INDIAN SOCIETY FOR MEDICAL STATISTICS

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To,

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Dated: 26 October 2019

Subject: Recommendations of the Society's 'High Level Committee for Advancement of the Biostatistics Speciality' for enhancing research output and its quality in medical colleges of the country – Request for your kind consideration.

Sir

As you are aware, training of medical education in our country continues to attract criticism and it is generally perceived that quality of this training still needs considerable improvement. Particularly, for teaching & training in Biostatistics, it is often pointed out that teaching of the subject in medical colleges at the undergraduate as well as postgraduate level, is neither need-based nor up to the mark and in a few centres of the country, it is almost missing. Not only this, some recent studies have revealed that contribution of Indian medical colleges in health research has been negligible. It is often thought that the poor status of the Biostatistics' speciality in Indian medical colleges presently, may be largely responsible for the sub-optimal medical research output and its quality in the country.

To look into reasons for poor research output and unsatisfactory research-quality in medical colleges of the country, the ***Indian Society for Medical Statistics (ISMS)*** – the only professional Society of its kind in biostatistics in whole of SEA, had last year constituted a high level 9 - Member Committee, consisting of top biostatistics faculty of the country, with Dr B L Verma – its Founder & Former President, as its Chairperson. This 9–Member Committee, after having frequent & prolonged conversations on the subject for about an year, have now come-out with some Specific Recommendations (attached herewith) to improve-upon the current scenario of health search in medical colleges of the country.

On behalf of ***ISMS***, I request you to kindly consider our Society's above Recommendations & take necessary action in the matter to implement them. We are of the view; this will considerably improve the medical research output and its quality in these institutions. The members of our Society will feel greatly obliged to you for this act of kindness.
Thanking you and with kind regards
Encl.: Committee Recommendations

Yours Faithfully

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Indian Society for Medical Statistics

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Recommendations of a High Level Committee for Advancement of Biostatistics Speciality for Enhancing Medical Research Output and Its Quality in Medical Colleges of the Country

1. Preamble

The training of the medical education in our country continues to attract criticism. It is generally perceived that quality of training in medical education in our country needs improvement. In fact, systematic efforts to evaluate institutions' products in terms of clinical competence and teaching are often hard to be seen. Particularly, for teaching & training of Biostatistics, it is often pointed out that teaching of the subject in medical colleges at the undergraduate as well as postgraduate level, is neither need-based nor up to the mark and at places, it is almost missing.

As research output is easy to measure, using available databases; some Investigators have made occasional efforts, in recent past, in this direction[1,2,3]. Further, a recent World Report[2] has revealed that contribution of Indian medical colleges in health research is negligible. It has also been found[1] that India is amongst the major contributors of research articles, published in poor-quality predatory open access journals. It is often thought that poor status of the Biostatistics' speciality in Indian medical colleges is largely responsible for sub-optimal medical research output and its quality. Some brief highlights in this regard are given below.

i) Present Status of Research Output in Country's Medical Colleges:

A *World Report* – appeared in the Lancet[2] in May 2016, on 'poor research output from Indian medical schools, has attracted attention of policy makers and medical professionals alike. This Report also mentions a disturbing observation by the Hon' ble Supreme Court of India, in a judgement delivered on 6 May 2016 relating to a private medical college, where it described the state of country's medical colleges as "rotten". Citing views from selected eminent medical authorities of the country, this Report revealed that research funding agencies have neglected country's medical colleges so far and that, funding of medical research in the country has been

terrible. Their assertion was – "unless we invest and strengthen biomedical research capacity now, it is unlikely that we will see the kind of improvements in health outcomes we would like to see in next 20-30 years". Similarly, Dr Soumya Swaminathan, Former DG – ICMR, in one of her interviews, given to Shreya Shah[4] of *IndiaSpend* sometime back, while emphasizing on unsatisfactory status of medical research in the country, had indicated that "there are only a few medical colleges in the country that encourage and promote culture of research and we need to ensure that in the coming years, many more medical colleges and their faculty get involved in the research".

A systematically conducted study by Delhi Group of Doctors[3] on research output from Indian medical institutions, have brought forth alarming results for medical colleges of the country. Using SCOPUS data base, they analysed research outputs of 579 Indian medical institutions and hospitals – Government and of the private sector, 316 under MCI and 263 under NBE, between 2005 and 2014.The total research output during 2005 -2014 was of 101,034 papers with average number of publications per institution being 14.5 papers each year. The above Study revealed that 332 (57.3%) institutions did not publish a single paper during above 10 years. The Southern States of Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra and Tamil Nadu had 55.6 % of the total number of the MCI recognized medical colleges of the country but a large percentage of these medical colleges had no publications during the above period. The above findings suggested that the research output of the Indian medical colleges during the above past 10 years (2005-2014) was poor.

ii) **Present Status of Biostatistics' Speciality in Medical Colleges:**

It appears, proper attention has not been given to *Biostatistics Speciality* in medical colleges of the country since beginning. It is often realized that we should not think of imparting good quality training in medical education or undertaking quality medical research, unless there is well trained faculty in Biostatistics and there are adequate data-analysis facilities in the institution. Since very beginning, there has been only one junior level technical position in Biostatistics, viz. *Statistician–cum- Lecturer* (which recently has been downgraded, as per the 2017 MCI Recommendations, to the position of *Statistician – Cum - Tutor*), in the Department of Community Medicine of each Medical College. The person appointed on this position plays only a very limited role in teaching of the subject to the medical students, training to the young faculty and in medical research. He / She takes only 10 -15 classes of the subject (lectures as well as practicals) to the undergraduate batch during their 4 ½ years of stay in the institution. This teacher has no role to play in the

University examinations of MBBS, PG or Super Speciality Courses. Also, this Statistician –cum - Tutor is denied of all promotional avenues and other perks that are given to the faculty of other specialties. In view of these, competent Biostatisticians are not willing to join such inconsequential positions with poor remuneration. All these are leading to the absence of formal teaching of Biostatistics (like a Foundation Course or Orientation Course in Biostatistics) for doctoral and post-doctoral medical students; integration of Biostatistical rigor into PG & Ph D thesis works and training of young medical faculty in Biostatistics & research methods from time to time.

In addition, *Biostatistics Speciality* has no independent status. Its faculty / staffing position as well as infrastructure are poor. So, any bio-statistical consultation or data – analysis help, if required by a medical faculty or postgraduate students, is often not available. As the research environment in medical colleges is unsatisfactory, the funded research as well as publications – particularly in high impact journals is almost negligible.

2. Major Factors Responsible for Poor Research and Quality of Teaching & Training of Biostatistics in Medical Colleges:

There could be many factors responsible for this state of affairs, but in the *Indian Society for Medical Statistics (ISMS)* – based on our own experience and interactions with our fellow medical colleagues working in these institutions, we are of the view that poor faculty positions in biostatistics, inadequate infrastructural facilities in biostatistics and very limited role of biostatistics in medical education & research, play a major role on the above issues. Resultantly, there is no proper training & teaching of bio-statistics and of research methods to the young faculty and students, bio-statistical consultation practices in the institutions are poor, funded research is not encouraged, inpatient as well out patient hospital data often remain unutilised for teaching & research purposes and proper help on application of bio-statistical methods and also for data – analysis, are often not met to the faculty and PG students, thus - resulting in poor health research outputs. In addition, quality of medical research is also often adversely affected. A study (2011)[5] on 'quality of reporting statistics in two Indian Pharmacology journals' found that inappropriate descriptive statistics was used in 78.1 % of articles and that, in 31.7 % of papers, incorrect statistical tests were applied.

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What is the Way Forward?

Several steps are needed to be taken to strengthen medical research in our medical Institutions. We, in ISMS, strongly believe that research output of these institutions can significantly be enhanced by considerably improving present shape of biostatistics speciality by re-organizing it – in terms of manpower, infrastructure, need-based teaching / training curriculum and data-analysis facilities and thereafter, by increasing role of biostatistics faculty in teaching & training of PG & super speciality students and young faculty (in bio-statistical methods & research methods), creating a good research environment in the institutions, encouraging them for their involvement in sponsored / funded research, providing frequent bio-statistical consultation-opportunities and helping faculty & PG students in the data – analysis of their research studies. In fact, MCI in recent past, has redefined the role of various basic specialities of medical colleges (like Microbiology and Biochemistry etc), but it has not revisited the role of Biostatistics in these institutions during past 5 decades.

3. Our Views for Reshaping the Bio-statistical Speciality in Medical Colleges:

i) The Biostatistics Speciality in medical colleges should be re-organized as an independent discipline. Thus, there should be a separate independent Department of Biostatistics in all medical colleges of the country with some senior faculty positions. In Colleges with PG and super speciality courses, this Department should be headed by Professor of Biostatistics.

ii) This Department should be equipped with data-analysis facilities, like internet, computers & printers, statistical software, electronic projectors and technical manpower (support staff), etc.

iii) Gradually, the *e-health record system* of the associated hospital should function under the control of this Department, so that generation of hospital data should properly be monitored and utilized for teaching & training, research policy formation and effective management health care system.

iv) For teaching of Biostatistics to the undergraduate, post graduate & super speciality students and training to the young faculty of medical colleges, the need-based course curricula in biostatistics & research methods, should be re-designed.

v) Role of biostatistics faculty in biostatistical consultations with PGs, Ph D & Super-speciality Theses and their involvement in research projects, should be considerably increased.

vi) The Department of Biostatistics should also create and train biostatistics' manpower for future needs of the national health and medical education system. More specifically, such

Departments should be encouraged to start M Sc (Biostatistics) and Ph D (Biostatistics) courses to generate technical manpower in the speciality.

vii) The Institutional Ethics Committee should work more effectively in these institutions, with essentially a senior faculty of biostatistics as its Chair or at least one of its members. This Department should take major responsibility of the institutional research output and its quality. It should encourage and extend all possible technical support to the different Departments of the medical college for preparation, submission of research proposals for funded research and collaborate with them in running such projects in institutions.

4. Specific Recommendations for Staff (Biostatistics) in Medical Colleges: i) with only Graduate Course and ii) with Post Graduate & Super Speciality Courses.

There are two categories of Medical Colleges in the country – with and without PG & Super Speciality Courses. The reshaping of the Biostatistics Speciality in them should be done, as given below:

i) Medical Colleges with only MBBS Course:

An independent **Biostatistics Unit** should be created in these Medical Colleges and following staff should be provided in this Unit for teaching and research activities. This Unit should also control College computer network and e-health system of the associated hospital. For administrative purposes, this Unit should work directly under the control of the Principal of the Medical College. The staffing position of the Unit should include:

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Assistant Professor of Biostatistics– 1 (Qualification: Ph D in the speciality- Biostatistics, Statistics or Equivalent).

Note: .

1. If Ph D qualified candidates are not available in the beginning, those with PG qualification in the speciality (M Sc in Biostatistics or M Sc in Statistics with 1 year teaching or research experience in medical & health data) may be appointed as Lecturer in Biostatistics (against the position of Assistant Professor).

2. Ph D completion tenure should be considered as candidate's 3 years teaching experience (in the light of the provision by UGC[6]).

3. *The present post of Lecturer in Statistics & Demography (under the Post Partum Program), should be clubbed with this Unit.*

Biostatistician - 2 (M.Sc. in the speciality)

ii) Medical Colleges with PG & Super Speciality Courses:

There should be a separate independent Department of Biostatistics (with minimum faculty, analytical facilities, support staff & the resources) in each PG Medical College of the country. In view of scarcity of trained / qualified teachers in biostatistics in the country, this should be done in stages, following two models, given below:

For new PG Medical Colleges, this Department should be started from very beginning. The College Computer Network and e- health staff of the associated Hospital should be under the control of this Department (as suggested for the Biostatistics Unit). However, for the existing Medical Colleges, this Department should be established gradually in the phased manner (say, it should be established in coming 5 -7 years from now). Till the establishment of the Department, the arrangement of the ***Biostatistics Unit*** *(as suggested above) with some changes may continue in these Medical Colleges.*

The Biostatistics Department should ideally be headed by a Professor Grade person, supported by at least one Assistant Professor along with other facilities, such as - computers, software, data entry operator and a good library, to take care of the biostatistics teaching, guidance for research and thesis-writing and also to provide support to the clinical faculty in their research projects / pursuits.

This is well known fact that good, well trained and experienced biostatisticians are presently not many and it will be difficult to get Professor Grade Personnel in bulk. As Medical Colleges in many States (like UP) have well established promotional avenues for the faculty, the Departments, for the time being, can be started with Associate or even Assistant Professor level faculty who can further grow it to higher levels in due course of time. However, the other requirements will be same as in the first model.

