DIABETES MANAGEMENT AND ECONOMIC BURDEN IN INDIA

S. Dinesh Kumar UGC-NET-JRF- Ph.D. Research Scholar Centre for Applied Research, The Gandhigram Rural Institute, Gandhigram, Dindigul District, Tamil Nadu, India

Abstract:

As per the International Diabetes Federation report 2019, 463 million people are diabetic in the world and this number is expected to reach 700 million in 2045. Diabetes was the direct cause of 1.6 million deaths in 2016. Diabetes prevalence has been rising more rapidly in middle & low-income countries and it is a growing challenge in India with an estimated 8.7% diabetic population in the age group between 20 and 70 years. The rapid urbanization, sedentary lifestyle, unhealthy diets and tobacco use are driving forces of increased prevalence rate in young adults. Managing diabetes can be expensive if blood glucose control is not maintained with diabetic patients. It includes direct costs (Expenses with medicine, hospital, drug costs and food) and Indirect costs (loss of income due to morbidity, mortality and disability). This paper analyzes the trend of global diabetes-related expenditure comparing Indian mean average expenditure with all other countries and mortality rate directly related to diabetes. The analysis is done using the Global report on Diabetes, 2016 by World Health Organization and International Diabetes Federation Atlas reports (2001, 1st Edition to 2017 8th Edition). From the above-said facts this paper focuses on the economic burden of the country in the present and future context.

Keywords: Diabetes, Economic burden, Mortality rate and Diabetes management expenditure.

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). It can lead to premature death and serious complications such as blindness, amputations, kidney disease and cardiovascular diseases. People with diabetes have more outpatient visits than usual, use regular medications, has higher chances of being hospitalized, and they are highly likely to require emergency and long-term care than people without the disease (Fernandes and Fernandes 2017). It is a progressive disorder that can only be managed, not completely cured even with so much scientific progress we made in the medical world today. The progressive nature of the disease and the lack of self-management among patients force them to land on both acute and chronic complications to the people with diabetes and their families. Indirectly it can impact the health systems and economy of a country through medical costs (direct and Indirect), loss of works and wages (Global report on diabetes, 2015).

Adding to the woes, dissimilar to western countries where elderly people are the most affected, young to middle-aged adults are the most affected in Asian countries. This can have long-term adverse effects on a nation's health and economy, especially for a country like India which is still developing. (Acharya et al. 2016). A developing country like India lacks an all-inclusive health care system, accessibility of information on the cost of treatment is also limited in existing health care systems both in the government and private sector. Although the government hospitals offer free treatment to the poor, except few private hospitals the chronic care model is lacking in many centres. Private hospitals are the ones preferred mostly despite of it is lavish nature.(Ramachandran et al. 2007). Managing diabetes can be expensive if blood glucose control is not maintained. It includes **direct costs* (Expenses with medicine, hospital, drug costs and food) and *Indirect costs (loss of income due to morbidity, mortality and disability). People who have medical insurance to cover the medical expenses of serious diabetes complication is very less and lack of knowledge to utilize the government insurances is still a huge barrier for Government and economically deprived population with diabetes. Total cost per patient for diabetic care is defined as "Total COI includes all the cost of treatment, investigation, consultation fee, intervention cost, transportation, days lost due to work, and hospitalization". (Acharya et al. 2016)

This study aims to assess the prevalence and the economic burden raised out of the treatment and management of diabetes in India comparing with other countries of the world.

Objectives:

- 1. To assess the prevalence and economic burden caused by diabetes in India compared to other countries of the world
- 2. To analyse the factors influencing the economic burden for India arising out of treatment and management of diabetes in India.
- 3. To provide suggestions to overcome the economic challenges caused by diabetes

Methodology:

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

Source of the Data:

Secondary data mainly derived from Diabetes Atlas 8th edition, 2017 released by International Diabetes Federation and Global Report on Diabetes, 2018 released by the World Health Organization in addition to other sources of data on prevalence, treatment and management of diabetes.

Diabetes and Economic Impact:

Diabetes imposes a great burden on the global healthcare system economically and it is hefty enough to affect the global economy as well. Direct medical costs, indirect costs associated with productivity loss, premature mortality and the negative impacts all taken into consideration when the burden of diabetes is measured. Diabetes has a direct impact on nations' gross domestic product (GDP). (Global report on diabetes, 2015)

*Direct costs: Total cost required to treat the diabetic patients including all direct medical and non-medical costs. It includes care and assistance costs.

