

Diabetes & Pandemic proportion: Trend analysis on prevalence of

Global diabetes since 2000

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Abstract:

Diabetes is a metabolic progressive disorder that can also have an everlasting impact on the economy of a country and it is a major public health concern. With all the scientific advancements in medical research field we can only be able to control diabetes but cannot cure it. We, humans are making significant breakthroughs in clinical research in recent times though. It is already an uphill task for the public health sector and in upcoming future considering the rise in prevalence it will be a hyper task. Globally 463 million people are reported to be having diabetes (diagnosed and undiagnosed combined) as per International diabetes federation report 2019 and this number is predicted to reach 700 million by 2045. This research paper aims to analyse the trend on the global prevalence of diabetes for the past 20 years and come up with suggestions to overcome the future challenges

Introduction:

“Diabetes is a serious, chronic disease that occurs either when the pancreas does not produce enough insulin (a hormone that regulates blood sugar, or glucose), or when the body cannot effectively use the insulin it produces” (WHO Global Report on Diabetes, 2016). Traditionally viewed as a “disease of the wealthy” and found among “elderly population in developed countries”. Now diabetes affects people from every class of the society and every age group. It became a threat to global community. (Dunachie & Chamnan, 2019)

A metabolic disorder, that has been on the rise consistently especially in the last 20-30 years. Sedentary life style and deviating from healthy eating habits has been the primary reasons. Along with that population growth, increasing obese population, rapid urbanization and poor stress management are the other reasons. Diabetes can be a distress to people in many ways. Physically from acute complications like hyperglycaemia, mild hypoglycaemic episodes, diabetic ketoacidosis and severe hypoglycaemic coma to chronic long term complications like

permanent damage to the eyes, kidneys, heart and nervous system. There are every day challenges a diabetic patient had to face for their life time that can affect their quality of life. Socially, economically and psychologically it can be a great burden on the individuals. This study aims to understand and analyse the trends in global prevalence of diabetes for the past 20 years evaluate its impact. It also attempts to analyse the predictions for diabetes prevalence in the future and provide suggestions to overcome the challenges of it. The secondary data is mainly derived from Diabetes Atlas reports, a biennial report published once in 2 years by International diabetes federation since 2000. 9 editions have been released so far. Along with that data from reports of World Health Organization, National Family Health Survey-4 and Indian Council of Medical Research were used in this study.

Aim:

To analyse the trend on the global prevalence of diabetes for the past 20 years and coming up with suggestions to overcome the challenges related to prediction of future prevalence is the aim of the study.

Objectives:

1. To understand the trends in global prevalence of diabetes for the past 20 years
2. To analyse the diabetes prevalence trends and evaluate its impacts
3. To analyse the predictions for the future prevalence and provide suggestions to overcome the challenges.

Methodology:

Descriptive Research design is used in this research. Quantitative Data Analysis is done using secondary data available.

Source of the Data:

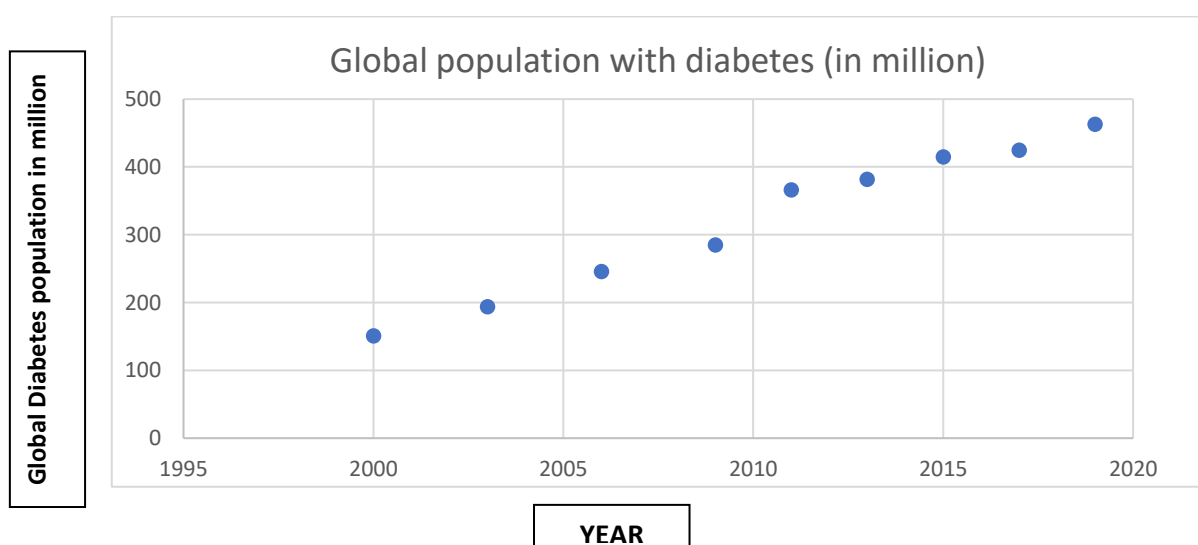
9 editions of diabetes Atlas released by International Diabetes Federation from 2000 to 2019 were the primary source for this article. Global report on Diabetes, 2018 and global disease burden estimates 2000-2016 released by World Health Organization, National Family Health Survey-4 report data and INdia-DIABetes study report by Indian Council of Medical Research were also the source for this study.

