Research Article

Medical Research in British India: Content Analysis of "The Indian Medical Gazette"

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The genesis and development of science education and scientific research in British India is quite well explored domain. There are many hypotheses on the advancement of science in colonies. This stream of discourse named as 'Colonial Science'. Within the analytical framework of 'colonial science', this paper is an attempt to map medical research in British India through a journal content analysis. From the available literature it is evident that there were a number of medical journals published in British India. Among them, one of the most famous medical journals was the "Indian Medical Gazette". The Gazette started in 1866 and continued till 1955. It was mainly run by the Indian Medical Services (IMS) officers. Within its 90 years of existence, it played an active role in shaping medical research in British India. The systematic data of Indian Medical Gazette is available through PubMed, an online repository of global biomedical journals. Through the content analysis of "The Indian Medical Gazette", this study tries to map medical research in British India. This research article analyse publication pattern, the most prolific authors and their affiliations. Further, through the content analysis and word cloud this study has identified most frequently occurring keywords and their importance in the medical research of British India.

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1. Introduction

During the 1500s, the Portuguese and the Spanish fleets were dominating on new maritime routes to the east. The powerful "Spanish Armada" was assembled by King Philip II of Spain to challenge the English Piracy on the sea and to restore the Roman Catholic faith in England (Martin & Parker, 1999).

The Spanish Armada was defeated by the British navy in 1588. The defeat of "Spanish Armada" was a significant milestone in European history. It not only secured England's global position as a naval power but also contributed to the decline of Spanish dominance in Europe and globally. After the demolition of Spanish Armada, the British and the Dutch fill the void in the trade route to the east. They were able to take active roles in global spices and textile business with the East Indies (Martin & Parker, 1999). The Dutch initially took a lead in this, focusing mainly on spices and in particular the trade of pepper corns from the Asian continent. The English were gradually falling behind the Dutch on these new trading routes.

On the 31st December 1600 Queen Elizabeth granted a charter to the about 200 English traders who formed an "Association of Merchant Adventurers of London", to trade with the East (Johnson, 26th March 2015). This traders association was later become "The East India Company". With the span of time, by the 1700s the East India Company grew large and become dominating factor in global textile trade. The Company even assembled its own army to protect its business and other interests in their trading zones. Most of their forces were based at three major 'stations' in India, namely at Bombay, Bengal and Madras provinces.

Initially the East India Company used its military to protect their direct business interests. This was changed with the famous "Battle of Plassey" in 1757. It marked the beginning of British imperialism in the Indian subcontinent. It had profound implications for the social, political, and economic landscape of India. This major turning point and the subsequent events of following years, the Company took full administrative powers over its newly acquired territories. In addition, the Company also looked after the maintenance of law and order and right to tax anyone living within its territories (Johnson, 26th March 2015).

2. Science in British India

In the initial years of their rule in India, the East India Company was primary engaged with the expansion of their territory. There were very little or no initiatives were taken with respect to imparting education or development of science within their territory. According to Basu (1867),

> "*The Battle of Plassey was fought in 1757; and Wood's Despatch, commonly called the Educational Charter of India, is dated 1854. This would show that the system of education now*

> *in vogue in this country was not introduced in hot haste but after the mature deliberations of nearly a century"* (Basu, 1867).

The Company was largely interested in extracting and exploitation of economic values from the natural resources. During the initial years it was mainly concerned with the geological explorations within their newly occupied territory. According to Kumar (2017) "*Colonisation primarily meant exploration and exploitation of Natural resources"*. Further, to strengthen their activity, the Company brought about several scientific institutions in India. It was mainly to collect data on natural resources for their efficient exploitation and further territorial expansion. Overall, the British policies and actions were to discriminated, demoralised Indian mind. They justified their control over India by using science as a useful instrument (Govind & Yadav, 2022). Moreover, Pre-British India had nothing like a scientific society, or scholarly journal, to provide platform for scientific research (Kumar, 2017). Due to this inertia from the Company, Indians with their own initiatives introduced Western system of education. The Hindu College of Calcutta was established even before Macaulay's highly applauded or famous minute or Wood's Educational Despatch to India (Basu, 1867).