The following staff should be provided for teaching and research activities of the College. They will also manage College's computer network and its website.

<u>Professor of Biostatistics – 1</u> (Qualification: PhD in the speciality - Biostatistics, Statistics or Equivalent, with at least 8 years of teaching & research experience).
<u>Associate Professor of Biostatistics –1</u> (Qualification: PhD in the speciality, with at least 4 years teaching & research experience as Lecturer or Assistant Professor in the speciality)
<u>Assistant Professor of Biostatistics –2</u> (Qualification: Ph D degree in the speciality – Biostatistics, Statistics or Equivalent).

<u>Note</u>:

1. If Ph D qualified candidates are not available, candidates with PG qualification in the speciality (M Sc in Biostatistics or M Sc in Statistics with 1 year teaching or research experience in medical & health data) may be appointed as Lecturer in Biostatistics (as against the Post of Assistant Professor of Biostatistics).
2. Ph D completion tenure should be considered as candidate's 3 years teaching experience (in the light of provision in UGC[6]).
3. *The Post of Lecturer in Statistics & Demography (presently under the Post Partum Program) should be clubbed with this Department.*

Biostatistician – 2 (M.Sc. Degree in the speciality)

Most importantly, this Department should run M Sc (Biostatistics) & Ph D (Biostatistics) Courses to generate technical manpower in the speciality on regular basis. The Department should have a computer laboratory for training of students and for carrying out advanced statistical analysis of research data of the faculty as well as outdoor & indoor hospital data. The Department should provide biostatistical and research methodology consultation to all the PGs and ensure that all research (including PG theses) have used adequate statistical methods.

5. Teaching of Biostatistics to the Medical Students:

a) For Undergraduate / MBBS Students

Although biostatistics is woven into several teaching-learning activities at undergraduate (MBBS) level, there is no recommendation for structured lessons. At undergraduate level, this is taught as part of the Community Medicine and the convention is to allocate 15 didactic lectures (spread across first, second and third professional classes) and 10 practical sessions to this subject. In view of emphasis now on evidence-based medicine and need to interpret large chunks of medical data that are generated due to digitization, there is a need to formalize this without increasing the burden on the students. The teaching, for the time being, may continue to be 15 hours of lectures and 10 hrs of practical, till the designing of the need-based syllabus of biostatistics teaching (by an Expert Group) so that it gets a complete medical orientation:

b) **For Post Graduate (MD & MS) and Super Speciality Students:**

All PGs should necessarily undergo a 20-hour Foundation Course in Biostatistics and Research Methodology, followed by an examination which must be passed by each student with at least 50% marks before he or she submits the PG thesis. This must be the part of the certificate, signed by the Head of the institution in the front page of the thesis. This Course should be conducted by the Department of Biostatistics with assistance of teachers from other Departments.

Perhaps due to lack of infrastructure to impart on-site training of biostatistics, a distance learning approach has now been recommended by the NMC. This is, for time being, a welcome step taken by NMC and may improve the learning of research methodology. but on-site support to research and collaboration is still lacking. Our view is – such a learning Course & training in Biostatistics and Research Methodology to the PG students and young faculty, should be given on-site by the Department of Biostatistics.

6. University Examination in Biostatistics

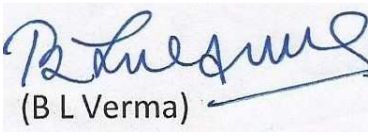
Medical Students at the Undergraduate as well as PG & Super Speciality levels should be assessed through a University level examination. To conduct this examination should be the responsibility of the Biostatistics Unit / Department of Biostatistics. In ISMS, we feel, unless it is done, students will not take interest in the teaching of the subject at both the levels of their medical education.

7. Formation of a Special Expert Group for Designing a Need-Based Syllabus (at Graduate & PG / Super Speciality levels) for Teaching and University Examination in Biostatistics

The NMC should form a Special Expert Group on teaching of Biostatistics (for both – at Graduate & PG levels), to decide about different aspects of the need – based syllabus of Biostatistics & Research Methodology and also, for students' University examination in the subject. The ISMS – particularly this Committee, if invited by NMC, will be pleased to join hands with NMC for the purpose.

Annexures:

1. Jain, NC and Khan, GS: Predatory Journals: A downside on research and hampering the impact & relevance of scientific outcome. RUHS Journal of Health Sciences, 2018, 3, 99-105.
2. Sharma, Dinesh C: Poor research output from India's medical schools. In: World Report. *The Lancet*, 387, 10034, e28, 28 May 2016.
3. Ray, Samrat; Shah, Ishan and Nundy, Samiran: The research output from Indian medical institutions between 2005 and 2014. *Curr Med Res Prac*, 2016, 6, 49-58.
4. Shah, Shreya : Current situation unsatisfactory – India's top Doc lays out new vision for health research. 10 August 2017, IndiaSpend (www.indiaspend.org).
5. Jaykaran and Yadav, Preeti: Quality of reporting statistics in two Pharmacology journals. *Journal of Pharmacology and Pharmacotherapeutics* 2011, 2. 85-89.
6. UGC Circular no. F.17 – 8 /2013 (PS) dated 1 March 2016.



Committee - Chair

On behalf of the High Level Committee for Advancement of Biostatistics Speciality,
Constituted by the Indian Society for Medical Statistics

Place: Jhansi (UP) Dated: 25 October 2019

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Review Article

Predatory Journals: A Downside on Research and Hampering the Impact and Relevance of Scientific Outcome

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ABSTRACT

The advancement of medical knowledge is quint-essentially based on the authentic and reliable scientific research and publications. This is in addition to the recently mandated requirement of original research publications in indexed journals to ensure career progression in academic/medical institutions, thus the need for 'publications' in scientific medical scholarly journals has increased substantially. On the other hand, this has given an unparalleled rise in the number of stand alone journals and publishers "Predatory" is the term, who are ready to process the manuscripts on priority with almost guaranteed publication, at a cost, but having no credibility to the research being published. To foster awareness creation among students at the post-graduate level and for faculty of medical colleges and research institutions, it has become very important to avoid these predatory journals. It is high time that the thinking among researchers of 'Publish or Perish' be changed to 'Publish and Flourish' by adopting stringent measures which have evolved over time to curtail this birch of predatory publishing. Researchers should now take the road less travelled. This review article aims to highlight all the relevant and important points about the threats posed by predatory journals and also suggests possible ways to overcome them.

INTRODUCTION

The unscrupulous threat that has emerged to dwindle the integrity of academic publishing, popularly known as "Predatory journals", are exploiting the open-access (OA) model by corrupting the peer-review process, which is often absent or minimal in such predatory journals leading to mis-reporting of scientific data and results which is very direful for the community as a whole. After working in a research area if one has been involved with research projects in the past years, the final step in the research process is always about disseminating and delivering research outcomes/results for the benefit of the society and people. Typically, all researchers (junior and senior scientists, faculty and students) fulfill the first step by presenting their research work at several local, regional or national or international conferences. These activities are important, but ultimately they need to publish the work and their findings in scientific journals. Now comes the most important and critical part that where to and how to publish the work in renowned and high impact factor indexed Journal Citation Reports (JCR) journals for recognition of the findings. This is where utmost care and responsibility needs to be undertaken so that one does not fall to the fate of the so called "Predatory Journals", which have evolved with time, ruthlessly to exploit researchers years of hard work, time and devotion one gave for the research work to come to some good conclusion and results. Recently the numbers of such predatory journals have outgrown, they just prey on researchers, by sending invitations to publish papers in the journals, so it is high time that these predatory journals should be avoided and this is possible only when the researchers are aware of the harm they are rendering.

Predatory Journals

A wide definition and how to avoid them:

A sensible and sound journal selection prior to submission of work would in most of the cases, if not all, contribute to a major extent in avoiding this mishap known as "Predatory Journals". This case is a learning experience particularly for the early career and developing country

researchers. These predatory journals did not catch the sight of many researchers worldwide, until Jeffrey Beall, a research librarian at the University of Colorado in Denver, after coming across increased number of spam mails loaded with invitations from such journals, did intensive research on these and later developed his own blacklist[1] of what he calls "Predatory Open-access journals". There were 20 publishers on Beall's list in 2010, and now there are more than 300. It has been estimated that there are as many as 4,000 predatory journals today, at least 25 percent of the total number of open-access journals.[2] Moreover, to obtain a blacklist of dubious journals and publishers, the archived copies of Beall's list may be useful.[3,4] Conversely, the white lists can be obtained from PubMed/MEDLINE[5-7] and Directory of Open Access Journals (DOAJ)[8], Master Journal List of Clarivate Analytics[9], and Publons.[10] Additionally, Open Access Scholarly Publishers Association (OASPA)[11], Committee on Publication Ethics (COPE)[12], International Committee of Medical Journal Editors (ICMJE)[13], International Association of STM Publishers[14], and Centre for Journalology website[15] may also be useful in providing the list of legitimate journals or publishers. To find a journal with an impact factor (IF), JCR may be useful. Also, Memon AR, in one of his reviews on menace of predatory journals has suggested the authors from the developing world that they should confirm, prior to the submission of their work, the legitimacy of the journal and its publisher. They should seek help from their senior colleagues and those with expertise in journal selection.[16]

Why to avoid?

The need to publish in JCR indexed journals is very important as it keeps track of the numbers of citations to articles published in top-tier scholarly journals. Measuring the number of citations articles in a given academic journal received on average tells about its impact factor, which is used as an indicator of the importance of a journal in a field, with journals with higher impact factors being more important. Also, one should be keen in checking the latest IF with JCR and cross check the journal's identity with its International Standard Serial Number (ISSN) (online/print), which is unique for every journal/ periodicals.[17] But that does not mean that the journals having lower ranking in the JCR ranking are not important and should not be used for publications, it might just be an indication that the journal serves a niche expert audience, has a very specific subject matter, or serves a small subfield. In these cases, it may be best journal for your purpose, even though it is not one of the top journals in its discipline.[18] All the basic and relevant points which are important from the view of avoiding these predatory journals and going for the right journal choice will be further discussed in this article.

Journals are the basic source of current information in any science based field and are the main formal information channels for scientific communications.[19] One of the major goals of these scientific channels is to disseminate qualified scientific information.[20] It is difficult for clinicians, scientists, and health policy analysts to keep up with more than 2 million new research articles published each year in medical and scientific journals.[21] Furthermore, many published reports are of poor to average methodological quality and most of the scientific articles are never cited. One approach to facilitate the identification of sound medical evidence is to identify high quality journal.[21,22] A well-written article, novel in concept, and scientifically sound research design qualifies for a good paper. The demand to publish due to 'publish or perish' culture among research and academic institutions is increasing, but it should also be noted that only a highly ranked publication can propel young researchers in their academic careers.[23] Researchers should also be aware of 'hijacked' journals. These are respected journals, usually with an impact factor from Clarivate Analytics (formerly known as Thomson Reuters) for which someone has created a counterfeit website. The counterfeiters then send spam emails, acting as if they were the real publishers of the journal. They accept all submissions and charge the authors. Their victims are typically author seeking fast publishing in impact factor journals. Free submission and publication is a significant factor for individual health researchers. In the presence of external funding or grants, authors would not be deterred to publish by paying publication charges and may even consider journal reputation with high impact and open access. Grant-writing and external funding is still not fully explored by Indian health researchers.[23] By far, predatory publishers damage science more than anything else. They do not faithfully manage peer review, allowing questionable science to be published as if it had passed a strong peer review. We know that peer review often results in papers being rejected for publication, but this rejection is contrary to

Table 1: Summary of Ethical issues related to predatory journals[26]

Issue	Elaboration
Misrepresentation	Predatory journals distort who they are and what services they offer
Lack of editorial and publishing standards and practices	Predatory journals lack standards and best practices as established by the scholarly publishing community, which improve the quality and ethics of published work
Academic deception	Authors misrepresent their scholarly effort by choosing to publish in predatory journals
Research and funding wasted	Research published in predatory journals may not receive the recognition it deserves and may become inaccessible, hence the effort and risk of research as well as funding are wasted
Lack of archived content	Predatory journals do not archive their content in third party sites making it inaccessible in the future
Undermining confidence in research literature	Predatory journals undermine faith that readers and the public have in research literature

the business model of many open-access publishers, because they only want to generate as much revenue as possible.[24] Another most important harm posed by the predatory journals is that they never archive their content in third party sites such as CLOCKSS (Controlled Lots of Copies Keeps Stuff Safe: a community-governed archive).[25] Since the journals are founded solely for financial reasons they are likely to cease publication when profits decline or investors turn their attention elsewhere. Keeping all this in mind, even before starting to write a research article, the researchers should first explore the JCR indexed Journal list as to which will best suit for their work to be published, and should go according to the instructions given on the journal home for article writing and submission. The ethical issues related to predatory journals are summarised in table 1.

