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Review

Whither diabetes research in India today?

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ABSTRACT

Background and aims: India has the second largest number of patients with diabetes, and research to contain it and limit its complications is needed.
Methods: A literature search was done using Pubmed and Google Scholar search engines to prepare a narrative review on this topic.
Results: India's contribution to research on diabetes remains inadequate, both quantitatively and qualitatively. Most of the work thus far has been done by a limited number of organisations and individuals, and has been confined to certain limited areas of interest. Nearly 40% of the publications on diabetes in India between 2000 and 2009 originated from just 20 institutions. Many important aspects of diabetes in India remain uninvestigated. In this review we make an attempt to evaluate the current status of diabetes research in India and to understand the hurdles dissuading a large proportion of healthcare professionals in India from embarking on a career in research. We also suggest solutions for overcoming these hurdles.
Conclusions: Considering the major health and economic problems posed by the unrestrained diabetes epidemic in India, research in this area remains highly inadequate.

1. Introduction

It is also believed that type 2 diabetes (T2D) occurs early in Asian Indians, progresses faster and is beset with higher rates of complications than seen with other ethnic groups. Studies which have led to these conclusions have been mostly done in migrant Asian Indians. In spite of being home to more than 77 million individuals with diabetes [1], representing nearly 17% of the global diabetes burden, India's contribution to research on this critically important public health problem remains woefully inadequate. In this article, we describe the contribution of Indian studies on diabetes, and its place in global research. For the purposes of this review, we searched PubMed for original and review articles published since the year 2000, using the search terms "diabetes", "type 2 diabetes", "type 1 diabetes", "research" and "India".

2. Diabetes research in India: some statistics

Less than 2% of the global research output on diabetes originates from India, a figure that has not significantly changed over the past 15 years [2–5] (Fig. 1). To put things in perspective, a single institution in the U.S. (Harvard University) published more articles on diabetes between 1951 and 2012 than the whole of India [5]. While India has jumped from the 15th to the 9th position with respect to number of publications on diabetes between 2000 and 2009, it should be recognized that other countries such as China have made even greater advances in the same timeframe, leapfrogging from the 13th position to the 5th position with a 244.2% increase in the number of publications (as compared to 122.64% for India) [6]. India now faces the prospect of being left behind in diabetes research by countries such as Brazil, which have also shown significant increases in publication numbers over the past couple of decades.

Between the years 2014 and 2018, there were ten institutions in India that had published more than 100 papers on diabetes, most of these being prestigious Government Institutes or Medical Colleges or private Universities, with a couple of specialized private research institutes also included (Table 1) [3]. Nearly 40% of the publications on diabetes in India between 2000 and 2009 originated from just 20 institutions. This means that large swathes of India are unrepresented when it comes to diabetes research, and that there are

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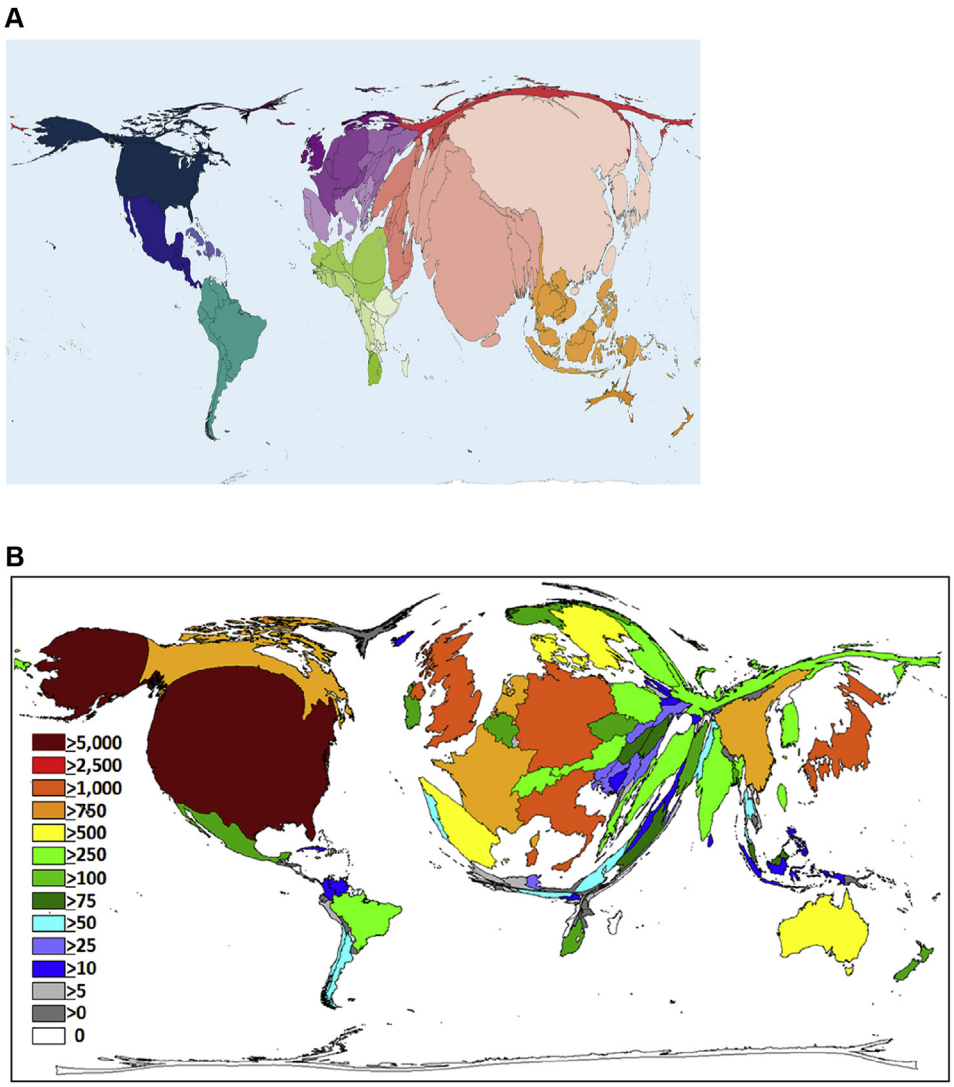

