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Diabetes care in India: Physician practices and perspectives

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Abstract

Diabetes care in India: Physician practices and perspectives
By Seema D Shah

Aims: To describe physicians' practice characteristics, services and views on diabetes care in India in context of the Chronic Care Model and Innovative Care for Chronic Conditions Framework.

Methods: 160 physicians attending a national diabetes conference in India in 2009 responded to an anonymous, self-administered paper survey regarding their clinic characteristics, diabetes management resources, clinical targets and patient performance, and barriers and needs for optimal diabetes care.

Results: The sample of predominantly male, urban private-practice specialists reported that providing optimal care is challenging in a resource- and time-constrained setting with high patient loads. Diabetes cases represent half of the physicians' patients, with an age range of 31-60 years, who are largely homemakers or have sedentary jobs. Proper patient follow-up and self-management education are lacking. Conferences, journals, internet, and the pharmaceutical industry are major education sources. Although 77% of physicians report using standardized guidelines, roughly 50% of patients are meeting the targets. At a clinic level, integration of electronic record-keeping (60% are paper only), decision-support, and more non-physician staff are areas of need. At the community level, improving public awareness and access to affordable medications and services are major issues.

Conclusion: Physicians in India are aware of the patient, healthcare organization and community/policy level issues that are resulting in sub-optimal quality of diabetes care. Research associations and training institutions, in collaboration with other sectors and the public, have the capacity and opportunity to provide access to quality resources and training to improve diabetes care delivery, advocate for regional and national quality assurance and capacity-building, and raise public awareness.

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ABBREVIATIONS

ADA	American Diabetes Association
CAM	complementary alternative medicine
CCM	Chronic Care Model
CDC	Centers for Disease Control
CMD	cardiometabolic disease
CVD	cardiovascular disease
DALY	disability-adjusted life year
EASD	European Association for the Study of Diabetes
ESC	European Society of Cardiology
ICCC	Innovative Care for Chronic Conditions
ICMR	International Council for Medical Research
IDF	International Diabetes Federation
IT	information technology
NCD	non-communicable disease
NPCDCS	National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke
QALY	quality-adjusted life year
T2DM	type 2 diabetes
WHO	World Health Organization

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CHAPTER I

Introduction

Diabetes is a leading non-communicable disease globally with an estimated 285 million adult cases in 2010, more than 70% of which were in developing countries with China and India leading the way [1]. India had an estimated 50.8 million cases of diabetes for 2010, and this number is projected to reach 87 million by 2030 [2]. Age-standardized and world-population adjusted estimates place the prevalence at 7.8%, in comparison to the prevalence of 10.3% in the United States, with higher rates in urban centers and regionally in southern states [2-4]. The growth of diabetes and related cardiometabolic diseases has been attributed to industrialization, globalization and rapid technologic and socioeconomic development and related demographic, nutritional and epidemiologic transitions that contribute to the traditional behavioral cardiometabolic disease risk factors and unmask ethnic predispositions [5, 6]. Diabetes results in a higher occurrence of disabling complications, increased psychosocial burden, higher healthcare costs and reduced life expectancy – representing a major individual, public health and socioeconomic burden for India.

Diabetes mellitus is characterized by increased blood glucose (hypergylcemia), which results from a lack of insulin, an essential hormone for carbohydrate metabolism, impaired action of insulin, or both. This etiology forms the basis of its major classifications: Type 1 diabetes occurs in childhood and is due to insulin deficiency caused immune-mediated destruction of the insulin-producing beta-cells in the pancreas. Type 2 diabetes is the most predominant form, and is caused by a combination of genetic

and lifestyle factors, occurs predominantly in adults but is increasing at younger ages due to the earlier onset of obesity, increasing insulin resistance in the body. Other less common types of diabetes are related to pregnancy and other pancreatic and genetic abnormalities. In this study, the general term of diabetes refers to type 2 diabetes [7].