There are several theories given by many eminent scholars on the growth and development of science in the colonies. Perhaps the most famous and contested opinion was given by Basalla (1967). According to Basalla's proposed model there are three distinct but overlapping phases or stages of spreading of science in colonies.

> "*During 'Phase 1' the non-scientific society or nation provides a source for European science. The word non-scientific refers to the absence of modern Western science and not to a lack of ancient, indigenous scientific thought of the sort to be found in China or India. 'Phase 2' is marked by a period of colonial science, and 'phase 3' completes the process of transplantation with a struggle to achieve an independent scientific tradition (or culture)"* (Basalla, 1967).

Basalla's 3-phase model has been severely criticized by some prominent history of science scholars, social historians of modern Indian science (Patra & Muchie, 2017, Raina, 1999, Dasgupta, 2024, Krishna, 1992). In the similar line, Kochchar (1991, 1992, and 1993) proposed three stage models for the growth and advent of modern science in India.

"The first stage is considered as *the colonial-tool stage where the production and growth of modern science in India was encouraged by the British with a view to furthering colonial interests. British-sponsored science, by its very nature was field science and its agenda was decided on grounds of political and*

commercial gain. In the pursuit of this state-sponsored science, Indians provided cheap labour. It was only much later, with the westernisation of the Indian middle classes, that Indians began to pursue science on their own initiative but this was as an extension of the nationalist movement and science increasingly began to be seen purely as an intellectual exercise rather than as a means of producing wealth. The second stage was the Peripheral-native stage where Indian was trained and hired to provide assistance to the government science machinery. Finally the "Indian Response stage" where Indian took to scientific research on their own initiative" (Kochhar, 1991, 1992, 1993).

In the above mentioned conceptual lens of 'colonial science' this paper is going to investigate the Medical Research in British India from the scholarly publication pattern of Indian Medical Gazette. This paper has investigated the trends of publication pattern, authorship pattern, content analysis of the title of the articles.

The section 2 follows will do a brief literature review on medical research in British India followed by a short history of the Indian Medical Services and the Indian Medical Gazette. Section 3 deals with te objectives of this research, section 4 is the methodology, section 5 is the results and discussion and finally the section 6 is the conclusion of this study.

2.1. Medical Research in British India

The period of British rule from 1757 to 1900 had observed many major socio-political and economic transformations. The medical field was not immune to those factors and witnessed many radical changes. During that period, western medicine system was introduced and gained momentum over the traditional medicine system. Newly introduced western medicine system was supported by the British as well as Western-educated Indians. Although, in the initial years, medical profession and practise was dominated by the European, later may educated Indian elites joined into the medical profession. Moreover, there were many scientific breakthroughs in the field that impacted medical systems and institutions during that time (Saini, 2016).

In British India, the medical profession and even medical research was mainly dominated by the Indian Medical Service (IMS). In the initial years, IMS was controlled by the East India Company and later by the monarch. In addition, historians have argued that the colonial administration used Western system of medicine as a tool to expand and justify their authority in India (Saini, 2016, Govind & Yadav, 2022). However, the European dominance was contested roughly from the 1900s onwards by the emerging Indian nationalism. Indian nationalists and doctors built their separate

identities of the new nation and its medicine around their own ideas and mainly welfare of its people and geography (Chakrabarti, 2009).