*Indirect costs: All costs caused by productivity loss due to morbidity condition and mortality caused by diabetes. (Yesudian et al. 2014)

The International Diabetes Federation (IDF) estimation reveals that diabetes global health care expenditure more than tripled over the period of 10 years (2003 to 2013) due to increased prevalence and increase in per capita spending for the treatment and management of diabetes both by the government and Individual. Low and middle-income countries will carry a larger expenditure burden of future global healthcare than high-income countries. (IDF diabetes Atlas, 2013). One study estimates that from 2011 to 2030 it is expected to cost US\$ 1.7 trillion loss in GDP worldwide, including both the direct and indirect costs of diabetes. It is US\$ 800 billion for low and middle-income countries and US\$ 900 billion for high-income countries. (Bloom DE, 2011)

S1. No	Region	Number of people with diabetes (20-79 years) 2017 in millions*	Projected Number of people with diabetes (20-79 years) 2045 (in millions)#
1.	African	15.5	40.7
2.	Europe	58.0	66.7
3.	Middle East and North Africa	38.7	82.0
4.	North America and Caribbean	45.9	62.2
5.	South and Central America	26.0	42.3
6.	South- East Asia	82.0	151.4
7.	Western Pacific	158.8	183.3

	Global diabetes	prevalence	region-wis	e in 2017	(actual) and 2045	(projected):
--	-----------------	------------	------------	-----------	---------	------------	--------------

*Actual #Projected. Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017. Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-tools/134-idf-diabetes-atlas-8th-edition.html</u>, retrieved on- 26/11/2019

African region and the Middle East & North Africa diabetes population is projected to increase more than twice in 2045 compared to 2017. The South-East Asian region is

projected to increase almost twice – India is contributing to 88.9% of the total diabetic population of the South Asia Region, so it is evident that India is also projected to have an almost two-fold increase (72.9 to 134.3 million). The lowest projected increase in the diabetic population is in the Western Pacific region. The highest proportion of undiagnosed diabetes population and poor preventive measures are considered as key factors in contributing to the rapid increase in diabetes population in African and the Middle East & North Africa regions.

<u>Top ten countries/territories with the diabetic population aged 20-79 years in 2017</u> (actual) and 2045 (projected 2045) (in millions)

Rank	Country	Number of people		Rank	Country	Number of people
		with diabetes				with diabetes
		(2017)				(2045) Projected
1.	China	114.4	X	1.	India	134.3
2.	India	72.9		2.	China	119.8
3.	United States	30.2 —	▲	3.	United States	35.6
4.	Brazil	12.5	▼	4.	Mexico	21.8
5.	Mexico	12.0		5.	Brazil	20.3
6.	Indonesia	10.3 —		▼ 6.	Egypt	16.7
7.	*Russian Federation	8.5	$\overline{}$	★ 7.	Indonesia	16.7
8.	Egypt	8.2		▼ 8.	Pakistan	16.1
9.	*Germany	7.5		9.	#Bangladesh	13.7
10.	Pakistan	7.5		10.	#Turkey	11.2

*Countries listed in top 10 countries with the highest diabetic population in 2017 but not featured in estimated top 10 countries with the highest diabetic population in 2045 #Countries not listed in top 10 countries with the highest diabetic population in 2017 but featured in estimated top 10 countries with the highest diabetic population in 2045

Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017 Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-</u> tools/134-idf-diabetes-atlas-8th-edition.html (Nam Han Cho (chair) dkk. 2017)

As per the 2017 IDF report, China is leading the table with 114.4 million people known with diabetes between the age of 20-79 and is not far behind is evident when the predictions for 2045 reveals that India will surpass China and take the No.1 spot with 134.3 million people known with diabetes between the age of 20-79. The third highest populated country with people known with diabetes (USA) will have less than one-third of India's people known with diabetes population.