Recently, some vigilant researchers are now raising the alarm against this predatory menace which they describe as the proliferation of online journals that will print seemingly anything for a fee, but this also warns you on the other hand that non-experts doing online research on choosing journals will face trouble in distinguishing credible research journals from predatory ones, with a recent article published in by R Prasad[27] in '*The Hindu*', dated 12th March 2018 New Delhi edition, a daily Indian newspaper, which reveals that according to the *BMC Medicine* paper, around 35% of authors in such journals were from India and 27% of predatory journal publishers were also based here, thus making India the number one country in both categories.

A September 2017 paper in *Nature* found that authors from India accounted for 27% of the 1,907 papers published in predatory journal.[28] From initially being duped into publishing papers in these journals, researchers in India, particularly those from state universities, are now actively seeking out such journals. Recently, a critical analysis has been published in *Current Science* (March 2018 issue), elaborating on the serious re-consideration of the current UGC-approved list of journals, suggesting that there is an urgent need to form new regulations to curtail unethical practices in scientific publishing alongwith some awareness programmes being organized about publication ethics at Indian universities and research institutes.[29] The University Grants Commission (UGC) may perhaps be responsible for this, as they introduced this Academic Performance Indicators (API) system in most of the state colleges and universities for grabbing an academic position and promotion assessment alongwith a second mandate that every PhD scholar has to publish at least two research papers prior to their thesis submission. Nonetheless, this policy of UGC has undoubtedly led to a sudden and huge demand for journals that willingly publish substandard papers for a small fee. With this huge pressure, last year in January 2017, the UGC introduced a white list of journals where researchers could publish to meet the API conditions. UGC also has released a list of 38,653 approved journals for the purpose of Career Advancement Scheme (CAS).[30] The white list prepared by UGC has at least 200 predatory journals, but as on 9th April 2018, the access link is no more available.

Several organizations also have started conducting symposia on creating awareness on predatory publishing, last year one such symposium had been organized by European Association of Science Editors (EASE) on predatory journals at V World Conference on Research Integrity, in Amsterdam, in May 2017. Nevertheless, on the other hand, several other studies revealed that India is among the major contributors of articles published in poor-quality predatory OA journals[31-33], thus contributing to duality in scientific publishing in India. Seethapathy GS et al[34] stated that India not only publishes the majority number of predatory journals in the world but Indian researchers are among one of the biggest contributors to such journals. Not only this, various organizations like ICAR, CSIR, and ICMR labs and other national institutes such as IITs, NITs have also fallen fate to these predatory journals. This exceeding number of publications in predatory journals caught the attention of *Nature*, one of the most competitive and well-regarded scientific journals and they have explored whether it was better to blacklist them or create a "white list" of those open-access journals that meet certain standards of research publications, therefore *Nature* included a checklist on "how to perform due diligence before submitting to a journal or a publisher." The history of scientific excellence, progress in scientific research, and science education in India dates back from centuries and an analytic database called 'Nature Index' launched in 2014 by the Nature Publishing Group highlighted that India's research outputs have grown steadily since 2012 and ranks 13th for its high-quality scientific publications in an independently selected group of 68 high-quality scientific journals.[35] Recently it has been also stated clearly, that how harmful predatory journals are in medicine and related fields and it means that the research which isn't read does not exist.[36]

How to identify the predatory journals?

Predatory journals and publishers are difficult to identify, but not impossible to do so. Unfortunately, the main reason is that predatory publishing is often confused with open access publishing, which is a boon to scientific communications. Therefore, distinguishing between genuine and predatory open access publishers is a challenge for many. But still, before one proceeds for selecting a journal for publishing, there are several check points available as of now to warn you about the predatory publishers in general. First and foremost is the Beall's list to be looked upon. Furthermore, to help the researchers in choosing the right journal for publishing their research work, a movement called as "Think Check Submit" was started by representatives of different publishing groups worldwide *viz*.; Association of Learned and Professional Society Publishers (ALPSP), Directory of Open Access Journals (DOAJ), International Network for the Availability of Scientific Publications (INASP), International Standard Serial Number (ISSN), Association of European Research Libraries (LIBER), Open Access Scholarly Publishers Association (OASPA), The International Association of Scientific, Technical and Medical Publishers (STM), UKSG, and individual publishers, which is a cross-industry led initiative by which check list/points made by them can be followed (Figure 1) to make sure that one is choosing trusted journals for their respective research.[37]

According to WAME (World Association of Medical Editors), a global nonprofit voluntary association of editors of peer-reviewed medical journals has a policy statement for identification of these predatory journals given on their website: http://www. wame. org/policy-statements#Definition PR. It provides a very informative review about the facts on predatory journals on various topics like; Identifying Predatory or Pseudo-Journals, WAME Professionalism Code of Conduct, WAME Editorial: Conflict of Interest in Peer-Reviewed Medical Journals: The World Association of Medical Editors Position on a Challenging Problem, Definition of a Peer-Reviewed Journal.[38] For a Journal to be considered as a peer reviewed, it should have obtained external reviews for the majority of manuscripts it publishes, including all original research and review articles. The other condition for it is that a manuscript should have been reviewed by at least one external reviewer; typically comprising of two reviewers and sometimes more opinions can be also sought. Such journal should always state their peer review policies, including which kinds of articles are peer reviewed and by how many reviewers, in the instructions for authors, and this should be fully ensured by the journal's editor. The severe impact of publications in predatory journals compelled The Medical Council of India (MCI) to introduce the rule that publications in e-journals cannot be used in the assessments for appointments or promotions in medical institutions.[39] Another similar small working group of general medical journal editors known as ICMJE (International Committee of Medical Journal Editors) have some recommendations to review the best practice and ethical

Are you submitting your research to a trusted journal? Is it right journal for your work?

- More research is being published worldwide.
- New journals are launched each week.
- Stories of publisher malpractice and deception are also on the rise.
- It can be challenging to find up-to-date guidance when choosing where to publish.

How can you be sure the journal you are considering is the right journal for your research?

Reference this list for your chosen journal to check if it is trusted.

- Do you or your colleagues know the journal?
  - Have you read any article of the journal before?
  - Is it easy to discover the latest papers in the journal?
- Can you easily identify and contact the publisher?
  - Is the publisher name clearly displayed on the journal website?
  - Can you contact the publisher by telephone, email, and post?
- Is the journal clear about the type of peer review it uses?
- Are articles indexed in services that you use?
- Is it clear what fees will be charged?
  - Does the journal site explain what these fees are for and when they will be charged?
- Do you recognise the editorial board?
  - Have you heard of the editorial board members?
  - Do the editorial board mention the journal on their own websites?

If you can answer 'yes' to most of all questions on the list.

Complete the check list and submit your article only if you are happy you can answer 'yes' to most or all of the questions.

You need to be confident that your chosen journal will have a suitable profile among your peers to enhance your reputation and your chance of gaining citations.

Publishing in the right journal for your research will raise your professional profile and help you progress in your career.

Your paper should be indexed or archived and be easily discoverable.

You should expect a professional publishing experience where your work is reviewed and edited

Only then should you submit your article.

Figure 1: Checkpoints by "Think Check Submit" movement[37].

standards in the conduct and reporting of research and other material published in medical journals, and to help authors, editors, and others involved in peer review process and also the biomedical publishing fraternity to create and distribute clear and valid medical journal articles. They provide useful insights into the medical editing and publishing process for the media, patients and their families, and general readers, so one should meticulously follow these guidelines for publishing any medical research papers from clinical trials specially, as the results have a direct influence and relation to the patient's well being and health, which the pseudo journals do not follow and thus resulting in reporting of fraud results which are very fatal for the society. Another option which one can easily avail is to refer to Directory of Open Access Journals (DOAJ) which is a community-curated online directory that indexes and provides access to high quality, open access, peer-reviewed journals. Being an independent entity, all funding for it is via donations, 50% of which comes from sponsors and 50% from members and publisher members. It provides the services free of cost, including being indexed in DOAJ. Data are available for public, aiming specifically to increase the visibility and ease of use of open access scientific and scholarly journals in order to increase their usage and impact. More importantly, to ensure that research and publication integrity is maintained, it is essentially required that the institutions and journals cooperate with each other on all aspects of research and publication integrity, which has been set by COPE (Committee on Publication Ethics), which is not followed by predatory journals. Predatory journals do not follow the COPE guidelines on publication ethics which strictly focus on research misconduct and transparency among authors and research integrity.[40] These are some of the best practice guidelines on publication ethics and have been ardently written for a framework developed to implement their own publication ethics policies and systems.[41] Best Practice Guidelines on Publication Ethics have been written to offer journal editors a frame-work for developing and implementing their own publication ethics policies and systems.

Hence, it is very important for all the researchers worldwide to be fully aware of the existence and knowledge about these predatory journals and avoid the bait that they throw to catch the research articles. It is all about fraud, deception and irresponsibility, which can never be tolerated in science and must be addressed critically, thus focusing on an urgent need to develop a mechanism both by institutes and funding agencies to identify the quality of the articles published by the respective institutes and researchers. Also, medical researchers with enough scientific passion at medical colleges/institutes/organizations should also be encouraged to improve their quality of research and submit their publications to recognized scientific peer-reviewed journals. Therefore, one should be cautious at all levels, think before they submit, and also advise others of the hazardous world of predatory publishers and their journals. One more aspect which might help in preventing these journals to flourish may be to do a research in future to understand that why some authors publish in these journals, as such knowledge will surely be a great help in developing programs to prevent submissions to predatory journals. Only then can the menace of these predatory journals be reduced, making the research more effective in terms of reaching the society and people who are the ultimate beneficiaries of the outcome.

Conflicts of Interest: None

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Poor research output from India's medical schools

India's medical schools have been criticised for their neglect of research after a study showed that the country's colleges produce few publications. Dinesh C Sharma reports from New Delhi.

Medical training in India continues to attract criticism. After the recent report of the Parliamentary Standing Committee on Health, which called for the Medical Council of India (MCI) to be scrapped, the country's Supreme Court has described the state of medical colleges as "rotten".

In a judgment delivered on May 6, in a case relating to private medical college Kalinga Institute of Medical Sciences admitting more students than approved, the court warned that unless the government took corrective steps, the health of the people could suffer because of inadequately educated doctors. Now an important dimension has been added to the ongoing public discourse. A new study found that 332 of 579 (57%) medical colleges did not publish a single research paper between 2005 and 2014. Experts feel such neglect of research in medical colleges has serious implications for the health challenges of the country.

The absence of a focus on research in medical schools and weak infrastructure are among the reasons for the low research output. In large teaching hospitals, huge patient burden leaves little time for faculty to undertake research. Additionally, many private medical colleges do not even have the minimum number of teaching staff recommended by the MCI. "Research is not prioritised in our medical colleges and most faculty members have no prior exposure to research methods", Soumya Swaminathan, secretary of the government's Department of Health Research (DHR), told *The Lancet*.

"Teaching about research methodology in undergraduate and postgraduate courses is given very low priority. Those pursuing postgraduate degrees do some…research because it is mandatory to obtain the degree, but it is inconsequential. And for getting a job in the private sector, a research publication on a CV is of no relevance", pointed out Anoop Misra, chairman of the Fortis-C-DOC Centre of Excellence for Diabetes, Metabolic Diseases and Endocrinology, New Delhi.

> "'…Unless we invest in and strengthen biomedical research capacity now, it is unlikely that we will see the kind of improvements in health outcomes we would like to see in the next 20–30 years'…"

Research output can be measured through available databases and can serve as a proxy for the quality of medical training, Samiran Nundy of Sir Ganga Ram Hospital, New Delhi, who led the recent study, told *The Lancet*. Affiliation searches done in the Scopus database showed that 4% of the 572 medical colleges contributed 40% of total research output but their output was still low in comparison with the research output of medical colleges in the west. "States with the largest number of private medical colleges fared the worst, with the lowest research output from their medical institutions", Nundy added.

Research funding agencies have neglected medical colleges in the past. Only in 2014 did DHR begin supporting the establishment of Multi-disciplinary Research Units in government-run medical colleges. These units are designed to provide infrastructure, human resources, and some funding for research on local priorities. About 50 such units have been approved but just a handful of them are fully functional. The process of setting them up is bureaucratic, beginning with DHR signing an agreement with the state government concerned.