Tropical diseases had challenged the British presence in India from the beginning. It was estimated that more soldiers lost their lives due to tropical illness throughout the nineteenth century than to all 'native uprisings' combined. European officers, both military and civilian, and their families were at risk of the warm climate. Officials were contracting several tropical diseases on a regular basis. Tropical diseases, such as cholera, influenza, malaria, enteric fever, dysentery, diarrhoea, and Kala-azar were major causes of death. After the revolt in 1857, the British government realized the importance of medical care for its people and particularly the British troops serving in the continent. The imperial government had taken several initiatives for the study, detection, treatment and prevention of epidemic diseases. The British paid close attention to the high death rates among Indian army soldiers. The most important thing is that they precisely documented the frequency of illness within the army personals. This was to create an efficient preventive strategy to manage epidemics like cholera, which at the time was the leading cause of death for British soldiers (Isaacs, 1998).

Indian Medical Service and practice was mainly to take care of soldiers. It was entirely hospital-based service solely for the British army. However, in 1835 Sir James Ranald Martin, an Indian Medical Service officer, proposed sanitary perspectives for the healthcare. In the 1870s, the annual sanitary reports started releasing cholera mortality statistics. As a result of periodic cholera outbreaks a major sanitary reforms took place. This sanitary reforms and initiatives helped in expanding medical services beyond the military service to the general public (Ramasubban, 2022).

As the medical service as well the profession was mainly carried out by the Indian Medical Service. Officers from the medical service have been assigned to research on certain issues and particular diseases. The Government of India extended this practice by deputing officers in connection with field inquiries on the causation and prevention of prevalent diseases. For instance, David Douglas Cunningham (1843-1914), a Scottish doctor in the Indian Medical Service and Timothy Richards Lewis (1841-1886), a Welsh army surgeon studied public health issues including cholera and malaria in 1869. Giles was assigned to examine the causes and prevention of kala-azar and beri-beri, and then to cholera and malaria. In 1896, W. M. Haffkine studied the prophylactic inoculation against cholera in Bengal. He also engaged in research on plague and its causation and prevention (Bradfield, 1938; Herron & Alexander (2018).

Medical schools played a significant role in the early 19th century to regulate medicine throughout the British Empire, including its colonies in Canada and India. Robert (2024) argues that the rise of the British Empire was a determining factor in the gradual replacement of private medical apprenticeships with that of institutionalized medical education. Despite the lack of a unified medical policy throughout the British Empire, the imperial state played a significant role in the development of a medical curriculum that prioritized modern medical education including training in hospitals, and human dissection as standards of medical competency (Robert, 2024).

According to Bradfield, (1938), the organised medical research in British India started in the late 19th century. In 1894, the Indian Medical Congress submitted proposal to the Indian Government for the construction and funding of research institutes. This perhaps marked the beginning of organized medical research in India. Before this, the medical research in India was individual or private initiatives. Nonetheless, a lot of these initiatives have significantly advanced the nature of tropical illnesses. Noteworthy examples are, Lewis on trypanosomes and filaria, Vandyke Carter on spirilla, leprosy, and mycetoma, Macnamara on cholera, and Fayrer on snakes and snake venoms are a few notable contributors (Bradfield, 1938).

2.2. Indian Medical Services

Under the leadership of Captain (later Sir James) Lancaster, the East India Company's first fleet sailed in December 1600. The fleet accompanied with "foure tall ships" each carried "Surgeons twoe and a Barber". McDonald (1956) considered those men as the forerunners of European and later Indian doctors. Those men served the Company as well as the British monarch over the three and a half centuries. They have given their services and often laid their lives to the service of the East India Company, in the three Presidencies of Bengal, Bombay, and Madras. Indian Medical Service formed in 1897 and the Presidency Services were merged with the Indian Medical Services. On August 15, 1947, the Service was terminated with the independence and handover of power to India and Pakistan (McDonald, 1956).

Crawford's History of Indian Medical Services (IMS) was meticulously and splendidly recorded the IMS and its activity in India. He considered that IMS did a great job in India by introducing Western Medicine and Western Sanitation (Crawford's History of I. M. S., 1914; Crawford, 1914a; Crawford, 1914b).