Long-term uncontrolled diabetes results in serious complications such as vision loss, foot amputations, kidney failure, heart attacks, strokes and early death [7]. Although diabetes is not ranked among the top ten causes of mortality in India, individuals with diabetes generally die from leading causes such as cardiovascular and renal complications [8-10]. The morbidity from diabetes, however, causes the most significant social and financial burden on the individual and society. The financial burden is only one facet of diabetes, as the psychosocial health of the patient and the family who care for the patient are also affected, which contributes to the challenge of providing optimal diabetes care [11].

Consensus exists on clinical and community interventions to prevent and manage diabetes [12]. They combine modifiable lifestyle risk factor management (i.e. diet, physical activity, stress, tobacco), intensively controlling blood pressure and cholesterol levels together, and preventative checks (e.g. annual eye, foot, and urine tests) to identify precursors of progression to complications [12-16]. Yet, the few studies from India demonstrate poor quality of chronic disease care where glycemic, lipid, and BP targets are not achieved in almost half the subjects surveyed, and only 17.5% of patients are using aspirin [17-19]. Thus, despite evidence demonstrating efficacy of interventions for diabetes management, their implementation is far from optimal in India.

Chronic disease care is rooted in complex interactions between providers, patients, and systems to ensure routine health care [20]. The Chronic Care Model (CCM) (Figure 1), developed in the early 1990s, provides a conceptual framework of the multi-level interactions required for optimal quality of care [21]. The Chronic Care Model includes six main elements: the health system, delivery system design, decision support, clinical information systems, self-management support, and the community (resources and policies), which facilitate productive interactions between the provider team and patient. In 2003, further themes were added to the model's elements to reflect research and program advances in chronic disease care; they include patient safety, cultural competency, care coordination, community policies, and case management [22]. Studies have shown the effectiveness of the model's application to improve clinic and patient outcomes in diabetes care [23, 24]. Moreover, it can be applied to a variety of health care settings and target populations, because it allows the flexibility to still explore the local context within its framework elements and has been tested in settings with different ethnicities and socioeconomic groups [21, 25, 26].

To accommodate the limited resources and sociocultural differences of low and middle-income countries, the World Health Organization (WHO) created the Innovative Care for Chronic Conditions (ICCC) framework (Figure 2), which organizes CCM elements along micro (patient and family), meso (health care organization and community), and macro (policy and financing) levels, emphasizing the roles of the patients, communities, health care providers and policy makers [27].

FIGURE 1: Chronic Care Model (CCM)