"Funding of medical research in India is terrible. The few funding agencies that do exist are short on funds. Disbursal of funds, even for approved projects, takes more than a year. Researchers are often not paid for considerable periods of time", explained Misra. The Indian Council of Medical Research, he suggests, should support long-term cohort studies that address specific research problems through consortia of good quality researchers instead of giving small grants for projects of a futile nature to researchers with limited capability to do research.

By neglecting biomedical research, India is missing out on the important role it can play in shaping global policies in the health sector. "The value of health research and what it can bring to health policy and practice is underappreciated. Unless we invest in and strengthen biomedical research capacity now, it is unlikely that we will see the kind of improvements in health outcomes we would like to see in the next 20–30 years", said Swaminathan.

Investigating problems relevant to the Indian situation can throw up new solutions. "We need research which is scientifically and socially relevant to us in order to improve the abysmal standard of health care. Indians suffer from diseases that are different from those seen in the west, they present to doctors when the disease is at an advanced stage, and 70% of them go to private facilities, which are expensive and cannot always be trusted", added Nundy.

Dinesh C Sharma

Mark Clarke/Science Photo Library

For the **study** see *Curr Med Res Pract* 2016; **6:** 49–58

The research output from Indian medical institutions between 2005 and 2014

Samrat Ray, Ishan Shah, and Samiran Nundy

Abstract

Background

The research output from Indian medical institutions is generally regarded to be poor but there have been no previous studies to document this especially after the recent proliferation of 263 medical colleges, mainly in the private sector and under the aegis of the National Board of Examinations, as well as the 316, mainly public sector, colleges under the Medical Council of India.

Methods

Using the SCOPUS database we analyzed the research output from 579 Indian medical institutions and hospitals between 2005 and 2014, including the contributions of individual states and compared the output of Indian medical institutions with some of the leading academic centers in the world.

Results

Only 25 (4.3%) of the institutions produced more than 100 papers a year but their contribution was 40.3% of the country's total research output. 332 (57.3%) of the medical colleges did not have a single publication during this period. The states which had the largest number of private medical colleges fared the worst with more than 90% of the medical colleges in Karnataka and Kerala having no publication at all. In comparison, the annual research output of the Massachusetts General Hospital was 4600 and the Mayo Clinic 3700.

Conclusion

The overall research output from Indian medical institutions is poor. This may be because medical education has now become a business and there is little interest in research which is not thought to be a profitable activity. We believe that a drastic overhaul of Indian medical education is necessary similar to that initiated by Flexner in the USA in the beginning of the last century.

Keywords

SCOPUS; Research output; Indian medical institutions; MCI

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1. Background

Assuring a minimal level of healthcare to the expanding population of India has become a major issue over the last decade. Although there has been an overall improvement of medical resources and healthcare since independence, the distribution of these has been very uneven, with the rich having access to a burgeoning and unregulated private sector dominated by the corporate, for-profit hospitals and the poor left to go to underfunded, overcrowded, and inefficient public institutions.[1] There is a shortage of doctors in public hospitals and in rural areas because most of them choose to join the private sector or work in the cities.[2]

In an attempt to increase the number of doctors in India, the government has enhanced the number of seats in existing medical colleges and liberally allowed the creation of new medical institutions financed both by public, but mainly private funds.[3] However, this policy has not been an unqualified success with what is generally perceived to be a fall in the standards of medical education, which has now become a business venture for many politicians and is accompanied by widespread corruption both in its entry and exit processes.[4] and [5]

The primary authority controlling medical education standards in this country is the Medical Council of India (MCI), which was first established in 1934 under the Indian Medical Council Act, 1933. Currently, there are around 316 institutions all over the country that have been recognized by the MCI.[6]

The other body that controls postgraduate medical education, mainly in the private sector, is the National Board of Examinations (NBE). This was set up in 1975 when the General Medical Council in the United Kingdom derecognized Indian medical qualifications because of their varying standards.[7] Mrs. Indira Gandhi, the then Prime Minister, in retaliation, derecognized British qualifications and set up the NBE, an autonomous body under the Ministry of Health, to regulate and oversee postgraduate medical education and the examinations in India in institutions that were outside the ambit of the MCI, as well as to assess foreign qualifications.[8] The NBE now conducts the largest portfolio of examinations in medicine in India, and during 2014, it held them for 150,000 medical graduates and specialists. Currently, there are more than 250 hospitals and institutions all over the country that have been accredited by the NBE for conducting postgraduate and superspecialty courses in this country.[9]

However, it is now generally perceived that the quality of training being imparted by the majority of both MCI and NBE affiliated institutions has deteriorated alarmingly as there has yet been no systematic assessment of their products in terms of their clinical and academic competence or research output.[10], [11] and [12]

It would be difficult to evaluate fairly and objectively clinical competence or teaching, but research output is easy to measure through the available databases and is used by many well-known publications, such as the popular QS World University Rankings. It incorporates indices like the academic peer review, faculty/student ratio, and citations per faculty as tools of assessment of research output.[13], [14] and [15] There are others, such as the US News and World Report, the Shanghai, and the Times Higher Education Ranking Systems that have also been widely used for the same purpose.[16] and [17]

We decided to evaluate the research output of all the MCI and NBE institutions in India using Scopus, the largest database of peer-reviewed literature in existence. It contains around 53 million records, 70% with abstracts, 4.9 million conference proceedings, and 1200 open access journals. It has a 100% Medline coverage, with 20+ million records back to 1996.[18], [19], [20], [21] and [22]

Using Scopus we carried out the following:

- Analyzed the total research output of all medical colleges and hospitals recognized by the MCI and NBE during 2005–2014.
- Assessed the output from individual states of India.
- Compared the research output of India's top medical institutions with some of the well-known ones abroad.

2. Methods

We counted the total number of documents (including original articles, reviews, case reports, and reports of conferences and symposia) published by an individual institute over a period of 10 years (2005–2014). For those established after 2005, we evaluated the number of publications from the year of establishment to 2014. The MCI and NBE institutes were listed in separate league tables.[23]

We ranked them as follows:

Compiled a list of top 25 institutes under the MCI (Fig. 1) and the NBE (Fig. 2) from different states of India.

<img class="figure large" border="0" alt="Distribution of number of publications by Medical Council of India (MCI) ..." src="http://origin-ars.els-cdn.com/content/image/1-s2.0-S235208171630037X-gr1.jpg" data-thumbEID="1-s2.0-S235208171630037X-gr1.sml" data-imgEIDs="1-s2.0-S235208171630037X-gr1.jpg" data-fullEID="1-s2.0-S235208171630037X-gr1.jpg">
Fig. 1.

Distribution of number of publications by Medical Council of India (MCI) recognized institutions (*N* = 101,034). For full form of institutions refer to Appendix 1. Legends indicate the %age of total number of publications.

Figure options

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<img class="figure large" border="0" alt="Distribution of number of publications by National Board of Examinations (NBE) ..." src="http://origin-ars.els-cdn.com/content/image/1-s2.0-S235208171630037X-gr2.jpg" data-thumbEID="1-s2.0-S235208171630037X-gr2.sml" data-imgEIDs="1-s2.0-S235208171630037X-gr2.jpg" data-fullEID="1-s2.0-S235208171630037X-gr2.jpg">
Fig. 2.

Distribution of number of publications by National Board of Examinations (NBE) recognized institutions (*N* = 101,034). For full form of institutions refer to Appendix 1. Legends indicate the %age of total number of publications.

Figure options

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Listed MCI and NBE institutes according to their State location, as well as their research publications (Table 1 and Table 2).

Table 1.

State wise distribution of publications and highest ranking institutes in each state in MCI recognized institutions.

State	Total institutes (MCI)	Total publications 2005–2014	Total number of zero publication institutes, *n* (% of total)	Publications per institute	Highest ranking institute among the state	No. of publications by highest ranking institute, *n* (% of total)
Andhra Pradesh	36	2038	24 (66.7)	56.61	Nizam Institute of Medical Sciences Hyderabad	939 (46.1)
Assam	3	343	0 (0)	114.33	Guwahati Medical College, Guwahati	175 (51)

State	Total institutes (MCI)	Total publications 2005–2014	Total number of zero publication institutes, *n* (% of total)	Publications per institute	Highest ranking institute among the state	No. of publications by highest ranking institute, *n* (% of total)
Bihar	10	216	7 (70)	21.60	Rajendra Memorial Research Institute of Medical Sciences, Patna	169 (78.2)
Chandigarh	2	9354	0 (0)	4677.00	Postgraduate Institute of Medical Education and Research, Chandigarh	8145 (87.1)
Chhattisgarh	3	96	0 (0)	32.00	Pandit Jawaharlal Nehru Memorial Medical College, Raipur	96 (100)
New Delhi	11	20,113	0 (0)	1828.45	All India Institute of Medical Sciences	11,377 (56.6)
Goa	1	243	0 (0)	243.00	Goa Medical College, Panjim	243 (100)
Gujarat	16	963	7 (43.7)	60.19	Government Medical College, Surat	205 (21.3)
Haryana	3	1417	1 (33.3)	472.33	Postgraduate Institute of Medical Sciences, Rohtak	1283 (90.5)
Himachal Pradesh	2	743	1 (50)	371.50	Indira Gandhi Medical College, Shimla	743 (100)
Jammu & Kashmir	4	1749	1 (25)	437.25	Government Medical College, Srinagar	705 (40.3)
Jharkhand	3	50	2 (66.7)	16.67	Rajendra Medical College, Ranchi	50 (100)
Karnataka	41	11,585	17 (41.5)	282.56	Kasturba Medical College, Manipal	2583 (22.3)
Kerala	23	2454	17 (73.9)	106.70	Sree Chitra Thirunal Institute of Medical Sciences and Technology, Trivandrum	1251 (50.9)
Madhya Pradesh	11	736	6 (54.5)	66.91	Gajara Raja Medical College, Gwalior	208 (28.3)
Maharashtra	43	9035	25 (58.1)	210.12	Tata Memorial Hospital, Mumbai	2506 (27.8)
Manipur	1	626	0 (0)	626.00	Regional Institute	626 (100)

State	Total institutes (MCI)	Total publications 2005–2014	Total number of zero publication institutes, *n* (% of total)	Publications per institute	Highest ranking institute among the state	No. of publications by highest ranking institute, *n* (% of total)
					of Medical Sciences, Imphal	
Meghalaya	1	114	0 (0)	114.00	North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences, Shillong (2006–2014)	114 (100)
Orissa	6	586	2 (33.3)	97.67	Sriram Chandra Bhanj Medical College, Cuttack	195 (33.3)
Pondicherry	8	2303	5 (62.5)	287.88	Jawaharlal Nehru Institute of Postgraduate Medical Education and Research, Pondicherry	1901 (82.5)
Punjab	8	1758	1 (12.5)	219.75	Dayanand Medical College, Ludhiana	566 (32.2)
Rajasthan	10	1509	4 (40)	150.90	Sawai Maan Singh Medical College, Jaipur	678 (44.9)
Sikkim	1	0	1 (100)	0.00	–	0 (0)
Tamil Nadu	33	5851	24 (72.7)	177.30	Christian Medical College, Vellore	3742 (63.9)
Tripura	2	47	1 (50)	23.50	Agartala Government Medical College, Tripura (2006–2014)	47 (100)
Uttar Pradesh	21	10,845	9 (42.9)	516.43	Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	3499 (32.3)
Uttaranchal	5	400	4 (80)	80.00	Himalaya Institute of Medical Sciences, Dehradun	400 (100)
West Bengal	10	4654	3 (30)	465.40	Medical College, Calcutta	1462 (31.4)

Table 2.

State wise distribution of publications and highest ranking institutes in each state in NBE recognized institutions.