According to Crawford, from the middle of the eighteenth century onward, the East India Company was virtually constantly at war. The Indian Medical Service had always been a military service, reserve to supply medical professionals for duty with the Indian Army in times of war. India participated in the European war between France and England from 1745 to 1748. This conflict was prolonged in India for another fifteen years by assisting different Nawabs and Rajas of India. Subsequently, these wars required the regular up keeping of armed forces that backed with the experience and robust medical service. In every conflict and frontier mission that the Indian army participated, the Indian Medical Services played very important role (McDonald, 1956).

Along with the service to the military, the IMS did many revolutionary discoveries. The life cycle of the malarial parasite has been discovered by the officer of this service. This discovery has fundamentally changed the understanding of the disease. Consequently, and, among other things, made it possible to build the Panama Canal. It has eliminated most of the dangers associated with amoebic dysentery and reduced the death rate from cholera. Doctors from IMS have figured out how the bubonic plague spreads. These developments ultimately lead to the disease's complete extinction. Even it is widely recognised the contributions of IMS doctor for the discovery and treatments for enlarged prostate, new methods for eye surgery, particularly in relation to cataract and glaucoma surgery (McDonald, 1956; Crawford, 1907).

Indian Medical Gazette was one of the major outlets of such publications of that time. Many of such path breaking publications was published in the famous medical journal of that time. Hence, a content analysis of literature published in Indian Medical Gazette will be perhaps giving a better understanding of medical research in British India.

2.3. Indian Medical Gazette

The first issue of the Indian Medical Gazette was published on January 1st, 1866. It played a significant role in the medical landscape of British India for about a century. Since its inception, the Indian Medical Gazette has been closely associated with the Indian Medical Service. Deputy Surgeon-General David Boyes Smith was the first editor was the Gazette. He was affiliated with the Indian Medical Service. The Gazette was successful because of the wholehearted efforts given by two editors Kenneth McLeod (1871-1892) and Walter Buchanan (1899-1918), both were serving as senior officers in IMS. Although the Gazette was not explicitly identified as an IMS publication, it was generally considered as an official publication of IMS.

The Gazette is one of the oldest medical journals in India. It was first published in 1866 and was a significant platform for medical professionals in the Indian subcontinent to share their research findings, clinical observations, and discussions on various medical topics. The journal covers a wide range of medical disciplines, including but not limited to medicine, surgery, pharmacology, public health, and medical education. Apart from providing an extensive and scholarly account of the medical, surgical, and sanitary practices being practiced in the East, the Indian Medical Gazette served as a valuable archive for group inquiry and study. It also gained recognition in Europe as a trustworthy source on tropical diseases. Despite being known as the Indian Medical Gazette, its scope and coverage never limited to India only (The "Indian Medical Gazette", 1897).

During its long history, The Indian Medical Gazette was a reliable platform for the exchange of knowledge and ideas among healthcare professionals in Indian subcontinent. It has made significant contribution for the development of medical science and practice in the region. It has also played an important role in shaping healthcare policies and practices not only in British India but also in the whole Asia pacific region. It had published articles on public health issues, medical ethics, and healthcare delivery systems.

3. Objectives

It was discussed in the previous section that the Indian Medical Gazette was an important research outlet among the medical community in British India. Hence a content analysis of this journal will be helpful to understand the depth and breadth of the medical research in colonial India. With this aim the study has the following objectives:

- To map the publication patterns of articles in The Indian Medical Gazette
- The most productive authors
- The types of items published in the journal
- The content analysis by means of word cloud and word frequency analysis of title and keywords.

4. Methodology

The publication data of Indian Medical Gazette was downloaded from the PubMed (website https://pubmed.ncbi.nlm.nih.gov/). This online database was designed, developed and maintained by the National Center for Biotechnology Information (NCBI). NCBI is located, at the National Library of

Medicine (NLM), National Institutes of Health (NIH), US. The database is widely used for accessing biomedical related literature. Presently, it comprises more than 37 million records for biomedical literature from various sources. It is one of the valuable and freely available resources for researchers, healthcare professionals, students, and anyone interested in the biomedical field.

