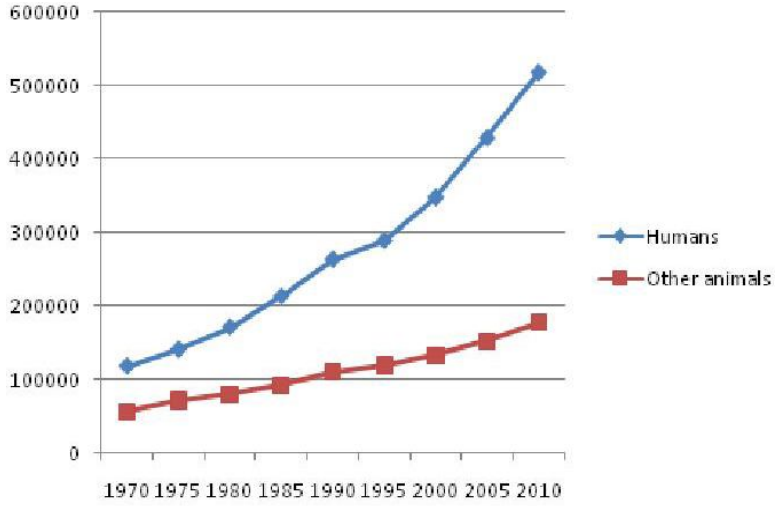


Figure 6: Relative Prevalence of Sub-Categories for Article Types

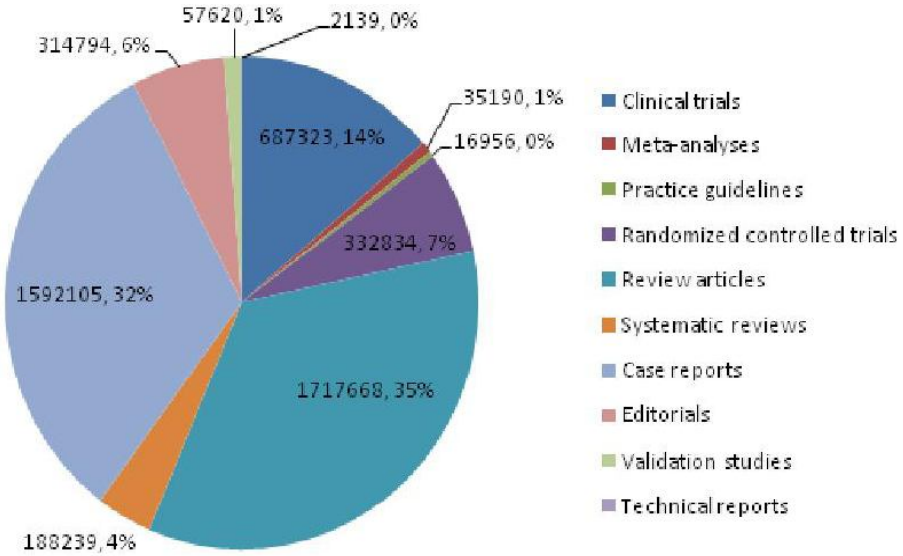


Figure 7: Comparison of 40-Year Trend between the Subcategories of Article Types

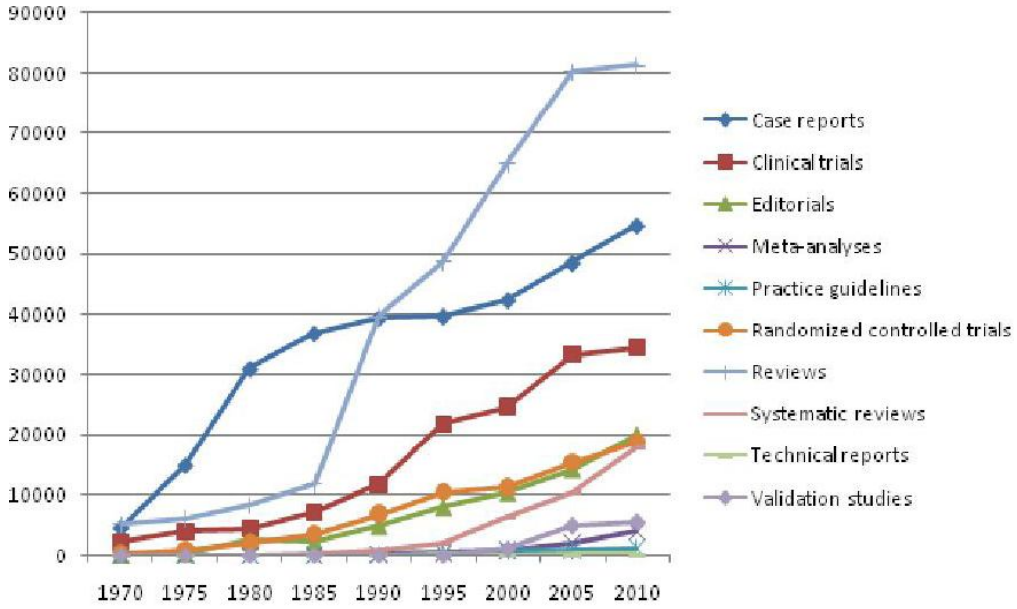
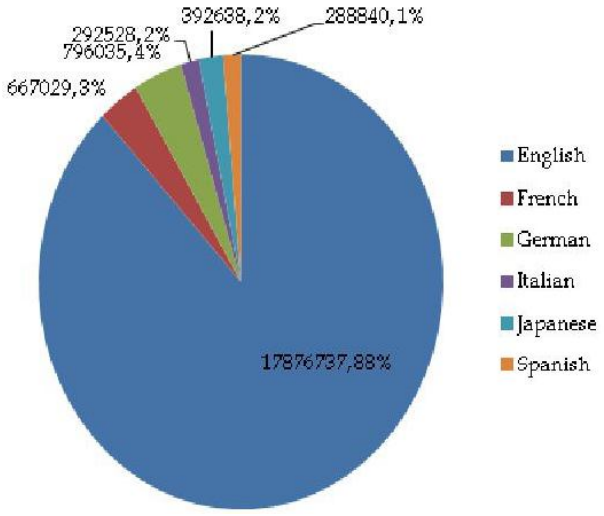


Figure 8: Relative Prevalence of Sub-Categories for Language



characteristics of published articles which are indexed from 1970-2010. This study found an overall observation that the largest number of articles in a particular category was also the fastest to increase in number in a 40-year trend. Thus prevalence of specific article category was associated with greater increase in its number over the years.

This study found increased number of abstracts but this determined only the quantity and not the quality or content of the abstracts. [15] Interestingly, there was a positive trend shown by increase in number of full text articles[16] which were made available through open access publishing policies of the journals [17] and the archiving of PubMed central.

Although the increasing numbers of low-level evidence- such as reviews and case reports pose a probable threat to EBP/EIP, this also emphasized the growth in importance of clinical decision making and critical reflective reasoning. It is however imperative that reviews included systematic reviews, which are a positive shift towards EBP/EIP. Systematic reviews not only identify evidence gaps but also establish research priorities.[18]

Interestingly, there were more practice guidelines[19] and meta-analyses, which were a next step to systematic reviews in evidence pyramid and there are well recognized barriers to uptaking evidence from systematic reviews and meta-analyses due to decision makers and stakeholder perceptions.[20] Randomized controlled trials are considered as a gold standard in evidence,[21] which showed a good positive increase in number across the years. Overall, the relative prevalence of various study designs confirmed the description of 'evidence pyramid' as one of priorities.[22]