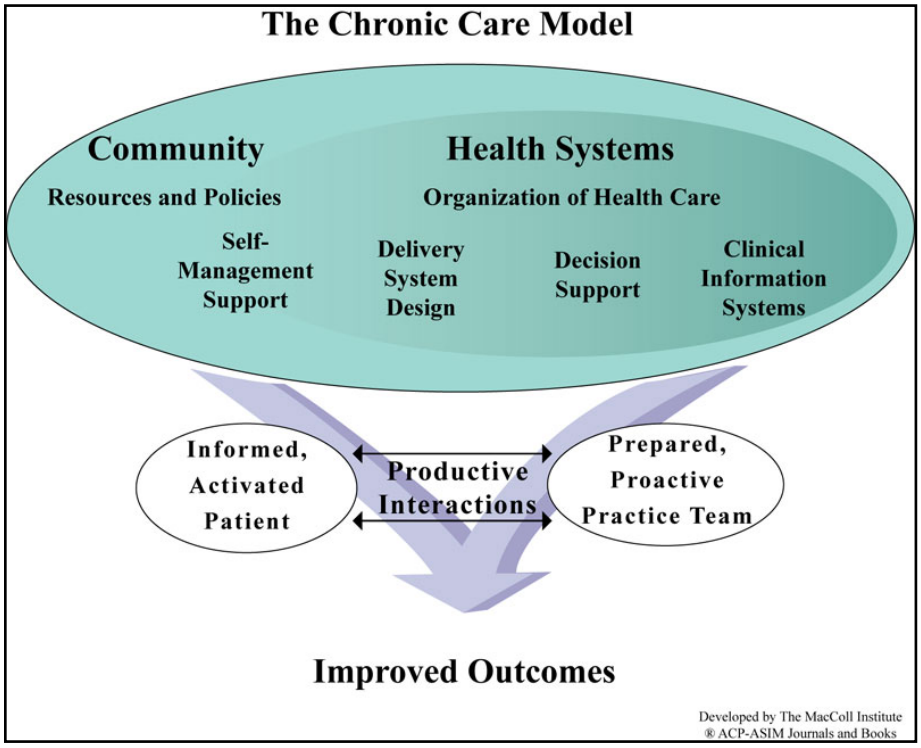
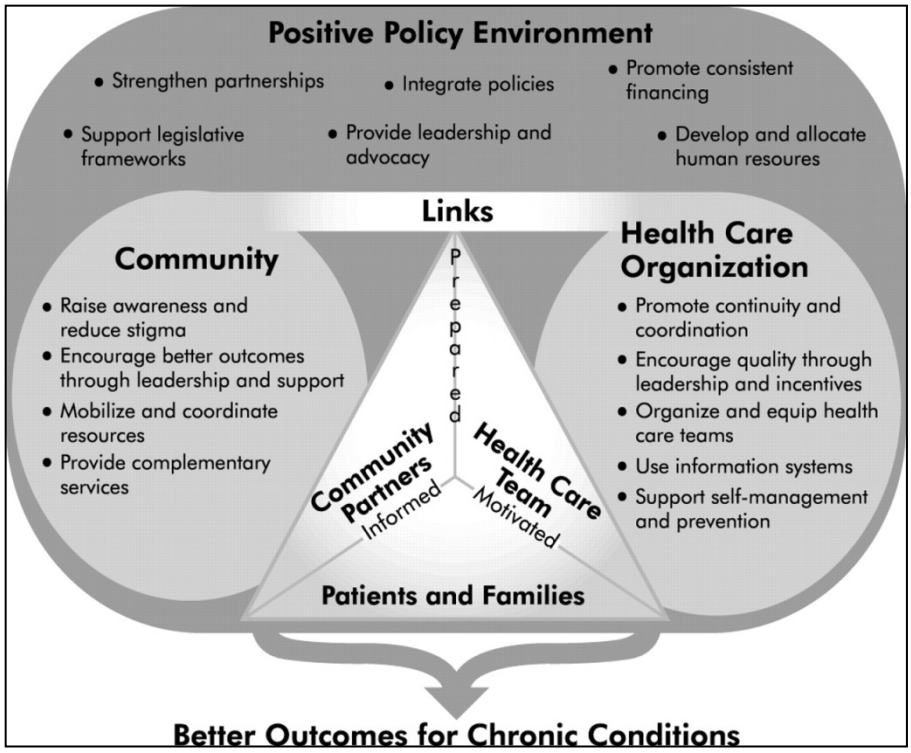


FIGURE 2: Innovative Care for Chronic Conditions (ICCC) Framework, WHO



Purpose of Study

This study assessed physicians' practices and performance and their perceptions of diabetes care in India and recommendations for improvement. The aim was to gather evidence to help develop locally-relevant diabetes management initiatives to curb the Indian diabetes epidemic.

Research Questions

The Chronic Care Model was utilized to guide this assessment of physicians' practices and perspectives on diabetes care in India. With the presented evidence regarding the need to improve quality of diabetes care in India, the investigator sought to understand the clinical context and provider practices, and focused on the CCM healthcare organization elements of delivery system design, clinical information systems, decision support, and self-management support. Given the above rationale, this study seeks to answer the following research questions regarding diabetes care by physicians in India within the CCM context:

- **Delivery System Design**

  (1) What are the provider demographics and clinic and patient characteristics?