The full achieve of The Indian Medical Gazette is available from the website https://www.ncbi.nlm.nih.gov/pmc/journals/2470/. The website is a complete repository of the journal except the following issues v. 51, no. 10, 1916; v. 75, no. 11, 1940; v. 90, no. 3-5, 195. So, this study is based on the available records of Indian Medical Gazette available on PubMed. Also, the indexing of the journal is not available for example the authors, keywords in many records are missing. All the articles are available in scanned pdf format. A further full records analysis will give a better picture of the trends. Case by case meta-analysis will perhaps give a better and clearer picture. This study is based on single journal hence there is many inherent limitation of this study.

5. Results

Based on the literature review and the research questions raised above the section follows will discuss the, publication trend, document types, authorship pattern, word frequency and word cloud of research articles of The Indian Medical Gazette

5.1. Publication trend

As per the available records from the PubMed website during its 90 years of its existence, The Indian Medical Gazette has published 21,934 articles. In the year 1866 the number of articles published were 353 (Figure 1). Upon careful looking at the publication trends it can be seen that the Gazette has published about 200 articles every year except a few years (1955, 38 articles; 1953, 160 articles, 1883, 164 articles, 1884, 177 articles, 1916, 181 articles, 1920, 186 articles, 1888, 189 articles, 1918, 189 articles, 1915, 194 articles, 1890, 196 articles, 1919, 197 articles). So, it is evident that the Gazette had played a consistent role in publishing medical research during its long existent in British period.

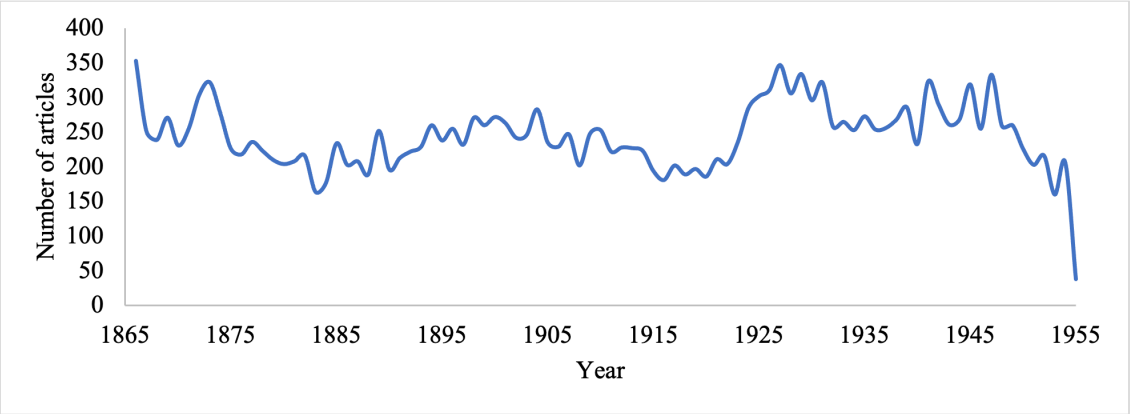

Figure 1. Number of articles published during 1865-1955

5.2. Document types

Among the retrieved 21,934 items the breakdown of the items are as follows; Journal Article 18,101 (82.52 %), Editorial 2,640 (12.04 per cent), others or not listed 1,008 (4.60 per cent), Erratum 134 (0.61 per cent), Corrigendum 49 (0.22 per cent) and News 2 (0.01 per cent). Figure 2 shows the types of documents published in the Indian Medical Gazette