State	Total institutes (NBE)	Total publications 2005–2014	Total number of zero publication institutes, *n* (% of total)	Publications per institute	Highest ranking institute among the state	No. of publications by highest ranking institute, *n* (% of total)
Andhra Pradesh	24	1732	16 (66.7)	72.16	LV Prasad Eye Institute	1202 (69.4)
Assam	2	4	1 (50)	2	Down Town Hospital, Guwahati (2004–2006)	4 (100)
Bihar	2	1	1 (50)	0.5	Mahavir Cancer Sansthan, Patna (2012–2014)	1 (100)
Chhattisgarh	3	43	2 (66.7)	14.33	Jawahar Lal Nehru Main Hospital and Research Centre, Bhilai	43 (100)
New Delhi	28	3045	14 (50)	108.75	Sir Ganga Ram Hospital	1067 (35)
Gujarat	9	183	7 (77.8)	20.33	Muljhibhai Patel Urological Hospital, Nadiad	180 (98.3)
Haryana	5	32	4 (80)	6.4	Artemis Health Institute, Gurgaon (2008–2014)	32 (100)
Jharkhand	2	0	2 (100)	0	–	–
Karnataka	29	467	27 (93.1)	16.1	Manipal Hospital, Bangalore	292 (62.5)
Kerala	26	65	24 (92.3)	2.5	Malabar Institute of Medical Sciences, Kozhikode	56 (86.1)
Madhya Pradesh	7	160	5 (71.4)	22.85	Jawahar Lal Nehru Cancer Hospital & Research Centre, Bhopal	86 (53.7)
Maharashtra	47	2549	35 (74.8)	54.23	PD Hinduja National Hospital and Medical Research Centre, Mumbai	677 (26.5)
Manipur	1	0	0 (0)	0	–	–
Mizoram	1	4	0	4	Civil Hospital, Aizawl (2005–2011)	4 (100)

State	Total institutes (NBE)	Total publications 2005–2014	Total number of zero publication institutes, *n* (% of total)	Publications per institute	Highest ranking institute among the state	No. of publications by highest ranking institute, *n* (% of total)
Nagaland	1	0	0 (0)	0	–	–
Odisha	4	80	2 (50)	20	Ispat General Hospital, Rourkela	75 (93.7)
Pondicherry	1	0	0 (0)	0	–	–
Punjab	5	0	0 (0)	0	–	–
Rajasthan	7	0	0 (0)	0	–	–
Sikkim	1	0	0 (0)	0	–	–
Tamil Nadu	36	1217	27 (75)	33.8	Aravind Eye Hospital, Madurai	473 (38.8)
Uttar Pradesh	6	5	5 (83.3)	0.83	Metro Heart Inst, Noida (2005–2011)	5 (100)
West Bengal	13	325	10 (76.92)	13	Vivekananda Institute of Medical Sciences, Kolkata	197 (66.6)

Compiled a cumulative list of the top 25 medical institutions (MCI + NBE) in descending order of the number of publications (Table 3).

Table 3.

Distribution of national and global institutions as per the number of publications during 2005–2014.

Institute	State/country	Publications 2005–2014
National		
All India Institute Medical Sciences	New Delhi	11,377
Postgraduate Institute of Medical Education and Research	Chandigarh	8145
Christian Medical College, Vellore	Tamil Nadu	3742
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	Uttar Pradesh	3499
King George Medical College, Lucknow	Uttar Pradesh	2878
Kasturba Medical College, Manipal	Karnataka	2583
Tata Memorial Hospital, Mumbai	Maharashtra	2506
National Institute of Mental Health and Neurosciences, Bangalore	Karnataka	2418
Institute of Medical Sciences (Banaras Hindu University), Varanasi	Uttar Pradesh	2140

Institute	State/country	Publications 2005–2014
Maulana Azad Medical College	New Delhi	1968
Jawaharlal Nehru Institute of Postgraduate Medical Education and research, Pondicherry	Pondicherry	1901
Seth Gordhandas Sunderdas Medical College and King Edward Memorial Hospital, Mumbai	Maharashtra	1858
Kasturba Medical College, Mangalore	Karnataka	1719
University College of Medical Sciences	New Delhi	1701
Medical College, Calcutta	West Bengal	1462
Jawahar Lal Nehru Medical College, Aligarh	Uttar Pradesh	1359
Vardhaman Mahavir Medical College and Safdarjung Hospital	New Delhi	1313
Postgraduate Institute of Medical Sciences, Rohtak	Haryana	1283
Sree Chitra Thirunal Institute of Medical Sciences and Technology, Trivandrum	Kerala	1251
Government Medical College, Chandigarh	Chandigarh	1209
LV Prasad Eye Institute, Hyderabad	Andhra Pradesh	1202
Lady Hardinge Medical College	New Delhi	1166
Institute of Postgraduate Medical Education and Research, Kolkata	West Bengal	1081
Sir Ganga Ram Hospital	New Delhi	1067
Amrita Institute of Medical Sciences and Research Centre, Kochi	Kerala	1031
Global		
Massachusetts General Hospital	USA	46,311
Mayo Clinic, Rochester	USA	37,633
All India Institute of Medical Sciences, New Delhi	India	11,377
Peking Union Medical College, Beijing	China	10,102
Postgraduate Institute of Medical Education and Research, Chandigarh	India	8145
Tokyo Medical University	Japan	4856
Christian Medical College, Vellore	India	3742
Faculty of Medicine, University of Geneva	Switzerland	3600
Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow	India	3499
Aga Khan University Hospital, Karachi	Pakistan	2332
Sir Ganga Ram Hospital, New Delhi	India	1067
Grant Medical College, Mumbai	India	294
Osmania Medical College, Hyderabad	India	129

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Compared the output of the top Indian institutions with some of the well-known institutes abroad over the same period (Table 3).

3. Results

There are a total of 579 medical institutes in the government and private sectors. 316 institutes were under the MCI and 263 under the NBE. Their total research output during the period 2005–2014 was 101,034 papers, with the average number of publications per institution being 14.5 papers per year.

However, there were 332 (57.3%) institutions that did not publish a single paper during this 10-year period, which included 162 (51.2%) under the MCI and 170 (64.6%) under the NBE.

Fig. 1 shows the cumulative state-wise list of top 25 medical colleges and hospitals under the MCI and their research output from 2005 to 2014. It shows that the top 10 medical institutes under the MCI, in order of their research output, are the All India Institute of Medical sciences (AIIMS) in New Delhi, the Postgraduate Institute of Medical Education and Research (PGIMER) in Chandigarh, the Christian Medical College (CMC) in Vellore, the Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS) in Lucknow, the King George Medical College (KGMC) in Lucknow, the Kasturba Medical college (KMC) in Manipal, the Tata Memorial Centre in Mumbai, the National Institute of Mental Health and Neurosciences (NIMHANS) in Bangalore, the Institute of Medical Sciences Banaras Hindu University (IMS BHU) in Varanasi, and the Maulana Azad Medical College (MAMC) in New Delhi. The total research output from these institutes from 2005 to 2014 was 41,256, constituting about 40.8% of the total cumulative research output from the 579 medical institutions.

Fig. 2 shows the top 25 medical institutes under the NBE and their research output during the same period. The top 10 institutes were the LV Prasad Eye Institute, Hyderabad; Sir Ganga Ram Hospital (SGRH), New Delhi; PD Hinduja National Hospital and Medical Research Centre, Mumbai; Indraprastha Apollo Hospital, New Delhi; Aravind Eye Hospital, Madurai; Fortis Hospital, New Delhi; Jaslok Hospital and Research Centre, Mumbai; Bombay Hospital and Institute of Medical Sciences, Mumbai; Manipal Hospital, Bangalore; and Lilavati Hospital and Research Centre, Mumbai. However, the total research output from these institutes was 5715, constituting only 5.6% of the total cumulative research output from all Indian medical institutions.

Table 1 shows the cumulative output of the individual states of India from the medical colleges under the governance of the MCI. It can be seen that the union territory of Chandigarh tops the list, with an average of 4677 publications per institute, with PGIMER being the highest publisher (n = 8145). The cumulative research output from the MCI-recognized medical colleges of all the states from 2005 to 2014 was 89,828, with an average of 284.26 publications per institute, contributing to 88.9% of the total research output of the country. The southern states of Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra, and Karnataka have 55.6% of the total number of MCI-recognized medical colleges in the country, but a large percentage of these colleges have no publications—Kerala (n = 17; 73.9%), Tamil Nadu (n = 24; 72.7%), Andhra Pradesh (n = 24; 66.6%), Maharashtra (n = 25; 58.1%,), and Karnataka (n = 17; 41.4%).

Table 2 shows the output from the individual states of India from medical institutions under the NBE. New Delhi tops the list, with an average of 108.75 publications per institute, with Sir Ganga Ram Hospital being the most prolific (n = 1067). The cumulative research output from the NBE-recognized medical institutions of all the states from 2005 to 2014 was 9912, with an average of 37.6 publications per institute, contributing to 9.8% of the total research output of the country. Just as for MCI institutions, again Karnataka, Kerala, Tamil Nadu, Maharashtra, and Andhra Pradesh contribute the majority, i.e. 61.5% of the total NBE-recognized institutions in the country (n = 162). However, again a large number of the institutes from these states are found to have no publications at all—Karnataka (n = 27; 93.1%), Kerala (n = 24; 92.3%), Tamil Nadu (n = 27; 75%), Maharashtra (n = 35; 74.4%), and Andhra Pradesh (n = 16; 66.6%).

Table 3 shows a list of the top 25 MCI and NBE medical institutions of the country in descending order of their total research output from 2005 to 2014. This has been compared with some well-known centers abroad (Table 3). Only 25 out of a total of 579 institutions have more than 1000 publications from 2005 to 2014 (4.3%). This compares with some of the well-known institutions abroad, like the Massachusetts General Hospital, Boston, USA, which had a total of 46,311 publications, and the Mayo Clinic, Rochester, USA, which had a total of 37,633 publications during 2005–2014 accounting for more than 4.07 and 3.3 times the number of publications from AIIMS, respectively.

4. Discussion

Our findings suggest that the research output of Indian medical institutes is generally poor, with 57% of them not having a single publication included in the Scopus database between 2005 and 2014, and only 25 (4.3%) institutes (out of 579 that are affiliated to the MCI and NBE) producing more than 100 papers a year. We also found that most of the southern states that have the largest number of private medical colleges produce very little in the way of research publication and finally that even our most prolific research institutions published less than a third of the number of papers than the leading centers abroad.

The reasons for this state of affairs are alleged to be the overwhelming clinical burden in most medical colleges leaving little time to devote to academic activities; but we believe it is more due to the lack of guidance and absence of role models among seniors, who themselves have published little.[24] and [25] There is also little institutional support in the way of funds and infrastructure to carry out projects, which are generally believed to be an unnecessary expenditure of time and effort.[26] and [27] However, probably more important is the lack of incentives to do research and publish, because most faculty promotions, which in other countries depend a lot on research output, are in India usually time bound, based on seniority and, unfortunately, often influenced by political and bureaucratic 'contacts'.[28] and [29] The other reasons are that the lack of guidance results in poor protocol design, and with little help from colleagues with language problems, it results in papers that answer irrelevant questions or duplicate work that has been done elsewhere.[30] and [31] Even if a paper is finally produced, the chances that it might be rejected by a Western journal, to which most are first sent, is high, because of the lack of relevance to its home readership.

Thus, most faculty and students in Indian medical institutions are discouraged from embarking on a research project, let alone writing a paper.

To stimulate research activities in its institutions, the MCI has now issued new guidelines in 2015, which require at least four research publications for the post of associate professor and eight research publications for the post of professor.[32] However, these guidelines, although well intentioned, have included publications in databases of doubtful merit, including only the first and second authors of a paper, excluding journals only published online, and distinguishing Indian and international journals.[33] It has also drawn opposition from some of the editors of leading Indian medical journals.[34]

The heavy clinical load is sometimes proffered as an excuse for the lack of research papers by many who say that their patient care is of the highest quality so that publications should not matter. This is belied by the fact that the most prolific Indian publications come from institutions that also deal with the largest numbers of patients. This is also true of many of the world's great hospitals, which along with providing a high standard of patient care are also leaders in publication. Although correlation of a hospital's research output with the quality of care has been a debatable topic and there have been studies showing a relationship of the teaching status of the hospital with the quality of patient care, very few have shown an association of patient care and research output.[16] and [35] Pons et al. did a cross-sectional analysis of secondary data of inhospital and risk-adjusted mortality for congestive heart failure and myocardial infarction between 2002 and 2004 and several bibliometric measures of publications from 1996 to 2004 in cardiovascular diseases.[36] They found a low-moderate negative correlation between the risk-adjusted mortality ratio and the weighted citations ratio for congestive heart failure and acute MI. They also found a strong correlation between the teaching status and the technological level of the hospital with inhospital mortality.

China, our neighbor, has made great strides in medical research, from being at India's level 10 years ago to now producing more research papers than most other countries.[37] On a global scale, it has emerged as the fifth leading nation in terms of its share of the world's scientific publications.[38] It invests much larger proportion of its GDP in research and development and, among other incentives, many of their medical universities, hospitals, and institutes now give monetary awards to authors with manuscripts published in journals indexed in Science Citation Index (SCI)—the higher the impact factor of the journal, the larger the bonus.[39]

4.1. What is to be done?

We believe that we need to work out our own solutions to our own health problems because they are unique and very few of our colleagues from the developed world will have experienced the difficulties of managing patients with such a different disease spectrum and advancement with such limited resources.[40] The only way to improve our healthcare we believe is to do relevant research with rigorous protocols and disseminate the results via medical journals. To do this, we must collect accurate data, evaluate the effectiveness of appropriate interventions, and set aside funds to support indigenous research projects.