Figure 9: Comparison of 40-Year Trend between the Subcategories of Language

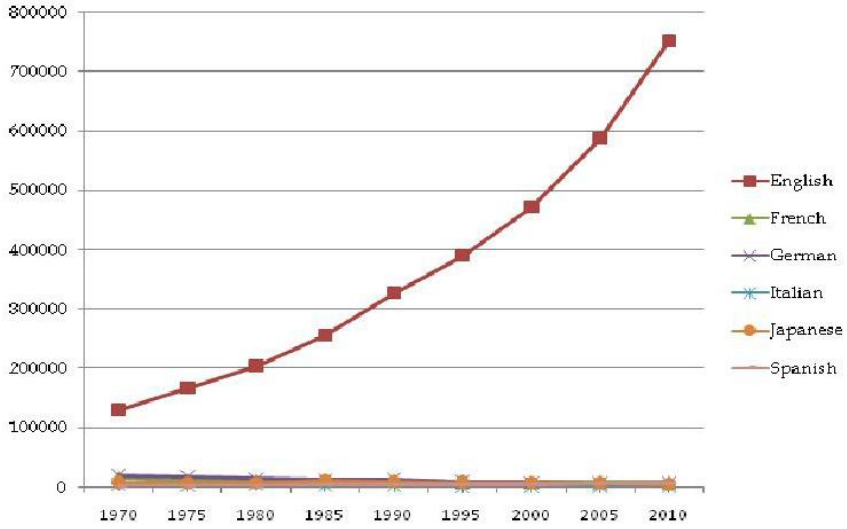
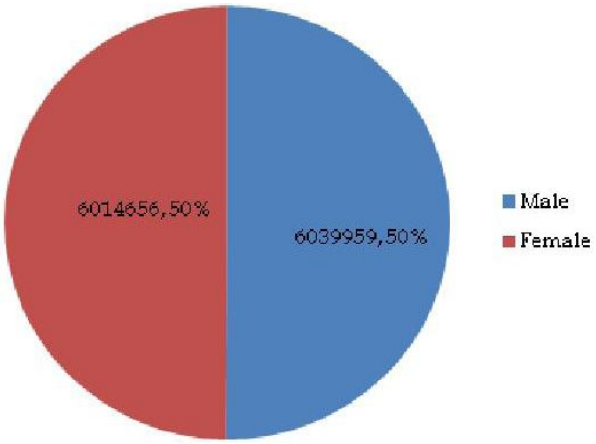


Figure 10: Relative Prevalence of Sub-Categories for Gender

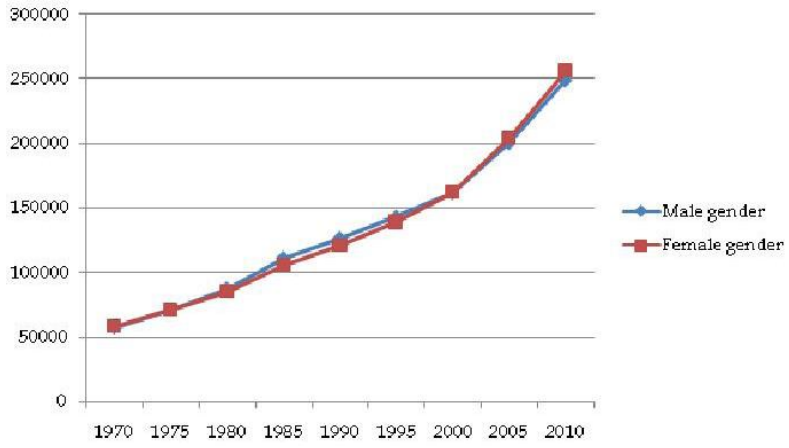


There were nearly equal number of articles on either gender (male= 6039959, 50%; female= 6014656, 50%).

The subject areas greatly increasing in numbers were for cancer, HIV/AIDS, toxicology and veterinary science. This is in agreement with earlier reports of globally increasing number of publications and research productivity in such areas.[23-5]This present study did not aim at exploring design-specific analysis such as randomized controlled trials' reporting or quality of reporting,[26,27] and hence caution is warranted prior to extrapolation of such findings.