	Overall	Urbar	n Areas	Rural Areas		
Name of the State	Prevalence in (%) (n=57,117)	Low Socio economic status (%)	High Socio economic status (%)	Low Socio economic status (%)	High Socio economic status (%)	
Andhra Pradesh	8.4	12.7	8.8	4.5	8.8	
Bihar	4.3	4.7	15.4	1.9	5.0	
Gujarat	7.1	5.4	11.6	5.4	5.3	
Karnataka	7.7	7.2	10.8	2.9	6.4	
Punjab	10.0	16.1	11.9	7.4	8.8	
Arunachal Pradesh	5.1	12.7	8.8	2.7	5.6	
Assam	5.5	8.1	7.4	1.9	5.3	
Manipur	5.1	13.7	12.4	3.0	4.6	
Meghalaya	4.5	4.4	9.2	1.1	4.3	
Mizoram	5.8	5.6	8.3	1.3	4.5	
Tripura	9.4	15.0	7.7	5.1	8.4	
Tamil Nadu	10.4	15.5	13.3	6.5	8.3	
Chandigarh	13.6	26.9	12.9	7.8	8.3	
Jharkhand	5.3	6.8	5.6	2.6	5.6	
Maharashtra	8.4	12.2	10.6	4.5	6.8	

State-wise diabetes prevalence in India among 20 years or older in 2011 :

Source: ICMR – INDIAB – diabetes prevalence study – 2011

https://www.icmr.nic.in/sites/default/files/reports/ICMR_INDIAB_PHASE_I_FINAL_REPORT.pdf Figure -1: State-wise Diabetes Prevalence Rate among Low socio-economic and high socio-economic population (Urban)



Source: ICMR – INDIAB – diabetes prevalence study – 2011 https://www.icmr.nic.in/sites/default/files/reports/ICMR_INDIAB_PHASE_I_FINAL_REPORT.pdf





Source: ICMR – INDIAB – diabetes prevalence study – 2011 https://www.icmr.nic.in/sites/default/files/reports/ICMR_INDIAB_PHASE_I_FINAL_REPORT.pdf

As Figure 1 and 2 suggests, in the 15 states of India, in urban and rural population when the Socioeconomic Status increases the diabetes prevalence also increases is the majority of the cases. However, in urban areas of Andhra Pradesh, Chandigarh, Maharashtra, Punjab and Tamil Nadu and Northeast states like Tripura, Manipur and Assam the prevalence of diabetes was higher among individuals of low Socioeconomic Status than among individuals of higher Socioeconomic Status. Overall the Urban population has a higher diabetes prevalence rate when compared with the rural population although the gap is closing down as each year passes.

<u>Self- reported diabetes prevalence in selected districts all over Indian states and union</u> <u>territories - between ages 15-49 compared with their wealth Index and Treatment 2015-</u> <u>2016</u>

*Wealth	Per cent with	Per cent with	Per cent with	Per cent with
Index	diabetes (Male	diabetes (Male	diabetes (Female	diabetes -
	Self - reported	- who have	self-reported	Female - who
	between age	sought	between age	have sought
	15-49) (%)	treatment) (%)	15-49) (%)	treatment (%)
Lowest	1.0	57.8	0.8	64.6
Second	1.1	63.8	0.9	71.4
Middle	1.4	65.2	1.3	76.2
Fourth	2.0	73.6	2.3	84.1
Highest	2.7	81.6	2.9	88.2

Source: National Family Health Survey Report (nfhs-4) – 2015-16 Retrieved from: <u>http://rchiips.org/nfhs/NFHS-4Reports/India.pdf</u> (Indian Institute for Population Sciences (IIPS) and ICF | Ministry of Health and Family Welfare 2017) The National Family Health Survey – 2015-16 reveals that the higher the wealth index the higher per cent of people sought for diabetes treatment. The people who belong to the lowest wealth index and second category most often prefer not to take diabetes treatment which swiftly can worsen their diabetes and they may land up on diabetes-related complications sooner than expected. Diabetes expenditure is always expected to shoot up when the patient has landed with complication which eventually requires intense care hand hospitalisation.

*Wealth index- Households are given scores based on the number and kinds of consumer goods they own, ranging from a television to a bicycle or car, and housing characteristics such as the source of drinking water, toilet facilities, and flooring materials.