We should collaborate with experienced individuals and good institutions abroad not only to help our investigations but also to train our young researchers. This can be done through organizations like the World Association of Medical Editors, as well as the major medical journals, which have an international outlook like the BMJ.

An almost identical situation existed in the USA and Canada in the beginning of the last century when there were 155 medical schools, which varied greatly in their curricula, methods of assessment, and protocols for admission.[41]

In 1910, the Carnegie Foundation asked Abraham Flexner to propose recommendations for the standardization of the medical education system all over the country.[42] Flexner spent a year in Europe, visiting mainly German medical institutions, which were then the international leaders, and published his famous report in which he issued various recommendations, among which one of the most important was to ensure scientific training of the medical graduates and engaging faculty into active medical research. The report brought about a dramatic change in the existing medical education system of the US, reduced the number of medical schools from 155 to 31, initiated a system of transparent and rigorous inspections, advocated a single exit exam, and consequently made the nation the world's medical research powerhouse a position it maintains today.

Perhaps, it is time that India commissions its own Flexner report.

5. Conclusion

We have found the overall research output from the medical institutions of India to be low, with the majority of publications from only 10 selected institutions. Nearly 60% of them had not had a single publication included in the Scopus database in the last 10 years.

The reasons are mainly a lack of interest in research and publication, as well as lack of incentives.

We believe our system needs a radical overhaul similar to what happened in the USA after the publication of the Flexner Report.

Conflicts of interest

The authors have none to declare.

Appendix 1.

Full form of institutions in alphabetical order.

Abbreviation	Institute	State
AEH, Madurai, TN	Aravind Eye Hospital, Madurai	Tamil Nadu
AIG, Hyderabad, AP	Asian Institute of Gastroenterology, Hyderabad	Andhra Pradesh
AIIMS, Delhi	AII India Institute of Medical Sciences	New Delhi
AIMSRC, Kochi	Amrita Institute of Medical Sciences and Research Centre, Kochi	Kerala
Apollo Hospital, Chennai, TN	Apollo Hospital, Chennai	Tamil Nadu
BCHT, Mumbai, Maharashtra	Breach Candy Hospital Trust, Mumbai	Maharashtra
BHIMS, Mumbai, Maharashtra	Bombay Hospital & Institute of Medical Sciences, Mumbai	Maharashtra
Care Hospital, Hyderabad, AP	Care Hospital, Hyderabad	Andhra Pradesh
CMC, Kolkata, West Bengal	Calcutta Medical College	West Bengal
CMC, Vellore, TN	Christian Medical College, Vellore	Tamil Nadu
Command Hospital, Pune, Maharashtra	Command Hospital, Pune	Maharashtra
DBNH, Mumbai, Maharashtra	Dr. B Nanavati Hospital, Mumbai	Maharashtra
Fortis Healthcare, Delhi	Fortis Healthcare	New Delhi
Ganga Hospital, Coimbatore, TN	Ganga Hospital, Coimbatore	Tamil Nadu
GB Pant Hospital, Delhi	GB Pant Hospital, New Delhi	New Delhi
GEMHIPL, Coimbatore, TN	GEM Hospital India Private Limited, Coimbatore	Tamil Nadu
GMC, Chandigarh	Government Medical College, Chandigarh	Chandigarh
IMS, BHU, Varanasi, UP	Institute of Medical Sciences, Banaras Hindu University, Varanasi	Uttar Pradesh
IP Apollo Hospital, Delhi	Indraprastha Apollo Hospital	New Delhi
IPGMER, Kolkata, West Bengal	Institute of Postgraduate Medical Education and Research, Kolkata	West Bengal
Jehangir Hospital, Pune, Maharashtra	Jehangir Hospital, Pune	Maharashtra
JHRC, Mumbai, Maharashtra	Jaslok Hospital & Research Centre, Mumbai	Maharashtra
JIPMER, Puducherry	Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry	Puducherry
JLNMC, Aligarh, UP	Jawaharlal Nehru Medical College, Aligarh	Uttar Pradesh
KGMC, Lucknow, UP	King George Medical College, Lucknow	Uttar Pradesh
KMC, Mangalore, Karnataka	Kasturba Medical College, Mangalore	Karnataka
KMC, Manipal, Karnataka	Kasturba Medical College, Manipal	Karnataka
LHMC, New Delhi	Lady Hardinge Medical College, New Delhi	New Delhi
LVHRC, Mumbai, Maharashtra	Lilavati Hospital & Research Centre, Mumbai	Maharashtra
LVP Eye Institute, Hyderabad, AP	LV Prasad Eye Institute, Hyderabad	Andhra Pradesh
MAMC, Delhi	Maulana Azad Medical College, New Delhi	New Delhi
Manipal Hospital, Bangalore,	Manipal Hospital, Bangalore	Karnataka

Abbreviation	Institute	State
Karnataka		
MPUH, Nadiad, Gujarat	Mulijhibhai Patel Urological Hospital, Nadiad	Gujarat
NIMHANS, Bangalore, Karnataka	National Institute of Mental Health and Neurosciences, Bangalore	Karnataka
PDHNH&MRC, Mumbai, Maharashtra	PD Hinduja National Hospital and Medical Research Centre, Mumbai	Maharashtra
PGIMER, Chandigarh	Postgraduate Institute for Medical Education and Research, Chandigarh	Chandigarh
PGIMS, Rohtak, Haryana	Postgraduate Institute of Medical Sciences, Rohtak	Haryana
RGCIRC, Delhi	Rajiv Gandhi Cancer Institute and Research Centre	New Delhi
Sant Parmanand Hospital, Delhi	Sant Parmanand Hospital	New Delhi
SCTIMST, Trivandrum	Sree Chitra Thirunal Institute of Medical Sciences and Technology, Trivandrum	Kerala
SGPGI, Lucknow, UP	Sanjay Gandhi Institute for Postgraduate Education and Research, Lucknow	Uttar Pradesh
SGRH, Delhi	Sir Ganga Ram Hospital	New Delhi
SGSMCKEMH, Mumbai, Maharashtra	Seth G S Medical College and King Edward Memorial Hospital, Mumbai	Maharashtra
SIKIMS, Srinagar, J&K	Sher I Kashmir Institute of Medical Sciences, Srinagar	Jammu and Kashmir
SSSIHMS, Bangalore, Karnataka	Sri Sathya Sai Institute of Higher Medical Sciences, Bangalore	Karnataka
St. Stephen's Hospital, Delhi	St. Stephen's Hospital	New Delhi
TMH, Mumbai, Maharashtra	Tata Memorial Hospital, Mumbai	Maharashtra
UCMS, Delhi	University College of Medical Sciences	New Delhi
VMMC and Safdarjung Hospital, Delhi	Vardhaman Mahavir Medical College and Safdarjung Hospital	New Delhi
VNIMS, Kolkata, WB	Vivekananda Institute of Medical Sciences, Kolkata	West Bengal

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As many as 332 (57.3%) medical colleges in India did not have a single research publication between 2005 and 2014, according to a 2016 analysis. In comparison, the annual research output of the Massachusetts General Hospital was 4,600 and the Mayo Clinic 3,700, the paper said.

“The current state of affairs is far from satisfactory. There are only a few medical colleges in the country that encourage and promote the culture of research and we need to ensure that in the coming years many more medical colleges and medical college faculty get involved in research,” said Soumya Swaminathan, director of the Indian Council for Medical Research (ICMR), and a Secretary in the Department of Health Research, which is part of India’s Ministry of Health & Family Welfare. The ICMR has 25 major institutes, some smaller field units, and 8000 staff, including 800 scientists.

Swaminathan, who completed MBBS from the Armed Forces Medical College in Pune, MD in paediatrics from the All India Institute for Medical Sciences, and was a fellow at the the Children’s Hospital of Los Angeles, University of Southern California, USA, realized that few Indian institutions provide the opportunity to practice as well as conduct research. She chose to join the ICMR’s TB institute in Chennai, while striking a deal with the children’s hospital to work in the outpatient department in the evening.

“Clinical researchers need to see patients. They cannot do research in isolation, when you are not involved with patients and their problems,” said Swaminathan, who hopes to encourage more such opportunities during her time at the ICMR.

In her free time, which she said she had little of these days, she likes listening to both Hindustani and western classical music. “I love the outdoors. Whenever I get a break or chance to get a weekend off, I like to go in nature and take long walks,” she said, adding that one of her favourite places to go are the Himalayas.

IndiaSpend spoke to Swaminathan, previously the director of the National Institute for Research in Tuberculosis in Chennai, about how more research could be encouraged in India, the changing burden of disease, the quality of health data in the country, and more.

Edited excerpts from the interview.

Q: A 2016 analysis of medical papers published between 2005 and 2014 revealed that even though only 25 (4.3%) medical institutions produced more than 100 papers a year, their contribution was 40.3% of the country’s total research output. As many as 332 (57.3%) of medical colleges did not have a single publication during this period. In comparison, the annual research output of the Massachusetts General Hospital was 4,600 and the Mayo Clinic 3,700. Could you comment on the state of medical research in India?

This is an area of real concern for us because one of the mandates of the department of health research and the ICMR is to build health research capacity in the country. This analysis tells us that the current state of affairs is far from satisfactory. There are only a few medical colleges in the country that encourage and promote the culture of research, and we need to ensure that, in the coming years, many more medical colleges and medical college faculty get involved in research.

The first of five pillars of our new strategy, vision 2030, is strengthening biomedical and health research capacity in the country through a number of different schemes. Providing opportunities, encouraging people, training and getting people excited for research. I think that the challenge is to get more medical students in their undergraduate and postgraduate courses to get interested in research, to get excited about research. Still, we do have some brilliant medical researchers, and about 10 of our top institutions like AIIMS, St John’s, Christian Medical College in Vellore–are doing very high quality work.

Q: How can research be encouraged and improved in the country?

I think it's the whole eco-system that we need to look at. It would be foolish to think that by training alone or by sensitisation alone one could get more people involved in research. I think about 10 years ago the ICMR started a scheme called the Short Term Studentship (STS). This scheme is basically for medical students who can submit project proposals and they have a mentor either in their own institution or in another institution. During their holidays they take up a research project and get Rs 10,000. Over the years we have seen a huge and increasing demand for the scheme. Currently we get 7,000-8,000 applications every year and we award 1,000 STS fellowships. We've also now started giving awards to the best papers that come out of this.

When I travel around the country and meet medical students, there is a huge demand, from dental students and physiotherapy students that we should extend the scheme to them because this really ignites that spark. Colleges also take pride–they tell we had eight successful STS this year or 10 last year and so on. So that's starting with medical students.

Then we have schemes for MD students. We offer financial support for an MD thesis, which is competitive, and screened by an expert committee. The top 50 MD theses receive a fellowship of about Rs 50, 000 to help write it up, publish it as a paper and things like that. I think we need to have more such schemes.

We also need to make the environment research friendly. If you're working in an institute or medical college which does not have facilities, it wouldn't make a difference even if you have ideas for research. Projects require basic lab support, basic team you need to undertake it, research cannot be done by a single individual. Better the research, the more multidisciplinary the team. So you need lab scientists, field workers, statisticians and social scientists. In a regular medical college these things don't exist, even those few faculty who are interested they often get frustrated and give up.

For infrastructure, the department for health research has a scheme called the multidisciplinary research unit which provides funds to develop a high quality lab in government medical colleges.

The other thing is that in many of the states that permit private-practice, this is a big disincentive for research because then the faculty member just wants to finish their work in medical college and then go and start their private practice. Research needs time, extra

time beyond your working hours, you have to think a lot, work a lot, you have to go to the field. That is why we find…that if you look at these 40 institutions…the 25 institutions that contributed to 40 % of research output would probably not allow private practice. Where you don't allow practice, faculty members are all the time thinking about their own field so they are much more likely to engage in research.

The next big issue is the need for mentorship and role models. If you have never met or interacted with anybody who has done research, it is very unlikely that you would take it up. We are going to launch a new mentorship programme that will connect young faculty with experienced researchers both within India and outside India who are willing to spend some time in guiding ,mentoring and supporting young researchers.

There is another issue in India which I think we need to address that is the lack of collaborative spirit, a team spirit. Secondly, a kind of hierarchical approach which should not apply in our scientific institutions. Just because you are the director of the institution, does not mean you know everything about everything, you can only be an expert in one area and therefore you have to be open minded and encourage your younger scientists to look at other areas and maybe they become the world expert in that area. The seniors need to be able to accept that some of the juniors will excel, be brilliant and they need to be encouraged and not put down.