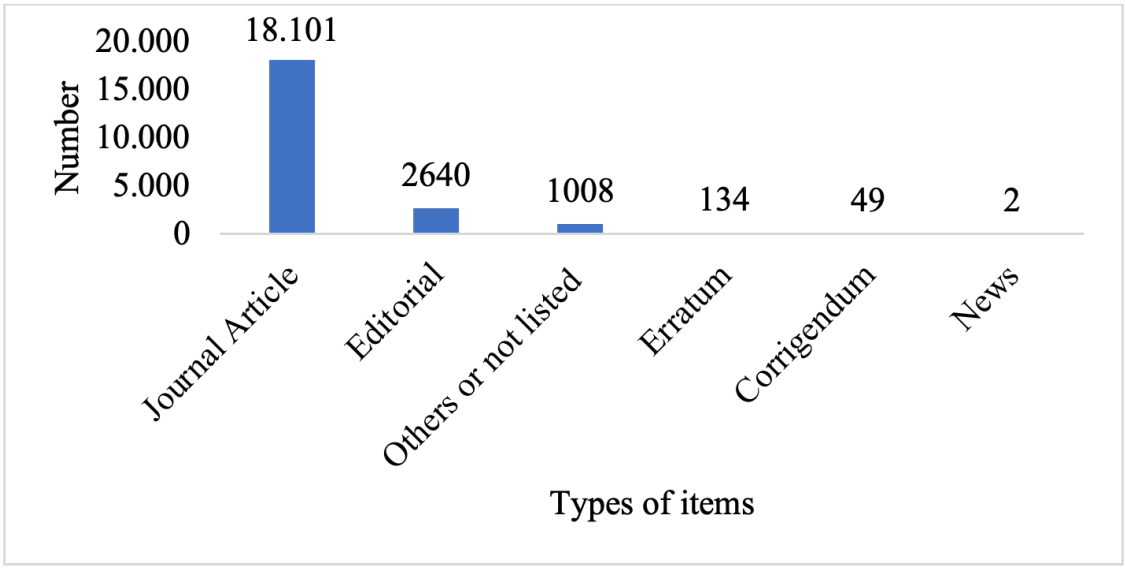

Figure 2. Types of document published in the Indian Medical Gazette

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5.3. Top Authors

Authorship analysis is an important indicator of research output. Among the 21,934 research items 7,181 (about 33 per cent) do not have any authors listed. These articles are various types of correspondence, editorial or news items. There are altogether 5,773 authors listed rest of the articles. The top authors are listed in Table 1

Sl no	Name of the author	Number of articles	Periods	Affiliations
1.	Chopra, R. N.	173	1922-1951	Brevet-Colonel, IMS (All-India Institute of Hygiene and Public Health, Calcutta)
2.	Napier, L. E.	109	1921-1951	Calcutta School of Tropical Medicine
3.	McLeod, K.	106	1866-1905	Calcutta Medical College
4.	Chaudhuri, R. N.	104	1934-1954	Calcutta School of Tropical Medicine
5.	Fayrer, J.	104	1866-1904	Medical College of Bengal.
6.	Gupta, B. M. D.	74	1923-1945	Calcutta School of Tropical Medicine
7.	Richards, V.	73	1871-1892	Civil Medical Officer / Officiating Health Officer, Port of Calcutta.
8.	Greval, S. D. S.	71	1921-1925	Lieutenant-Colonel, IMS (School of Tropical Medicine, Calcutta).
9.	Roy, G. C.	68	1866-1887	Civil Surgeon
10.	Pasricha, C. L.	67	1931-1947	Major, IMS (School of Tropical Medicine, Calcutta)
11.	Moir, D. M.	66	1890-1904	Major, IMS, Presidency General Hospital, Calcutta.
12.	Maynard, F. P.	57	1889-1921	Captain, I.M.S.
13.	Macnamara, C.	54	1881-1866	Surgeon to the Calcutta Ophthalmic Hospital.

Sl no	Name of the author	Number of articles	Periods	Affiliations
14.	Smith, H.	54	1893-1936	Lieutenant-Colonel, IMS (retd.) Blenheim, Main Road, Sidcup.
15.	Moore, W. J.	53	1866-1891	Surgeon, Rajpootana Political Agency.