S	Region	Health expenditure	Health expenditure
No.		due to diabetes	due to diabetes
		(20-79 years) 2017	(20-79 years) 2045 -
		(actual) - In billion	(Projected) In billion
		US Dollars	US Dollars
1.	African	3.3	6.0
2.	Europe	166.0	163.0
3.	Middle East and North Africa	21.3	35.5
4.	North America and Caribbean	377	408
5.	South and Central America	29.3	38.1
6.	South- East Asia	9.5	14.4
7.	Western Pacific	120.3	111.6

Global diabetes total health expenditure in 2017 (actual) and 2045 (projected):

Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017 Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-tools/134-idf-diabetes-atlas-8th-edition.html</u>

<u>Top 10 countries with Total healthcare expenditure on diabetes in 2017 and 2015 among</u> <u>20-79 years (In Billion International Dollars*)</u>

Rank	Country	Diabetes Expenditure -	Diabetes Expenditure – 2015
		2017	
1.	United States of America	348	320
2.	China	110	90
3.	Germany	42	33
4.	India	31	#
5.	Japan	28	#
6.	Brazil	24	29
7.	Russian Federation	20	23

Journal of Xi'an Shiyou University, Natural Science Edition

8.	Mexico	19	#
9.	France	18	17
10.	Canada	15	14

Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017 Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-tools/134-idf-diabetes-atlas-8th-edition.html</u>

They were not listed in the top 10 countries in 2015 (Cho et al. 2018)

***Billion ID-** An international dollar would buy in the cited country a comparable amount of goods and services a U.S. dollar would buy in the United States. This term is often used in conjunction with Purchasing Power Parity (PPP) data.

India which was not even in the top 10 countries for total healthcare expenditure on diabetes in 2015 jumped into the 4th spot with more than double expenditure in just 2 years. It indicates the amount of economic burden it has over middle-income countries like India. This trend is a growing trend and won't be a stagnant one.

Top countries	with mean	<u>healthcare e</u>	expenditure p	er person	with	diabetes	<u>(20-79</u>)	<u>years)</u>
<u>in 2017</u>								

Countries	Mean diabetes-related Expenditure Per Person (20-79) with diabetes (US dollars)
United States of America	11,638
Luxembourg	8,941
Monaco	8,634
Norway	8,020
Switzerland	7,907
Netherlands	6,430
Sweden	6,406
Austria	5,918
Denmark	5,748
Canada	5,718
United Kingdom	4988
China	549
Nigeria	240
India	119.4

Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017

Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-tools/134-idf-diabetes-atlas-8th-edition.html</u>

The United States of America claimed the No.1 Spot with a mean health expenditure per person of 11,638 dollars. An Expensive medical care system, expensive drugs and more factors has to be acknowledged here. India is one of the countries where mean diabetes-related expenditure Per Person (20-79) with diabetes is very low. Lower per capita expenditure in India is due to lack of access and affordability rather than lower need.

<u>Undiagnosed diabetes population – A concealed challenge:</u>

Early diagnosis is the biggest challenge in diabetes. Diabetes is otherwise known as the silent killer especially in the case of type 2 diabetes which does not exhibit symptoms always and also at an early stage. The onset would have been early but due to the lack of awareness, lack of regular blood sugar check-ups after 30 years and lack of clear symptoms at the time of diagnosis many people already landed up with complications. The below statistics can shed light on the seriousness of the issue.

Undiagnosed diabetes population are also subject to the use of healthcare services compared to people without diabetes, and consequently likely to incur larger healthcare expenditures.

Rank	Region	Proportion undiagnosed	Number of people with undiagnosed diabetes (in millions)
1.	Africa	69.2%	10.7(6.8-19.0)
2.	South-East Asia	57.6%	47.2 (36.0- 59.4)
3.	Western Pacific	54.1%	85.9 (76.1-108.0)
4.	Middle East and North Africa	49.0%	19.0 (13.1-25.3)
5.	South and Central America	40.0%	10.4 (8.8-12.6)
6.	Europe	37.9%	22.0 (17.6-30.3)
7.	North America and Caribbean	37.6%	17.3 (14.4-19.3)
8.	India	57.9%	42.2(32.1-52.2)

People living with diabetes 20-79 years who are undiagnosed by region-wise, 2017

Source: International Diabetes Federation Diabetes Atlas, 8thedition, 2017 Retrieved from: <u>https://www.idf.org/our-activities/advocacy-awareness/resources-and-</u> *tools/134-idf-diabetes-atlas-8th-edition.html*

Almost half (49.7%) of all people living with diabetes were undiagnosed in 2017, counting for over 224 million adults. The highest percentage was found in the Africa region where 69.2% of all cases were estimated to be undiagnosed. The South-East Asia (SEA) and Western Pacific Regions were estimated to have more than 50% of cases being undiagnosed (SEA 57.6%, WP 54.1%). The lowest proportions of undiagnosed diabetes were estimated in the North America and Caribbean Region (37.6%) and the Europe Region (37.9%). (Cho et al. 2018)

Mortality and DALY (Disability-adjusted life-year):

Diabetes ranked 15th in the global list of causes of death in 1990, has risen to 9th position in 2010. Chronic Kidney Diseases has jumped from 27th to 18th rank over two

decades, while Ischemic Heart Diseases and stroke have maintained their top two positions. In South Asia, diabetes is the 10th most important cause of death.