Also, to be really successful, you need to collaborate, you have to build teams. If you look at the top papers in journals like Science or Nature Today, sometime you find there are hundred co-authors. Today scientific disciplines have developed so much that you tend to become a great expert in one area and therefore you need people in other areas. Modelling is a good example; you may be a physician or even a statistician but if you don't have those modelling skills, you need to collaborate with a mathematician who is also a good modeller to be able to develop a good model.

Q: Is research limited by the quality and timeliness of data in India?

It is an important issue because we have a large number of sources of data in our country and sometimes, some of those data sets are more available to people, than others. The NFHS (National Family Health Survey) is a good example of data that is made available to researchers both within and outside the country for secondary analysis and for further use, once the main report is out. That's a best practice kind of a thing but there are many others data sets which are not available and secondly there are many different agencies collecting data on the same thing which are often not pooled.

One of the pillars of ICMR's new research strategy is on data depositaries and data warehouses. We would like to create a data warehouse of all health data from the country especially those that are collected using public funds. ICMR now has a network of labs that collects data on vector-borne diseases like Dengue. The NCDC (National Center for Disease Control) has their network of IDSP (Integrated Disease Surveillance Program) labs, while there are other agencies which are supporting projects, such as the the CDC (US-based Center for Disease Control) which also runs labs. Now unless we all pool our data we will not be able to see what is the national number for dengue for a particular year.

Similarly for antimicrobial resistance all labs need to start reporting data into a common source or platform, that should be perfectly transparent and available not only to the scientist but to the public as well. We are moving in that direction, saying whatever research we fund through the ICMR that data ultimately should come back to us and put into a public database, publicly available. Publicly available database means that if anybody wants to utilize it there should be a system by which they can access the data. I think we have lots of data that is not fully utilized in India so I think there is a lot of scope here. I think the government has realized that so all of us are working to see how we can better utilize the data and make it available in a form in which others can use it .

There are a lot of things happening now. We've been working with the Registrar General of India (RGI) to utilize the SRS (Sample Registration Survey) data, and with the global burden of disease (GBD) group in Seattle–the IHME (International Health Matrix Evaluation Institute) to develop state level disease burden estimates. Every year the GBD brings out an update on the global burden of disease, so India figures there. But we know that for us, India as one dataset does not make much sense because we have huge variations between states. State health secretaries want to know what is happening in their own state so that they can actually modify the policies. We expect to, by the end of the year, release the first report on the state level disease burden estimation. Then every year we will keep refining it.

Q: **As of 2015, 90% of India's cause-of-death data were incorrect/ incomplete or missing, thus reducing its utility for public-health. What could be done to change this and give a complete picture of India's disease burden.**

It is a big lacuna, and we need to strengthen this in two ways. One, deaths that occurs in hospitals need to be properly certified, which means doctors need training on medical death certification which we all don't get during our under- graduate post-graduate days. Even if a doctor is certifying cause of death, they write cardiac arrest which does not help.

Second, we need to be able get the cause of death of people who are dying at home. In rural areas most deaths occur at home. We need another system whereby a local health

functionary, whether it's the ANM or someone else, who can go and do a verbal autopsy. Then the doctor in that PHC (Primary Health Centre) needs to be able to certify the cause of death based on the details that are available. Unless we do this we will not improve cause of death data, and we will have to continue to depend on surveys and other indirect ways of finding out.

We need to move in the direction of all developed countries which have a good vital registration system where cause of death is carefully reported. Then we don't need surveys and all.

Q: **How could medical research help solve major health problems in India? For instance, India had 27% of the world's new TB cases in 2015, at 2.8 million. In 2015-16, India accounted for 5% of the under-five deaths (296,279 children) from diarrhoea & pneumonia globally, and malaria still affected 1.1 people in 2015.**

The third pillar of our strategy is evidence to policy and the fourth pillar is implementation research. Both of these basically aim to fill the gaps in knowledge and to make sure that the evidence that is generated goes into policy making.

We have a special focus on diseases that are to be eliminated. We are working with the ministry of health on Kala Azar, filariasis, measles, malaria, and tuberculosis. Our job here is to identify gaps in knowledge and try to develop tools to address those gaps. The gaps could be epidemiological in terms of not knowing the true burden of the disease. If you don't know the true burden of TB, or the true burden of leprosy in the country then it is difficult to gauge progress. So we can do a survey to find that out.

Second could be a good diagnostic test that could be used in the field to detect. For example, for malaria, we have this rapid diagnostic test. For Kala Azar we have a rapid diagnostic test, for TB we still don't have something.

Similarly, for Kala Azar we had this long one month treatment with injections then it became this one month-long treatment with oral drugs, today we have a single dose treatment that's come out of clinical trials at ICMR institutes and other institutes.

For diabetes we are looking at several clinical trials looking at yoga and other Ayurvedic medicine to slow down the progression from prediabetes to diabetes.

We are supporting a number of mental health projects. This year we started a new program, to see how best we can implement the district level programme, because the National Mental health programme was approved in parliament but the implementation of this policy requires a lot of innovation. This is health system research.

We support everything from basic science to developing new technology, new vaccines, and all the way through health system research. This year we also began engaging with the private sector because without them, we can't make much progress especially in the areas of drugs and new vaccine. We have already partnered with a number of companies to help them and to work together with them to either transfer technology developed by a scientist to industries so that kits can be marketed.

Another way of collaboration is to evaluate something they have developed. We can field test their product, or do clinical trials.

Third, we engage together on projects like we've done with Sun Pharma for malaria elimination in Mandla district of Madhya Pradesh. That's a public -private partnership where we bring the technical expertise, they bring in funding and the state government brings their workforce and supplies drugs and bed nets.

Q: India has seen progress in tackling visceral leishmaniasis (*kala azar*), a neglected tropical disease (NTD), eliminating yaws, a chronic skin disease that mostly affects poor children, and in treating lymphatic filariasis (elephantiasis). How could research help other disease control programs?

I think the learnings are that research plays an important role not only in developing program policies but also in evaluating them and modifying them from time to time. Whether it's which insecticide to use, unless you know whether the vector are developing resistance or not, when the insecticide should be sprayed, how much should be sprayed, and all that has to be found out through research studies.

For a long time we use chloroquine (for mosquitos), It was research that found out that the entire northeast plasmodium falciparum (which causes malaria) had become resistant to chloroquine. We changed the national policy to an arsenate based combination treatment for the northeast. That monitoring has to continue to ensure that those drugs are still working.

One is surveillance and feedback but the other is developing new strategies. For example, the government has started this National Program for Prevention and Control of Cancer, Diabetes, and Stroke. How is going to be implemented on the ground? What are the best ways that we can do cancer screening, what age group should we be screening, what technology should we use for breast cancer for cervical cancer?

One of the new initiatives is the health technology assessment program–we call it the medical technology assessment board–which we have set up under the DHR to look at questions regarding universal health coverage. How will you define health coverage and what are the things that can be included under that because, for an individual patient his or her treatment is important. Even if it costs Rs 1 crore, that individual is going to say that you must provide me with the treatment, whether it's for a rare cancer or a rare genetic disease. But the public health program looks at different aspects, at effectiveness, cost effectiveness and also at equity considerations. You can use your Rs 10 crore to treat three people, or you may be able to treat a thousand people.

Our job is to have an unbiased, transparent, and evidence-based approach so this board will really have to consist of people who are above all these vested interest, conflicts of interest etc. This was done in the U.K, where the National Institute for Health and Care Excellence and Health Intervention and Technology Assessment Program (HITAP) in Thailand, which are two successful program. We are collaborating with HITAP, which is similar to our program, and an independent body whose recommendations are generally accepted by the government of Thailand.

Q: As we've seen India is seeing a shift in its burden of diseases. Deaths due to diabetes increased 50% in India between 2005 and 2015, and is now the seventh most common cause of death in the country, up from the 11th rank in 2005, according to data published by the Global Burden of Disease (GDB). Has ICMR conducted any research on why Indian's have a higher risk for diabetes and cardiovascular disease when compared to other populations?

Today its non communicable diseases and cardiovascular disease and stroke which are two top causes of death in India and the underlying risk factors for these are hypertension, diabetes, and poor air quality–both indoor and outdoor air pollution–and then come other risk factors such as smoking, obesity, nutritional dietary deficiency. For risk factors , in 1990 unsafe water and nutritional disorders were the top two risk factors, today hypertension and diabetes are the top two disorders in the country. Now we have to ask ourselves why this shift.

There are many reasons. One is the changing demography. As you age on-communicable

diseases will increase. Second, with better immunization and access to treatment, antibiotics, infectious diseases are coming down. Maternal and child deaths are coming down because of improved health services and this is likely to keep coming down further as we wipe out one infectious disease after another or we're able to control them. And the population is aging at the same time.

Third reason are changes in our lifestyles. We all know that in the last 25 years India has urbanized, people have become more prosperous, physical activity has gone down, diets have changed. We are no longer eating fresh home cooked food. We are eating a lot more of outside food, processed food with increased sugar, salt and fat. Another factor is environmental pollution. India has double burden of indoor air pollution because of solid fuel use, which today luckily is declining rapidly because of the scale up of LPG. But also in cities environmental pollution is becoming a huge hazard. These risk factors are leading to an increase in cardiovascular and cerebrovascular events.

Q: What is the way forward for India to tackle non-communicable diseases.

NCDs requires action at different levels, one is at the policy level, the government level, in terms of what can we do to reduce the risk factors. A lot of it has to do with individual and personal habits and behavioural changes and there people need to realise and not wait. You see young people today in their 30's who are developing diabetes because of their lifestyle. They have motorised transport to get to the office, you get to the office, you tend to eat more than you need, you don't have regular exercise, and of course smoking and alcohol are additional risk factors. This is where I think a huge massive awareness campaign needs to start so at least our young people today become aware. The same thing happened in the West; they went through this period where they were over eating, then the young people in the west realised these were risk factors and began to take care of their health.

The government can look at policies on food labelling, salt content, sugar and on what is made freely available at subsidised rates. Today if we look at the Public distribution System (PDS), and the National Food Security Act, we supply rice and wheat at very low rates to people, Rs 2 and Rs 3, and in some states there are lentil dals and millets. But what is our diet deficient in? Our diet is deficient in micronutrients. The ICMR's National Institute of Nutrition has been doing a number of nutrition surveys over the years and the latest surveys show that over 80% of individuals in most of the states we've looked received less than 50% of the recommended dietary allowance of vitamins and minerals–important vitamins like vitamin A, D, iron, Zinc etc.

This could be one of the reasons why we are still having very high rates of malnutrition in

the country. The latest NFHS-4 data show that stunting and underweight has declined from NFHS-3 but not to the extent which we had hoped. This shows there is still a huge issue of malnutrition despite all our schemes–the ICDS (Integrated Child Development Scheme), the Anganwadis, the Mid-day meal, the PDS. That is why we have to think of the malnutrition problem not just in terms of the quantity of food but quality of food. If don't get micronutrients in your diet you only get carbohydrates and some protein, you're not going to grow well. If you have worms and other infection you're not going to absorb the nutrients well so we need to look at nutrition in a holistic way not just how much food you're eating.

*(**Shah** is a reporter/writer with IndiaSpend.)*

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Research Paper

Quality of reporting statistics in two Indian pharmacology journals

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ABSTRACT

Objective: To evaluate the reporting of the statistical methods in articles published in two Indian pharmacology journals. **Materials and Methods:** All original articles published since 2002 were downloaded from the journals' (*Indian Journal of Pharmacology* (IJP) and *Indian Journal of Physiology and Pharmacology* (IJPP)) website. These articles were evaluated on the basis of appropriateness of descriptive statistics and inferential statistics. Descriptive statistics was evaluated on the basis of reporting of method of description and central tendencies. Inferential statistics was evaluated on the basis of fulfilling of assumption of statistical methods and appropriateness of statistical tests. Values are described as frequencies, percentage, and 95% confidence interval (CI) around the percentages. **Results:** Inappropriate descriptive statistics was observed in 150 (78.1%, 95% CI 71.7–83.3%) articles. Most common reason for this inappropriate descriptive statistics was use of mean ± SEM at the place of "mean (SD)" or "mean ± SD." Most common statistical method used was one-way ANOVA (58.4%). Information regarding checking of assumption of statistical test was mentioned in only two articles. Inappropriate statistical test was observed in 61 (31.7%, 95% CI 25.6–38.6%) articles. Most common reason for inappropriate statistical test was the use of two group test for three or more groups. **Conclusion:** Articles published in two Indian pharmacology journals are not devoid of statistical errors.