Table 1 - Global diabetes prevalence among adults (aged 20-79 years) in last 20 years:

IDF diabetes atlas edition	Year	Population with Diabetes (in million)	Prevalence (in per cent)
1	2000	151	4.6
2	2003	194	5.1
3	2006	246	6
4	2009	285	6.6
5	2011	366.2	8.3
6	2013	382	8.3
7	2015	415	8.8
8	2017	424.9	8.8
9	2019	463	9.3

**Source: International diabetes federation global atlas reports, 2000-2019*

Graph 1: Global population with diabetes (in million)



From 151 million, in the year 2000 the diabetes population has a proliferated growth in the last 20 years. Above 200 per cent growth in diabetes population is observed globally since 2000 and reached 463 million in 2019. The global initiatives to prevent the increasing incidences of diabetes has not helped much so far. The diabetes incidences has increased in the low and middle income countries taking a paradigm shift from high income countries. The dynamics of diabetes has changed drastically. Complex interactions between life style, environment, genetic and clinical factors has combined together is determining the incidence and treatment of diabetes.

Table 2 - Future estimations for global diabetes prevalence with predicted year: (in millions)

Year the diabetes prevalence estimation made	Future estimated year	Estimated global diabetes prevalence (in million)
2003	2025	333
2006	2025	380
2009	2030	438
2011	2030	551.8
2013	2035	592
2015	2040	642
2017	2045	628.6
2019	2045	700.2

**Source: International diabetes federation global atlas reports, 2003-2019*

In 2003, International diabetes federation's 2nd global atlas report predicted that by 2025 the global diabetes population will reach 333 million and in the subsequent edition of global atlas they have increased their estimation for 2025 to 380 million. Astonishingly we have crossed that 380 million estimation by 2013 itself with 382 million. Correspondingly the predictions for the year 2030 which is 438 million has been surpassed in the year 2019 itself with 463 million. Considering the trend of predicted increase in diabetes population is achieved much

earlier and the lack of collaborative preventive measures will not help the course of action. The estimation of people with diabetes for the year 2045 is 700.2 million and it may be achieved far earlier, if this trend continues.

Picture 1- Impact of diabetes:

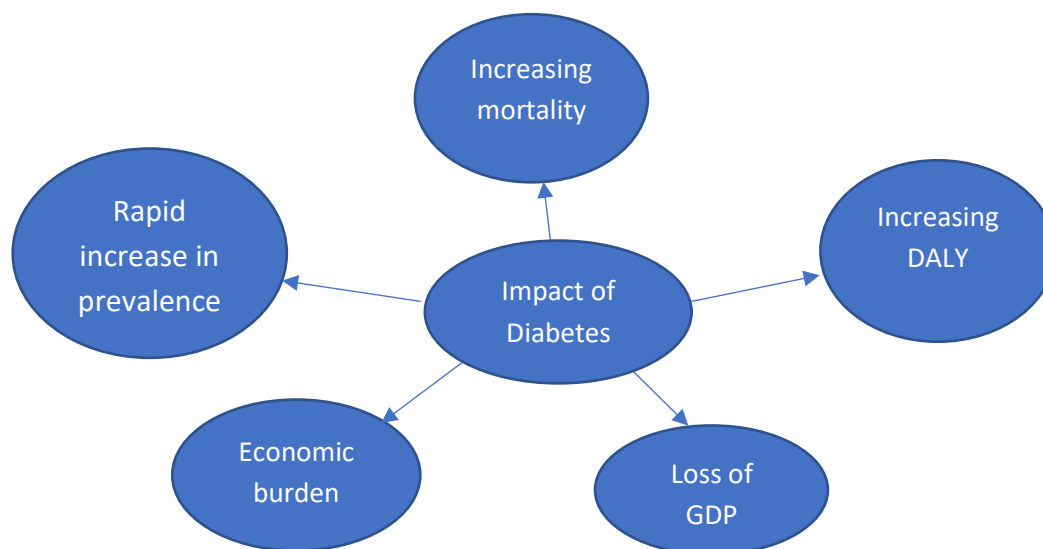


Table 3: Top 10 countries with highest estimated diabetes population in 2019 and their diabetes population in last 20 years (in millions):

Country	Estimated diabetes population in the year (in millions)								
	2000	2003	2006	2009	2011	2013	2015	2017	2019
China	22.6	23.8	39.8	43.2	90	98.4	109.6	114.4	116.4
India	32.7	35.5	40.9	50.8	61.3	65.1	69.2	72.9	77
U.S.A	15.3	16	19.2	26.8	23.7	24.4	29.3	30.2	31
Pakistan	8.8	6.2	6.9	7.1	NA	NA	NA	7.5	19.4
Brazil	3.3	5.7	6.9	7.6	12.4	11.9	14.3	12.5	16.8
Mexico	4.4	4.4	6.1	6.8	10.3	8.7	11.5	12	12.8

Indonesia	5.7	NA	NA	7	7.3	8.5	10	10.3	10.7
Germany	NA	6.3	7.4	7.5	NA	7.6	NA	7.5	9.5
Egypt	3.4	3.9	4.4	NA	7.3	7.5	7.8	8.2	8.9
Bangladesh	NA	NA	NA	NA	8.4	NA	7.1	NA	8.4

**Source: International diabetes federation global atlas reports, 2000-2019*

** NA – Data not available (Since they were not in the list of top 10 countries with highest diabetes population at that time)*

China, India and United States of America has been consistently the top three countries with highest adult diabetes population and this trend expected to continue till 2030. The highest per cent of diabetes population increase from 2000 to 2019 is observed in China, Brazil, Mexico and Egypt with 415, 409, 190 and 161.7 per cent respectively. 2 out of 5 individuals with diabetes globally is either from China or India. Countries that are with high population growths in last few decades have started to take over in top countries with diabetes population list.

Table 4: Global diabetes related expenditure (in billion US dollars) :

Year	Global diabetes related expenditure (in billion US dollars)
2007	232
2010	376
2011	465
2013	548
2015	673
2017	727
2019	760.3

**Source: International diabetes federation global atlas reports, 2007-2019*

Diabetes imposes great burden on the individuals and national healthcare systems of all the countries. The expenditure spent by patients from their own pocket or private payers or

public payers like government will come under direct costs of diabetes. Global diabetes expenditure rise is considerably high. From 232 billion USD in 2007 it has reached 760.3 billion USD in 2019. International diabetes federation estimates that the total diabetes related global expenditure will reach 825 billion USD by 2030 and 845 billion USD by 2045. This denotes 8.6 per cent and 11.2 per cent increase respectively. There is a large disproportion among countries when it comes to the diabetes related expenditure. United States alone spends 294.6 USD billion followed by China 109 billion USD and Brazil 52.3 billion USD, are the top 3 countries with highest expenditure related to diabetes contributes to more than half of the entire global expenditure when combined.

Mortality and DALY (disability adjusted life years):

Indirect costs are combination of mortality and Disability adjusted life years. These two can indirectly affect the economy of the country due to loss of labour force permanently or temporarily or reduced productivity which eventually has an impact on the Gross domestic product output of a country.