While mortality statistics paint an overall picture of the burden of disease, disability indicators are equally important. Years of life lost (YLL) years, of life lived with disability (YLD), and disability-adjusted life years (DALY) are convenient methods of assessing disability due to various conditions, DALY's are computed by taking the sum of YLL and YLD (Bhutani and Bhutani 2014).

Diabetes did not feature among the top 30 causes of DALYs in India in 1990, but 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 contributed to 2.2% (95% UI 2.1–2.4) of the total DALYs in India in 2016. Of the total diabetes DALYs in 2016, 57.2% were from YLLs and 42.8% from YLDs. (Tandon et al. 2018)

Discussions and recommendations:

India, the country soon to be crowned as the capital of Diabetes. The question before us is, are we prepared? Definitely not is the answer.

It is undeniable that Type 2 Diabetes Mellitus was indeed a costly disease and contributes to a huge portion of the increasing economic burden of non-communicable diseases. Therefore, efforts to identify the cost-effective way to handle these issues should be made one of the priority agenda in setting the national health policy on non-communicable diseases.

Firstly to reduce the economic burden of Non-communicable disease like diabetes, our country is in urgent need to act at all levels. The government should make policy-level decisions regarding providing better health care coverage to all families. This economic burden falls heavily on the people with diabetes and their families. There is sense of urgency is required to prevent heavy out of pocket expenditure including the cost of diabetic complications. Universal health care coverage has to be ensured to all the people of India by 2025.

Early detection, prevention and treatment of diabetes-related complications (secondary prevention) can be especially beneficial in terms of patient quality of life and cost-effectiveness. (Dall et al. 2010)

Preventive measures of diabetes and early diagnosis should be given extensive focus. When people have long-standing undiagnosed diabetes, the potential benefits of early diagnosis and treatment are lost. The costs related to undiagnosed diabetes are considerable. (World Health Organization 2016) Studies reveal that more than 50% of people with diabetes are still undiagnosed in South East Asian Countries like India. Early diagnosis either prevents or postpones the patients from landing on severe complications. It also provides a time cushion for people with Pre-diabetes (People neither have high blood glucose levels to be declared as a person with diabetes nor having controlled blood glucose levels to be declared normal). If diagnosed early pre-diabetic people can increase physical activity and go on a healthy diet to prevent or postpone from landing diabetes. National-level policies should be framed to creating awareness and promote early diagnosis through all Government hospitals, Primary Health care centres and other Healthcare institutions. Through mass media like Television and Social networks like Face book, Twitter will help in reaching out to younger generations. Mobile units can be used for remote populations where the lack of access to proper healthcare itself.

Thirdly, ensuring high-quality healthcare accessible to all the people with diabetes. People with diabetes who are at high risk (severe complications) still prefer Private hospitals over Government hospitals (due to Lack of staffs, equipment, essential drugs availability and Lab facility). Strengthening the basic Infrastructure of Government hospitals and PHC's and raising the standards is the need of the hour.

Most of the diabetic complications are preventable and all of them can at least be postponed by educating patients on various aspects of diabetes like Diet, Adherence to medication, physical activity and other self-management methods. It is a highly cost-effective method.

Conclusion:

The economic burden caused by diabetes is a great challenge in front of a country like India, where the country will have 19% elderly (above the age of 60) in the total population by 2050. The Lack of comprehensive healthcare insurance coverage to the people, undiagnosed diabetes population, lack of infrastructure, lack of access to quality medical care and very little awareness about the disease is all together can hurt the economy of the nation. Effective preventive measures, creating awareness about diabetes among mass population and ensuring adequate treatment facilities are need of the hour. Swift action can reduce the damage to the economy. More than the economy the welfare of the people has to be ensured by reducing the Years of Life Lost, Years of Life lost due to disability and Morbidity.