Key words: Inappropriate statistics, Indian Journals, Pharmacology

INTRODUCTION

Statistics is a tool in the hand of a researcher by which he can analyze his study findings. If statistics methods used in the study are inappropriate, the conclusions drawn from the study become questionable. Studies with poor methodological quality and poor statistics cannot prove or disprove study hypothesis with certainty. So conduction of these kind of studies raises many ethical issues like exposure of participants to risk of new intervention, deprivation of participants to established treatment, unnecessary use of animals in experimental studies, misuse of resources, and wrong clinical judgments on the basis of these studies once they get published.[1-5] Despite publication of various guidelines related to the reporting of various methodological and statistical parameters of a study, it has been observed that quality of statistical reporting is poor in various biomedical journals.[6,7] Various surveys done for the articles published in western medical journals indicate that statistical error in the published article is a common phenomenon and error rate may vary from 30% to 90%.[8-11] Although many surveys are done for statistical reporting in western journals, data are lacking for studies published in Indian medical journals. Some small studies done for articles published in Indian medical journals observed the same phenomenon of poor reporting of various statistical parameters.[12,13] It is observed that data related to the statistical reporting of articles published in pharmacology journals of India are lacking. So this study was designed with the aim of

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evaluating articles published in Indian pharmacology journals (*Indian Journal of Pharmacology* (IJP) and *Indian Journal of Physiology and Pharmacology* (IJPP)) for statistical reporting. These two pharmacology journals are widely circulated and Pubmed-indexed Indian pharmacology journals; hence they were selected for evaluation.

MATERIALS AND METHODS

All articles published in IJP and IJPP between 2002 to the latest issue of 2010 were downloaded from journals website (www.ijp-online.com and www.ijpp.com). In case of IJPP, articles published since 2002 were available on website. So to maintain uniformity for both journals, all articles which were published in or after 2002 were downloaded. Only original studies were considered for analysis. Short communications, research letters, and letter to editors were not taken into account. In case of IJPP, only articles related to pharmacology were downloaded. All articles were evaluated independently by first (J.K.) and second author (P.Y.). These articles were appraised for quality of reporting of descriptive statistics and quality of reporting of inferential statistics. Descriptive statistics is evaluated on the basis of appropriate reporting of data as mean, median, or frequency with the central tendencies. Inferential statistics was evaluated on the basis of reporting of assumptions of statistical tests and inappropriateness of statistical tests. Common methods of statistical analysis were also noted. Common reasons for inappropriate descriptive statistics and common reasons for inappropriate statistical tests were also noted. Any disagreements between two authors were resolved by consensus ($k = 0.87$ for inappropriate statistical tests). Appropriate method of descriptive statistics of ratio and interval data following the normal distribution is mean (SD) or mean ± SD. For ordinal data and for ratio and interval data not following the normal distribution, appropriate descriptive statistics is median and interquarantile range and for nominal data, frequency and percentage are appropriate. Appropriate statistical tests are selected on the basis of aim of the study and types of data. Once the statistical test is selected, all the assumptions for that particular statistical test should be checked before applying that statistical test.

Statistics

Values are described as frequencies, percentages, and 95% confidence interval around percentages.

RESULTS

Total 196 articles from various areas of research were downloaded from the journal sites. Major areas of research were diabetes (39 (19.8%) studies), central nervous system (17 (8.6%)), hepatoprotection (18 (9.1%)), and cardiovascular (17 (8.6%)). Other areas were inflammation (11 (5.6%)), antioxidants (9 (4.5%)), pain (7 (3.5%)), gastrointestinal (6 (3%)), and immunomodulation (4 (2%)). Most of the articles were dealing with animal studies (83% vs. 17%).

Descriptive statistics

Out of these 196 articles, information related to descriptive statistics was missing in four articles. Out of remaining 192 articles, inappropriate descriptive statistics was reported in 150 (78.1%, 95% CI 71.7–83.3%) articles. Out of these 150 studies 106/129 (82.1%) were from IJP and 44/63 (69.8%) from IJPP.

Most common reason for inappropriate reporting of descriptive statistics was the use of mean ± SEM at the place of "mean (SD)" or "mean ± SD" [Table 1].

Inferential statistics

Statistical methods

Most common type of statistical method used in the articles of both pharmacology journals was "one-way analysis of variance (ANOVA)" [Table 2]. Out of 214 statistical methods only 10.7% were nonparametric methods.

Assumptions of statistical tests

Information related to fulfillment of assumptions of statistical tests was mentioned in only two articles. In one article, normal distribution was checked by Komolgorov–Smirnov test.

Inappropriate statistical tests

Out of 196 articles from both journals, information related to statistical test was missing in four articles. Out of remaining 192 articles inappropriate statistical tests were found in 61 (31.7%, 95% CI 25.6–38.6%) articles. Most common reason for inappropriate statistical test was use of two group test for analysis of three or more than three groups (22.9%) [Table 3].

DISCUSSION

Main findings of this study are as follows: majority of articles published in two Indian pharmacology journals have inappropriate reporting of descriptive statistics, assumption of statistical tests were checked in only two article, and inappropriate statistical tests was used to analyzed data in 31.7% of articles.

Table 1: Inappropriate descriptive statistics in articles published in two Indian pharmacology journals (*n* = no. of articles)

Reasons for inappropriate descriptive statistics	IJP (*N* =106)	IJPP (*N* = 44)	Total (*N* = 150)
Use of "mean ± SEM" at the place of "mean ± SD"	95	41	136 (90.6)
Use of "Mean ± SEM" at the place of "median (range)"	6	2	8 (5.3)
Use of "mean ± SEM" at the place of "frequency (percentage)"	5	1	6 (4)

Table 2: Statistical methods used in articles published in two Indian pharmacology journals

Statistical methods	IJP (*N* =147)	IJPP (*N* =67)	Total (%) (*N* = 214)
One-way ANOVA	99	26	125 (58.4)
Kruskal Wallis	6	3	9 (4.2)
Repeated measures ANOVA	3	2	5 (2.3)
Friedman's test	0	3	3 (0.9)
Unpaired t test	21	20	41 (19.1)
Paired t test	4	7	11 (5.1)
Correlation and regression	5	2	7 (3.2)
Mann–Whitney test	3	3	6 (2.8)
Wilcoxon signed test	1	0	1 (0.4)
Fisher's exact test	3	0	3 (1.4)
Z test	1	1	2 (0.9)
McNemar test	1	0	1 (0.4)

Few articles were having one than one statistical method.

Table 3: Inappropriate statistical tests in articles published in two Indian pharmacology journals (n = no. of articles)

Parameters	IJP (N = 37)	IJPP (N = 24)	Total (%) (N = 61)
Parametric tests are used for scales/scores	8	6	14 (22.9)
Parametric tests used for nominal data	8	2	10 (16.3)
Two group test used for three or more groups	14	16	30 (49.1)
Test for unpaired data used for paired data	5	0	5 (8.1)
Three group test used for two groups	1	0	1 (1.6)
Paired test used for unpaired data	1	0	1 (1.6)

One major finding was inappropriate use of "mean ± SEM" for description of data. The ideal method of reporting of these kinds of data is "mean (SD)" or "mean ± SD." Although SD and SEM look similar, they give different information.[14] Standard deviation (SD) shows variability around the mean within the sample and standard error of mean (SEM) shows probability of proximity of sample mean around the population mean.[15] Readers and researchers are interested in knowing variability within the sample not the proximity of mean to the population mean. The value of SEM is always less than SD so when it is used as descriptive statistics readers may falsely conclude that variability of sample is small. To prevent confusion with CI in the place of "mean ± SEM" reporting as mean (SD) is a better method.[16] Similar findings were also observed in other studies done for western and Indian journals. In a study done by Negele (2001) for the articles published in four anesthesia journals, it was observed that inappropriate use of SEM was present in 23% articles.[17] In a similar study done for four Indian medical Journals by Saurabh *et al.* (2010), it was observed that inappropriate reporting of SEM was common in articles published in basic science journals but this inappropriateness was negligible in journals related to clinical practices.[18] In spite of highlighting this issue in various surveys, this practice of reporting the variability as SEM is common and is a matter of concern.[16,19,20] Ordinal data like scores or scales are sometimes described as "mean ± SEM" which is wrong as they should be reported as median (range).[16] This error was not much observed in this study as majority of data were in ratio scale but in some other studies this error found to be much more.[21]

In this study, majority of statistical tests were parametric tests. Nonparametric tests were used less frequently (10.7%). It has been observed that the use of nonparametric statistics is increasing regularly in articles published in medical journals.[22] Low proportion of nonparametric statistics may be because of ignoring of assumptions underlying parametric statistics by authors.[23] Most of the articles in this study were animal experiments where usually many groups are used for comparison; hence one-way ANOVA was most frequently used statistical method whereas in studies done for articles published in clinical journals student *t* test seems to be the most common method.[24] Most of the statistical methods were simple methods and sophisticated methods like survival analysis, multiple regressions were not observed. In this study, it is found that three statistical tests – one-way ANOVA, unpaired *t* test, and paired *t* test – cover about 82% of all statistical methods, so these are the most frequently used tests and interpretation of these tests should be taught in detail to postgraduate students and young researchers.

In this study, it was observed that fulfilling of assumptions of statistical tests was not reported in almost all the studies. One reason may be underreporting and second reason may be ignorance of researcher. Each statistical test has some assumptions and these assumptions need to be fulfilled before application of that statistical test. Information regarding fulfilling of these assumptions should be included in the manuscript. Similar observation was made in other studies.[25]

About 32% articles have at least one inappropriate statistical test and most frequent mistake was the use of two group test for comparison of three or more groups like use of unpaired *t* test for comparison of three unpaired groups. This problem was observed in other studies done for statistical reporting in western journals.[23,25,26] Frequency of statistical errors varies from journal to journal like for Chinese journals it is 46%,[23] for surgical journal it is 64%,[27] and for urology journals it is 28%.[28] Most common problem was the use of multiple unpaired *t* tests at the place of one-way ANOVA. Despite repeated recommendations, unpaired *t* test still continues

to be used at the place of ANOVA,[29] which is a matter of concern. Another mistake observed was the use of parametric statistical tests for ordinal data like scores or scales. It is very important to understand that ordinal data do not follow the normal distribution. Hence the use of parametric tests for these kinds of data is not justifiable.[30] In a study, it was found that ordinal data were used in about one-third of articles and these data are appropriately presented and analyzed in 50% articles.[31] In this study, most of the articles were dealing with continuous variables so this finding is not as prominent as observed in other journals.

There may be various reasons for finding these kinds of statistical errors in the published articles like insufficient knowledge of statistics and research methodology in researcher,[32,33] insufficient ethical review of protocol submitted for permission from institutional ethics committee, insufficient peer review of submitted manuscript, and less knowledge of statistics in journal editors. It is observed that in ethics committee statistical issues are not discussed in detail as members of ethics committee usually focus their attention on informed consent, etc. It is important to understand that poor-quality research is also unethical. So ethics committee should also have a qualified medical statistician who can give advice regarding the methodological and statistical aspects of the protocol.[34] Every article submitted to the journal should also be sent for statistical review and journals should have statistical advisors in their editorial board. It is observed that many journals do not have statistical advisors.[35] Postgraduate students and young researchers should be trained in research methodology and biostatistics. Research methodology should be incorporated in the curriculum of postgraduate course.

This study has some limitations. One of the major limitations is that focus of this study is very narrow. Only few but very important statistical parameters were observed. Parameters like post hoc power, adjustment of multiple endpoints, sample size calculation, confidence interval, use of exact *P* value etc. were not taken into consideration. Second limitation is only two pharmacology journals were considered for evaluation. As far as our perception goes, this is the first study done for articles published in Indian pharmacology journals and may be at international level.

This study shows that inappropriate statistics is very common in the articles published in Indian pharmacology journals. Measures should be taken by journal editors, ethics committee, and researchers to prevent these errors.

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University Grants Commission
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1st March, 2016

Dear Sir/Madam,

The issue regarding counting of the period of active service spent on pursuing Ph.D. was considered by the UGC in its 512th Meeting held on 4th February, 2016.

The clarification of University Grants Commission is as follows:

> ***"the period of active service spent on pursuing Research Degree i.e. for acquiring Ph.D. degree simultaneously without taking any kind of leave may be counted as teaching experience for the purpose of direct recruitment/promotion to the post of Associate Professor and above."***

This is for your kind information please.

With kind regards,

Yours sincerely,

(Jaspal S. Sandhu)

To : The Vice-Chancellor of all Universities.

Copy to :

Publication Officer, UGC, New Delhi for uploading on UGC website.

(Jaspal S. Sandhu)