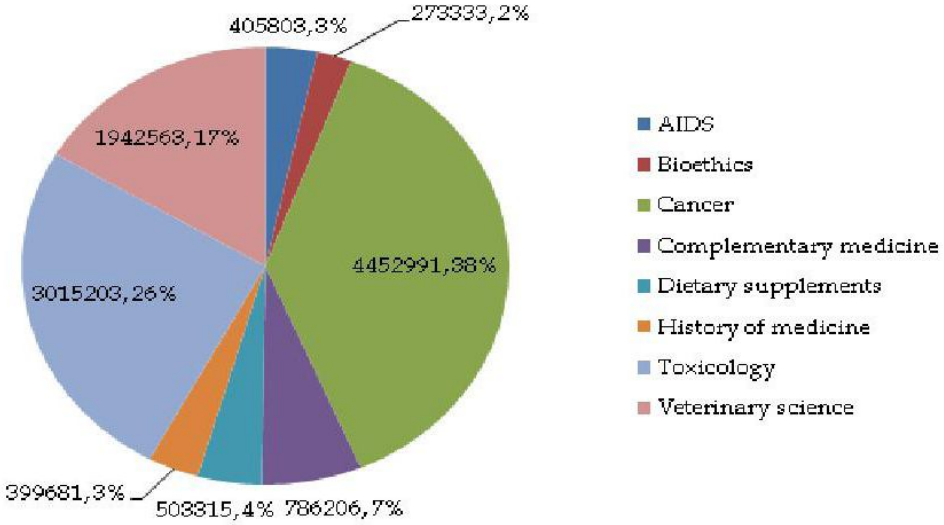
Specific search strategies of PubMed or MeSH terms[28] were also not employed or

Figure 11: Comparison of 40-Year Trend between the Subcategories of Gender



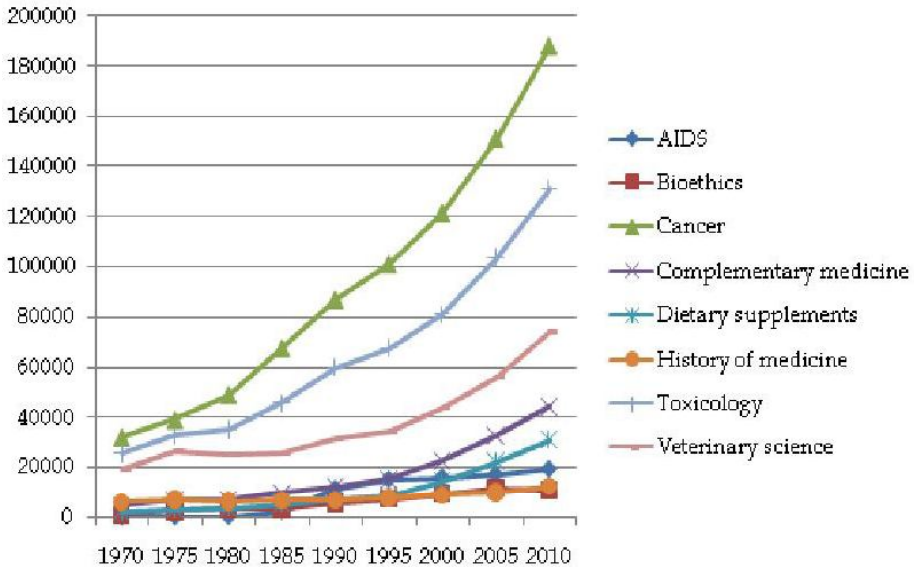
The number of articles on either gender increased steadily over the years, with no much difference between each other.

Figure 12: Relative Prevalence of Sub-Categories for Subject Areas



There were more number of articles on cancer (N=4452991, 38%) than on toxicology (N=3015203, 26%) and veterinary science (N=1942563, 17%).

Figure 13: Comparison of 40-Year Trend between the Subcategories of Subject Areas



There was a rapid increase in number of articles for cancer, followed by toxicology and veterinary science

explored in this study, nor the advanced search features[29,30] and this limitation is acceptable since this study is the first of its kind to attempt establishing evidence summary of PubMed as a whole. However, there existed a controversy on the inclusion of journals through PubMed central since earlier report showed that included journals were of a substandard quality.[31]

Future shines bright for further electronic archiving, and preservation of research information to ensure long-term dissemination without any geographical or international boundaries.[32] Integration of evidence from PubMed into clinical practice[33] is an area not under the scope of this study and hence future studies could possibly address that issue.

Conclusion

This study found an overall observation that the largest number of articles prevalent in a

particular category was also the fastest to increase in number in a 40-year trend. The study findings are of significance to educators, researchers and clinicians of biomedical sciences.

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