Acknowledgement:

The author would like to thank, Dr.S.Madheswaran, Vice-Chancellor of Gandhigram Rural Institute for his encouragement & support and most prominently his Research Supervisor, Dr.S.Gunasekaran, Professor and Head, Centre for Applied Research, Gandhigram Rural Institute for his guidance and support in carrying out this research.

```
http://xisdxjxsu.asia
```

VOLUME 17 ISSUE 05

References:

- Acharya, Leelavathi, N. Rau, N. Udupa, M. Rajan, and K. Vijayanarayana. 2016. "Assessment of Cost of Illness for Diabetic Patients in South Indian Tertiary Care Hospital." *Journal of Pharmacy and Bioallied Sciences* 8 (4): 314–20. https://doi.org/10.4103/0975-7406.199336.
- Bhutani, Jaikrit, and Sukriti Bhutani. 2014. "Worldwide Burden of Diabetes." *Indian Journal of Endocrinology and Metabolism*. https://doi.org/10.4103/2230-8210.141388.
- Cataloguing, WHO Library. 2016. "Global Report on Diabetes." In *Isbn*, 978:6–86. http://www.who.int/about/licensing/.
- Cho, N. H., J. E. Shaw, S. Karuranga, Y. Huang, J. D. da Rocha Fernandes, A. W. Ohlrogge, and B. Malanda. 2018. "IDF Diabetes Atlas: Global Estimates of Diabetes Prevalence for 2017 and Projections for 2045." *Diabetes Research and Clinical Practice* 138: 271–81. https://doi.org/10.1016/j.diabres.2018.02.023.
- Dall, Timothy M., Yiduo Zhang, Yaozhu J. Chen, William W. Quick, Wenya G. Yang, and Jeanene Fogli. 2010. "The Economic Burden of Diabetes." *Health Affairs* 29 (2): 7–10. https://doi.org/10.1377/hlthaff.2009.0155.
- Dandona, Lalit, Rakhi Dandona, G. Anil Kumar, D. K. Shukla, Vinod K. Paul, Kalpana Balakrishnan, Dorairaj Prabhakaran, et al. 2017. "Nations within a Nation: Variations in Epidemiological Transition across the States of India, 1990–2016 in the Global Burden of Disease Study." *The Lancet*. https://doi.org/10.1016/S0140-6736(17)32804-0.
- Fernandes, Sophia D., and Sunny D. A. Fernandes. 2017. "Economic Burden of Diabetes Mellitus and Its Socio-Economic Impact on Household Expenditure in an Urban Slum Area." *International Journal of Research in Medical Sciences* 5 (5): 1808. https://doi.org/10.18203/2320-6012.ijrms20171585.
- Indian Institute for Population Sciences (IIPS) and ICF | Ministry of Health and Family Welfare. 2017. "National Family Health Survey (NFHS-4), 2015-16: India." *International Institute for Population Sciences (IIPS) and ICF*, 1–192. https://doi.org/kwm120 [pii]10.1093/aje/kwm120.
- 9. Nam Han Cho (chair) dkk. 2017. *Eighth Edition 2017. IDF Diabetes Atlas, 8th Edition*. https://doi.org/http://dx.doi.org/10.1016/S0140-6736(16)31679-8.
- 10. Ramachandran, Ambady, Shobhana Ramachandran, Chamukuttan Snehalatha,

http://xisdxjxsu.asia

Christina Augustine, Narayanasamy Murugesan, Vijay Viswanathan, Anil Kapur, and Rhys Williams. 2007. "Increasing Expenditure on Health Care Incurred by Diabetic Subjects in a Developing Country: A Study from India." *Diabetes Care*. https://doi.org/10.2337/dc06-0144.

- 11. Tandon, Nikhil, Ranjit M. Anjana, Viswanathan Mohan, Tanvir Kaur, Ashkan Afshin, Kanyin Ong, Satinath Mukhopadhyay, et al. 2018. "The Increasing Burden of Diabetes and Variations among the States of India: The Global Burden of Disease Study 1990–2016." *The Lancet Global Health* 6 (12): e1352–62. https://doi.org/10.1016/S2214-109X(18)30387-5.
- World Health Organization. 2016. "Diabetes: Scale up Prevention, Strengthen Care & Enhance Surveillance."
- 13. Yesudian, Charles A.K., Mari Grepstad, Erica Visintin, and Alessandra Ferrario.
 2014. "The Economic Burden of Diabetes in India: A Review of the Literature." *Globalization and Health* 10 (1): 1–18. https://doi.org/10.1186/s12992-014-0080-x.