  (2) What is the distribution of allopathic and non-allopathic management among patients?

- **Clinical Information Systems**

  (3) How is information technology used in clinical practice?

  (4) What type of record-keeping is used?

- **Decision Support, Self-Management Support**

  (5) Which are the sources for medical references and guidelines?

  (6) What patient education or resources are provided?

  (7) What reminders are sent to patients?

  (8) Do clinicians know of standard evidence-based targets for patient care and what percentage of patients are meeting these targets?

- **General-all elements**

  (9) What are the barriers for optimal diabetes care and where should efforts be focused to improve care?

TERMS

Cardiometabolic disease (CMD): CMD refers to a clustering of risk factors (abdominal adiposity, dyslipidemia, hypertension, hyperinsulinemia, and glucose intolerance) that together lead to cardiovascular disease and type 2 diabetes.

Disability-adjusted life year (DALY): The sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability.

Quality-adjusted life year (QALY): A QALY is a measure of disease burden that includes quantity and quality of life: an arithmetic product of life expectancy and quality of the remaining life-years. It weights time in different health states: one year of perfect health equals 1, death equals 0, and less than perfect health is between 1 and 0. Some health states are considered worse than death and have negative scores. QALY provides a common measure to assess the extent of benefits gained from interventions with respect to health-related quality of life and survival for the patient.

Type 1 diabetes: Type 1 diabetes is a state of reduced or no insulin, the hormone that allows glucose in the blood to enter and be used by the body's cells. It is caused by destruction of the insulin-producing cells of the pancreas, typically due to an auto-immune reaction (attack by the body's own defense system) for reasons that are still unclear. The disease can affect people of any age, but it usually occurs in children and young adults, and people with the disease need daily injections of insulin to survive.

Type 1 diabetes is also referred to as immune-mediated, insulin-dependent, or juvenile-onset diabetes.

Type 2 diabetes (T2DM): Type 2 diabetes is characterized by insulin resistance and relative insulin deficiency, either of which may be present at the time that diabetes becomes clinically manifest. It is often, but not always linked to obesity, from over-nutrition and sedentary lifestyle, and is also affected by aging and familial and ethnic risk factors. The diagnosis of type 2 diabetes usually occurs after the age of 40 years but could occur earlier; there are increasing reports of children developing type 2 diabetes. In contrast to type 1 diabetes, people with type 2 diabetes are not dependent on exogenous insulin and are not ketosis-prone, but may require insulin for control of hyperglycemia if this is not achieved with diet alone or with oral hypoglycaemic agents.

Complications of diabetes

Cardiovascular disease (CVD): CVD includes diseases of the heart and blood vessels: angina (partial heart blood vessel blockage usually causing pain/discomfort), myocardial infarction or heart attack (full blockage of a heart's blood vessel, damaging the heart muscle and can lead to death), stroke (blockage of the blood vessels in the brain), peripheral artery disease (blockage of blood vessels in appendages), and congestive heart failure (heart muscle cannot pump blood properly resulting in symptoms such as difficulty breathing due to backup of water in the lungs, leg edema, and organ dysfunction because of decreased blood flow). CVD is the major cause of mortality among patients with diabetes.

Nephropathy: Nephropathy is a broad term for disease or damage of the kidneys. Major causes include diabetes, hypertension (high blood pressure), medications, and genetic abnormalities. Diabetic nephropathy (caused by damage to the blood vessels in the kidneys) is the most common cause of end-stage renal disease, which requires either dialysis (therapy to filter/clean blood) or kidney transplantation.

Neuropathy: When blood glucose and blood pressure are not controlled, diabetes can harm the nerves. This includes problems with digestion and urination, impotence, and most commonly peripheral neuropathy – which results in tingling and loss of sensation in the feet and legs. Loss of peripheral sensation can cause foot injuries to go un-noticed, leading to major infections and amputation.