Fig. 1. Density-equalising mapping comparing the population with diabetes (2017) (Fig. 1a) and number of publications on diabetes per country (1951–2012) (Fig. 1b). It can be noted that countries with the highest burden of diabetes, such as India and China, contribute disproportionately little to the published literature on the disease [4,5].
Source: Ref 4, worldmapper.org; Ref 5, Geany et al., PLoS One, 2015

Table 1
Top 10 institutions by number of research publications on diabetes, 1999–2008 [7].

Name	TP	TC	ACPP	H-Index
All India Institute of Medical Sciences, New Delhi	344	2482	7.22	33
Annamalai University, Annamalainagar	208	1122	5.39	23
Madras Diabetes Research Foundation, Chennai	169	1403	8.30	26
Post Graduate Institute of Medical Education & Research, Chandigarh	160	455	2.84	14
University of Madras, Chennai	93	417	4.48	14
Christian Medical Colleg e & Hospital, Vellore	91	231	2.54	12
National Institute of Pharmaceutical Education & Research, Mohali	84	789	9.39	17
Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow	76	397	5.22	12
Central Drug Research Institute, Lucknow	68	264	3.88	12
BHU Institute of Medical Sciences, Varanasi	65	193	2.97	9

Source: Ref 7, Gupta et al. *DESIDOC J. Lib. Inf. Technol.*, 2011

many Medical Colleges and "Research Institutes" that have not published even a single paper on diabetes.

Scientometric analysis shows that most of the research from India on diabetes is published in journals with low impact factors, and the citation numbers are also not impressive. It is also of concern that neighboring countries are catching up with India as regards the quality of research. While the average number of citations per paper over a three-year window was much higher for India than China between 2000-04, this gap between the two countries narrowed significantly by 2005–09 and is likely to have disappeared or even reversed by now [7].

Many of the publications on diabetes in India are in the form of case reports or Letters to the Editor, which while useful in their own right, do not significantly contribute to the body of evidence on the

Table 2
Priorities for diabetes research in India[a].

What are the research questions that have been partially addressed?	What are the areas of research that deserve further attention?
• Nationwide epidemiological studies on diabetes • Characterisation of young onset diabetes • Studies on genomics of diabetes including monogenic diabetes • Prevention of diabetes including use of novel interventions such as SMS alerts • Studies on Asian Indian phenotype • Studies on gestational diabetes • Evaluation of low birth weight and vitamin B12 deficiency as risk factors for diabetes • Evaluation of glycemic profiles of cereal staples, particularly rice	• Screening for diabetes using mobile apps and artificial intelligence-driven algorithms • Role of very low calorie diets in prevention of diabetes • Role of high dose metformin and combination oral agents in prevention of diabetes • Efficacy of exercise interventions in prevention and control of diabetes • Study of locally available foods claimed to have antihyperglycemic properties (e.g. karela, jamun, methi) • Efficacy of yoga in management of diabetes • Role of dual antihyperglycemic therapy at diagnosis of diabetes • Efficacy and cost-effectiveness of low-cost antihyperglycemic drugs vs. newer costlier agents • Evaluation of earlier-than-conventionally-recommended use of statins and ACE inhibitors/angiotensin receptor blockers for prevention of vascular complications

[a] Adapted from Ref 9, Misra et al., Lancet Diabetes Endocrinol, 2018.

nature of diabetes in India. The next main subgroup of papers is constituted by epidemiological studies on the prevalence of diabetes and its complications, which again are limited by the fact that they have a local slant, with limited applicability to the whole country. Further, large epidemiological data, or follow up of large cohorts (akin to the Nurses Health Study) are not available. There is also a significant body of literature from India dealing with diabetes complications, particularly those concerned with the heart, kidney and eyes. In spite of the enormous socioeconomic impact of limb loss due to diabetes, foot complications remain the poor cousin when it comes to diabetes research in India.