Table 5 - Estimated deaths due to diabetes globally:

Year	Estimated deaths due to diabetes globally	Male	Female
2000	9,44,240	4,25,540	5,18,700
2005	11,35,468	5,12,694	6,22,774
2010	13,10,595	5,96,375	7,14,220
2016	15,98,526	7,36,857	8,61,669

**Source: World Health Organization global disease burden estimates 2000-2016*

As per WHO global health estimates, diabetes which was ranked at 13th position in the top 20 global death causes in 2000 has moved up to 7th position in 2016. These estimations calculate diabetes as a direct cause of death. When we calculate the deaths due to diabetes and its related complications the numbers go remarkably high. As per International diabetes federation 2019 report, 4.2 million deaths occurred due to diabetes and its related complications

in adults 20-79 years. Globally there are more deaths among women (2.3 million) than in men (1.9 million) due to diabetes.

Table 6: Years lived with disability (YLD) globally due to diabetes:

Year	Total Years lived with disability (diabetes)	Male	Female
2000	1,85,18,515	94,21,830	90,96,685
2010	2,50,35,166	1,28,81,438	1,21,53,728
2015	2,79,13,649	1,44,25,102	1,34,88,547
2016	2,85,47,752	1,47,64,058	1,37,83,695

**Source: World Health Organization global disease burden estimates 2000-2016*

Table 7: Years of life lost (YLL) globally due to diabetes:

Year	Total Years of Life lost due to diabetes	Male	Female
2000	2,36,16,064	1,12,65,446	1,23,50,618
2010	3,11,70,672	1,49,75,057	1,61,95,616
2015	3,62,14,301	1,75,13,378	1,87,00,924
2016	3,71,18,394	1,79,95,072	1,91,23,322

Source: World Health Organization global disease burden estimates 2000-2016.

DALY (disability adjusted life years) is the sum of Years of life lost (YLL) and years of life lived with disability (YLD). As per WHO global health estimates among the top 20 leading causes of DALY globally, diabetes was ranked at 15th position in 2000 has moved up to 8th position in 2016. 880 DALYs per 1, 00,000 population is reported due to diabetes in 2016. Diabetes which was not even in the top 30 causes of DALYs in India in 1990 was the 13th leading cause of disease burden in 2016. In India 792 DALYs per 1, 00,000 population is reported due to diabetes in 2016. (Dandona et al., 2017)

Diabetes prevalence trend in India – An overview:**Table 8 - Diabetes Prevalence trend in India:**

Year	Overall diabetes Prevalence in India (in million)	Diabetes Prevalence rate (in per cent)	Name of the Study
1990	26	5.5	India state-level disease burden initiative
2015	*NA	7.3	ICMR-INdia DIABetes study
2016	65	7.7	India state-level disease burden initiative

Source: (Anjana et al., 2017) and (Indian Council of Medical Research India of, 2017)

**NA - ICMR-INdia DIABetes was a cross-sectional study carried out only in 15 states of India up to Phase II.*

India state-level disease burden initiative study (1990) found that diabetes prevalence among adults (aged above 20 years) in India was 5.5 per cent which accumulated to the total of 26 million people with diabetes in 1990. The State-level disease burden initiative study conducted in 2016 found that the prevalence of diabetes in India had increased to 7.7 per cent which meant 65 million people were diabetic in 2016. (Indian Council of Medical Research India of, 2017)

Table - 9: Prevalence of high blood sugar levels among adults aged (15-49 years) in India in 2015-16 as per NFHS-4 report:

National Family Health Survey-4 was the first National Family Health Survey to measure High blood sugar level prevalence among adults (15-49 years).

Women (15-49 years)	Urban (%)	Rural (%)	Total (%)
Blood sugar level high (>140 mg/dl)	6.9	5.2	5.8
Blood sugar level very high (>160 mg/dl)	3.6	2.3	2.8
Men (15-49 years)			
Blood sugar level high (>140 mg/dl)	8.8	7.4	8.0
Blood sugar level very high (>160 mg/dl)	4.4	3.5	3.9

Source: (Indian Institute for Population Sciences (IIPS) and ICF / Ministry of Health and Family Welfare, 2017)

Table-10 - State-wise diabetes prevalence in India among 20 years or older in 2015 as per ICMR India-DIABetes study results- Phase II:

In India, ICMR India-DIABetes study (2008-2017) is one of the first studies conducted comprehensively in almost all states to estimate the national prevalence of the diabetes and pre-diabetes.