Retinopathy: Diabetic retinopathy, damage to the blood vessels of the retina (light-sensitive eye tissue), can result in blurred vision and blindness. For some people, this results from macular edema, where the macula (part of the retina that provides sharp, central vision) swells from fluid build-up behind the retina. Damage to blood vessels may go unknown until proliferative retinopathy occurs, where there is growth of new blood vessels on the retinal surface, which can bleed and cause blindness. Since progression can be symptomless, regular eye examinations are important. Diabetes also increases the risk of other eye problems, specifically cataracts (clouding the eye lens) and glaucoma (increase in fluid pressure inside the eye causing optic nerve damage and loss of vision).

CHAPTER II

Literature Review

This chapter describes the literature review for this study. It includes the epidemiology of diabetes in India, including the traditional modifiable risk factors and the ethnic risk factors, standards for care, the current quality of diabetes care in India, and potential barriers to optimal diabetes care in reference to the components of the Chronic Care Model integrating the community, health system, provider team, and patient.

Epidemiology of diabetes in India

Type 2 diabetes is a major public health problem worldwide and in India. In 2010, the International Diabetes Federation estimated 285 million adults living with diabetes mellitus worldwide, which is expected to reach 430 million in 2030; this does not account for the larger number undetected or with pre-diabetes [1]. The number of people with diabetes is higher in developing countries with large populations like India which has an estimated 50.8 million cases or 18% of the world-wide cases [2]. The rise in diabetes can be attributed to socioeconomic development, aging populations, increasing urbanization, and globalization. These societal changes have resulted in changes in food consumption, reduced physical activity and other harmful behavioral patterns, that are familiar in high-income countries and now rapidly affecting low- and middle-income countries [5].

Due to the socioeconomic, demographic and health transitions, the prevalence of diabetes in India has gone from estimates of 1-2% before the 1950s to a national estimate

of 7.1% (2010), with urban and rural regions being on opposite ends having estimates of 7.3% and 3.1% on self-report respectively in a 2003-05 study [2, 3]. A 2001 national survey of stratified randomly sampled 11,216 adults from varied socioeconomic strata in 6 major Indian cities found age-adjusted prevalence of 12.1% for diabetes and 14.0% for impaired glucose tolerance with no gender differences [28]. Other studies since 2003 have found urban prevalence rates as high as 18-19% (crude) in South Indian cities in the states of Tamil Nadu and Kerala [29, 30]. In contrast, Northern cities had an age-adjusted prevalence of 5.2% in the state of Kashmir [31] and 8.6% in Jaipur, Rajasthan [32]. Most studies either use the World Health Organization (WHO) or American Diabetes Association (ADA) criteria for diagnosing diabetes, but there is still considerable variation in the generalizability of sample characteristics (e.g. age, gender, urban/rural), and the reporting of crude versus age-standardized rates [4]. Despite such variations in study design and analysis, a review of diabetes epidemiologic studies since 1988 shows obvious differences in prevalence rates in urban, semi-urban and rural populations: 5-15%, 4-6%, and 2-5% respectively [33]. Moreover, the study showed significant trends of the increasing diabetes prevalence over time for urban and rural populations, although at a slower rate in the rural areas [33].

The urban-rural differences in diabetes rates highlight the association of urbanization with worse health behavior; that is, an environment that lead to less physical activity (e.g. driving a scooter) and over-nutrition (e.g. access to and consumption of more processed foods, fast foods, higher fat and sugar content) [4, 6]. The greater prevalence in South India versus Northern and Eastern regions may be attributed to the intake of a higher glycemic load (e.g. polished rice that is a staple part of the diet) [34],

an example of increased dietary risk. Diabetes in India does have a positive and independent association with other established correlates like age, body mass index, waist-hip-ratio, family history, sedentary physical activity, and monthly income [28].