In particular, studies on basic pathophysiology of diabetes are lacking. There is also a paucity of randomized trials on the benefits of various treatment outcomes for diabetes in the Indian population, and of prospective studies looking at the trajectories of the natural history of diabetes and its complications. Most of the intervention trials are of limited duration (3–6 months) and there is singular lack of long term data, except small numbers included as part of multinational long term drug trials. Lacking original Indian data on these aspects, clinicians and opinion leaders in India are constrained to depend on treatment guidelines developed in Western countries, which may not be ideal for the T2D developing on the background of the Asian Indian phenotype. Efforts to develop India-specific treatment algorithms have, for the same reason, been forced to rely disproportionately on Expert Opinions. Similarly, the role of diet and physical activity in the development (and subsequent management) of diabetes and metabolic disease is another neglected field in research in India, meaning that dietary recommendations for Asian Indians can, at best, be extrapolations from Western guidelines modified by local experience. Most of these 'consensus' or 'expert opinion' guidelines are not nationally representative or backed by official governmental institutions.

Collaboration with colleagues and institutes is an important means by which a researcher can improve the quantity and quality of his output. India has been at the forefront of international research collaborations in diabetes. However, collaboration between researchers within India is less common, and most commonly takes place in the context of clinical trials sponsored by large pharmaceutical companies. Investigator-initiated collaborative research within India is exceedingly rare.

For cultural and linguistic reasons, most of the international research collaborations are with Anglophone countries such as the U.S., the U.K., Australia and Canada [3]. It is of concern that the role of the Indian partner in many of these only involves supply of clinical data (and often clinical samples) to the Western partner. Such collaborations do not truly advance the cause of diabetes research in India, nor do they contribute to capacity building in the country.

3. Reasons for India's problem of poor research output

There are several reasons why research in diabetes (and medical research in general) has not reached its potential in India.

- ❖ A career in research is not perceived as financially rewarding. Most physicians in training in India are entirely concerned with entering clinical practice, with all the attendant monetary and social benefits. Some are keen to take up academic teaching, but very few opt for a career solely in research.
- ❖ The sheer load of clinical work in many Government institutes, and the myriad competing demands for scarce funds, discourages otherwise interested clinicians in taking up research, while the commercial focus of most private institutions precludes the development of an environment conducive to research. Facilities for research are often minimal to non-existent, funds are not forthcoming, and decision-makers and administrators look down upon time spent in research as time wasted, even in the larger Government institutions.
- ❖ Writing up a research proposal and getting it accepted is a task beyond the core competence of many healthcare professionals.
- ❖ May clinicians do not have the statistical knowhow to analyse or present their results in the most effective manner; neither do they have access to qualified statisticians. This means that their chances of getting their results published in reputed journals are minimal, irrespective of the merits of their study.
- ❖ Many journals impose publication charges that are beyond the reach of ordinary researchers from India. This forces many authors to publish their work in low-impact journals, and some even fall prey to predatory publishers on account of ignorance.

4. Suggested solutions

A major paradigm shift is needed if India is to make a contribution to diabetes research commensurate to its burden of disease [8]. Awareness needs to be created among young healthcare professionals on the prospects of a career in research and the possible rewards-financial and otherwise. The focus for funding agencies should be to identify individuals with an aptitude for research and provide them with the necessary financial and technical assistance to bring their research projects to fruition. Senior researchers and institutes with a good track record in diabetes research should help in building research capacity in India by taking up the mentorship of their junior staff and colleagues. The focus should be on quality rather than quantity of research, with more original ideas with specific relevance to India being introduced and tested rather than

a host of more "me-too" studies. As noted earlier, there are several important aspects of diabetes and metabolic research that have not received their due attention in India (Table 2); efforts (and funding) should be preferentially directed to these [9].

5. Summary

India's contribution to diabetes research is, at present, neither commensurate to its burden of diabetes nor completely relevant to its public health needs. While there are significant hurdles to improving research output on diabetes in India, most of these can be overcome with concerted effort on the part of the stakeholders involved. The ultimate aim of these efforts should be that India becomes the "Diabetes Research Capital" of the world, rather than the "Diabetes Capital" of the world.

Declaration of competing interest

None.

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