Serial No.	State	Self-reported diabetes (%)	Newly diagnosed diabetes (%)	Overall prevalence of diabetes (%)
1.	Andhra Pradesh	5.8	2.6	8.4
2.	Bihar	2.0	2.3	4.3
3.	Gujrat	4.7	2.4	7.1
4.	Karnataka	3.9	3.8	7.7
5.	Punjab	6.3	3.7	10.0
6.	Arunachal Pradesh	2.0	3.1	5.1
7.	Assam	3.1	2.4	5.5
8.	Manipur	3.3	1.8	5.1

9.	Meghalaya	2.3	2.2	4.5
10.	Mizoram	2.9	2.9	5.8
11.	Tripura	4.5	4.9	9.4

Source: (Anjana et al., 2017)

When looking at the leading individual causes of Disability Adjusted Life Years (DALY's) in India, most Non Communicable Diseases have risen in rank since 1990. Ischaemic heart disease and COPD were the top two causes of DALYs in 2016 came all the way up from sixth and eighth place respectively in 1990. Diabetes showed a particularly dramatic increase, from 35th place to 13th place. (Tandon et al., 2018). A developing economy like India has a wide range of challenges in front of them as far as tackling the outcomes of increasing diabetes prevalence. Starting from diagnosis at an early stage, educating the mass about diabetes especially in rural population, confirming adequate quality medical care access to all of its people to prevent morbidities and chronic complications due to poor glycaemic controls.

Discussions and recommendations:

Few decades back diabetes mellitus was not considered as a serious threat to the global community. In the last two decades the increase in the prevalence globally throughout all regions is a proliferated one. The increase in prevalence was such an accelerated one that it has surpassed and exceeded way beyond the predictions of the experts. Table 1 & 2, showed that the actual prevalence was much higher and rapid than the predictions of International diabetes federation.

Similarly a study conducted to estimate the future prevalence of diabetes in 2000 has predicted that, by 2030 the number of people with diabetes in India is expected to increase by 151 per cent. Globally the number of people with diabetes is estimated to increase by 114 per cent. With the increasing prevalence of diabetes the cardio vascular diseases and other complication related deaths are inevitable (wild sarah, 2004). 2019 stats however show that the global prevalence had seen 206 per cent increase and the prevalence in India had seen 135 per cent increase.

The dynamics of increasing diabetes prevalence has to be understood to prevent the future increases in prevalence. Ageing population, increasing overweight and obese population, sedentary life style and Rapid urbanization are considered to be the prime reasons

for rapid increase in the diabetes prevalence. These specifics are substantiated by the International consortium estimations. They estimated that globally the number of adults with diabetes has increased from 108 million in 1980 to 422 million in 2014. They also determined that this increase was caused 28.5 per cent due to increase in the true prevalence, 39.7 per cent due to population growth & ageing and 31.8 per cent caused because of the combination of both. (DeFronzo RA, et al. 2015).

Relationship between increasing diabetes prevalence and obesity is supported by WHO Global health observatory data, 2016. It estimated that the prevalence of obesity and overweight is specifically high in the United States, Maghreb and gulf countries, especially among women. With 30 per cent of the adult population being obese and about two-thirds of the population are either overweight or obese. Not surprisingly these regions are hot spots of diabetes epidemic. Most European countries adult population has above 20 per cent obese population and high 50 per cent of overweight or obese population. (Jones & Persaud, 2010).

On the contrary countries around Indian sub-continent, China and other Asian countries has the lowest prevalence of obesity and overweight. (Below 10 per cent of adult population). However, those regions still exhibit highest incidence and prevalence of diabetes in recent years. It is because of a special diabetes phenotype among Asian population which causes low insulin reserve and high insulin resistance. (Jones & Persaud, 2010)

The diabetes prevalence was relatively high among the high income countries in 2000. The pattern though has taken a shift and the recent studies found that 79.4% of people with diabetes live in low- and middle-income countries. It is estimated that in the future the prevalence will be high among the countries which are moving from low to middle income.