Table 1. Top author, their number of articles and their affiliations of The Indian Medical Gazette

5.4. Content Analysis

Content analysis is an important and dominant data reduction technique used in qualitative research. *"It is a research method for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use. As a research technique, content analysis provides new insights, increases researcher's understanding of particular phenomena, or informs practical actions"* (Krippendorff, 2018). This method is a replicable technique that is used for condensing many words of text into fewer distinct categories based on explicit rules of coding. According to Stemler (2000) content analysis extends far beyond simple word frequency counts. Word frequency analysis is a fundamental method of qualitative text data analysis. It involves counting how often specific words or phrases appear in a given dataset. By examining word frequencies, one can get insights into the dominant topics within the text.

Visualization of words plays an important role in exploratory data analysis. Word frequency analysis and word cloud provide an opportunity of visualize the text data in the form of word, tags and important words are identified by its frequency.

After the initial cleaning of the data for example, stop word removal, punctuation marks removal, uniform text generation (upper case, lower case) and removal of some unwanted words the top 20 most frequent words are shown in Table 2

Sl no	Word	Frequency of occurrence
1.	case	2044
2.	medical	1937
3.	notes	1545
4.	treatment	1309
5.	cases	1047
6.	current	829
7.	topics	813
8.	service	804
9.	fever	779
10.	India	764
11.	cholera	624
12.	news	576
13.	report	508
14.	malaria	489
15.	hospital	422
16.	calcutta	422
17.	note	397
18.	Indian	382
19.	disease	340
20.	treated	338

Table 2. It shows the most frequent keywords in terms of its occurrence

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5.5. Word Cloud

Word Cloud is a visual illustration to present text data. Word Cloud represent the size of each word matches to its frequency in the given text (Dicle & Dicle, 2018). More frequently occurring words appear larger than the less frequently occurring words in the cloud. The following word cloud (figure 3) was created using the software package R to visualise the most frequently used words in the text extracted from the title of the articles. As shown in the table 2, the following words represents the Case, medical, notes, treatment, cases are the most frequently occurring (more than 1000 times in the word cloud.

Figure 3. The word cloud of most frequently occurred words

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6. Conclusion

The East India Company played a significant role in shaping medical education and research during its colonial rule in India. British medical education was institutionalised top-down approach which engaged local imperial administrations, with its main purpose was to serve the Company. The colonies, including India, became sites of medical innovation to meet the need of officers and staff of the company. British administration in the colonies influenced medical progress both locally and globally. In 1835, the teaching of "European-style" medicine began in India. Calcutta Medical College adopted English language education based on the European model. Beside this, in the subsequent years more medical schools were established in Madras, Lahore, Nagpur, and Patna. Native doctors from those medical schools played a crucial role in mass vaccination programs and public health measures, making medical education beneficial to the indigenous population.

To get and essence of the medical research in British India, this paper is an attempt to map the articles published in "The Indian Medical Gazette" a famous medical journal published in British India. The journal started its publication from 1866 and played a very active role in shaping medical research in British India. With the span of 90 years (1966-1955) the journal has consistently published many important medical related cases and it altogether published more than 21,934 articles.

Crawford, D.G. (1914) had the opinion that The Indian Medical Gazette, had a long life, and probably financially successfully. However the Gazette emphasized more on medical news and comments on current medical events and politics. According to Crawford (1914, p459) the gazette many not solely considered as a scientific publication. However, the document type analysis shows that most of items published in the journal were research articles.

The authorship analysis shows that the most prolific authors were from Indian medical services. The keyword analysis shows that the articles mainly related to medical case or cases.

This is an attempt to map the medical research in British India based on a single journal content analysis. A further in-depth analysis covering other journals of that time will perhaps give a clear and holistic picture of medical research in British India.

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