NCD – RisC study shows that the top ten countries with highest number of adults with diabetes between 1980 to 2014, has taken a shift away from European countries to Asian countries like Pakistan & Bangladesh, Egypt and Mexico, countries that are with high population growth in recent decades. (Risk & Collaboration, 2016)

Table 4 shows that more than threefold increase is observed within a decade as far as the global health expenditure is concerned. The global health expenditure for diabetes from 232 billion USD in 2007 diabetes to 727 billion USD in 2017 is a major leap and it is expected to increase further in future also.

The absolute economic burden related to diabetes has been estimated to increase from 1.3 trillion USD in 2015 to 2.2 – 2.5 trillion USD by 2030 worldwide. A roaring 88 per cent

increase in cost. It will be costing 2.2 per cent of the global gross domestic product (GDP) predicts a global economic burden of diabetes study. (Bommer et al., 2020)

Diabetes and related complications caused 4.2 million deaths an year among adult population (20-79 years) globally in 2019. Every 8 seconds a life is lost due to diabetes and related complications claims the 9th global atlas report. Mortality and DALY (disability adjusted life years) numbers due to diabetes also is a distressing one.

Undiagnosed diabetes population is still a great threat especially in African and Asian countries. In African region the undiagnosed proportion is 59.7 per cent and in Asian region its 56.7 per cent. Globally every other person with diabetes is estimated to be undiagnosed that is nearly 232 million. In European countries though the undiagnosed population is relatively low between 20-35 per cent.(International Diabetes Federation, 2019) Failure of early diagnosis can have negative effects such as high risk of landing up in complications and increase healthcare related costs. WHO states that preventive measures and early diagnosis must be given widespread attention. When people have prolonged undiagnosed diabetes, the prospective benefits of early diagnosis and treatment are vanished. The costs related to undiagnosed diabetes are significant. (World Health Organization, 2016)

Suggestions and recommendations:

1. While cure for diabetes is still being actively sought, collaborative efforts should be made by government, non-government organizations and private health care sectors to prevent and diagnose diabetes at early stage with special focus in low and middle income countries.
2. The allocation of funds in developing countries like India to tackle non-communicable diseases is relatively very low. Government has to prioritise health policies and ensure the allocation of adequate resources and collaborate with private organizations to combat a threat like diabetes.
3. Self-management is the foundation of diabetes care. Patient centred, well-co-ordinated efforts from a team of professionals like physician, dietician, counsellor and diabetes educator will lead to better adherence and control from patients.
4. Systematic assessment of risk factors among diabetic patients to prevent complications and timely interventions can result in better clinical outcomes.
5. Universal health care coverage has to be ensured to all the citizens by the government to reduce the undue economic burden imposed on them when they failed to control their

diabetes, landing up in complications and requiring hospitalization. Evidences show us that people with comprehensive health care insurances spends very little out of their pocket compared to people without any health insurances at all when a crisis arises.

6. Accessibility to quality treatment and lifesaving medicines like insulin is still a dream for people living in low-middle income countries. Globally one in two people do not have access to insulin when prescribed. Improving the infrastructure, ensuring adequate staffing, equipment, essential drugs availability and lab facility will help the course.
7. Like all the global pioneers of health care came to a common agreement recently on the diabetes diagnosis criteria, a Global diabetes risk calculator has to be established to identify the high risk population. Enrolling & educating them on diabetes prevention and following up with them on the progress is necessary to prevent diabetes or postpone them.
8. Undiagnosed population is a great threat since failure to diagnose early can increase the chances of complications at the time of diagnosis. Diabetes complications are irreversible and the economic burden of those complications are lavishing ones. Diabetes detection and awareness camps all over the country can lead to early diagnosis and can save a lot of time, money and effort.

Conclusion:

WHO specifies epidemic as a disease “occurring at the level of one region or community” whereas pandemic is a disease “prevalent throughout an entire country, continent or the whole world”. We have reached a level where diabetes prevalence has reached the pandemic proportions. There is no disparity in Age, class or community in the prevalence. Collective efforts from all the countries is required to overcome the challenges of diabetes in prevention, diagnosis and management. The failure to act swiftly can cause significant economic loss to the individuals as well as governments, gross domestic product (GDP) can take a hit because of loss of productive population and a major health concern issue to the public healthcare sector.

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