However, this disease that was mainly among the affluent who could afford rich foods and the mechanized lifestyle is growing among those with less income, who generally experience under-nutrition and active lifestyles [35]. This trend can been explained by the early fetal origins hypothesis, which explains that individuals with undernourished fetal environments have metabolism wired to function in a "famine state," such that when faced with increased nutrition, the body does not have the insulin capacity and other biochemical setup to respond appropriately [36]. This gene-environment interaction manifests as obesity, insulin resistance and type 2 diabetes and future cardiovascular complications [36]. Moreover, among people of South Asian origin, diabetes, cardio-metabolic risk factors [37, 38] and events [39, 40] occur at younger ages and lower body mass indices (BMI) when compared to other ethnic groups [6, 36, 40-51], and are rapidly increasing with socioeconomic and nutrition transitions [52-55]. In the Indian national urban diabetes survey, more than 50% of diabetic patients had an onset before 50 years of age [28]. This translates into more disability-adjusted life years (DALYs) from earlier chronic disease morbidity.

The presence of insulin resistance despite a lower BMI among Indians could also be explained by the tendency for South Asians to abdominal fat distribution rather than the uniform distribution among Caucasians [56-58]. Abdominal obesity is linked to early insulin resistance and is a key contributor to metabolic syndrome, and this relationship predisposes South Asians to diabetes and CVD at earlier ages development of

cardiovascular complications [57]. For example, 35% of CVD-related deaths in India occur in those between 35-64 years of age as compared to only 12% in the United States [59]. South Asians, as a group, are projected to account for between 40-60% of the global CVD burden within the next 10-15 years [60].

Standards for Diabetes Care and Prevention

The mentioned ethnic/gene-environment risk of Indians towards early insulin resistance and diabetes, is unmasked when exposed to a conducive lifestyle. In addition to the development of cardiovascular complications (i.e., heart attack, stroke) that occur, other common complications include kidney disease, vision problems, loss of sensation which leads to foot ulcers/amputations, sexual dysfunction, skin problems, and increased risk for infections [61]. However, robust evidence exists for the prevention of diabetes complications by the appropriate management of diabetes and comorbid conditions like hypertension and dyslipidemia, which are also risks for CVD. For most chronic non-communicable diseases like diabetes, the current aggregated evidence from large trials supports combining modification of lifestyle choices (better nutritional choices, regular physical activity, plus tobacco avoidance and/or cessation) [62-69] with intensive and multi-faceted risk factor management (i.e., intensively controlling blood pressure and lipid levels together) [13-15] and preventative checks (e.g. annual eye, foot, and urine tests) to identify precursors of progression to complications (cardiovascular disease, retinopathy, nephropathy, neuropathy, peripheral artery disease).

Major organizations and research bodies, such as the World Health Organization (WHO) [70], International Diabetes Federation (IDF) [1, 12], Centers for Disease Control

(CDC) [71], the American Diabetes Association (ADA) [72], and the European Association for the Study of Diabetes (EASD) and European Society of Cardiology (ESC) [73] have guidelines and recommendations for the prevention and management of diabetes and chronic diseases. These include information for individual care such as integrated disease management (e.g., clinical standards for diagnosis and treatment) and self-management and education, as well as population-level prevention strategies to foster an environment that promotes healthy lifestyles. The ADA/EASD [74] and the IDF [12] have provided consensus statements, although there is debate about the rigor of evidence and comparability to other recommendations [75, 76]. Policy literature, such as Disease Control Priorities in Developing Countries and a recent World Bank publication, also highlights individual to population-level strategies to curb non-communicable diseases, addressing cost-effectiveness and other implementation aspects [77-79].

The Indian Council of Medical Research (ICMR) has also developed its own set of diabetes management recommendations. Table 1 below presents a comparison of the 2009 ADA [80] and 2005 ICMR evidence-based targets [81] for major physical and biochemical risk factors and processes of diabetes care. They are largely similar, expect for the difference in BMI to account for ethnic variability.

Table 1: Comparison of American Diabetes Association (2009) and Indian Council of Medical Research (2005) targets for risk factor control and processes of diabetes care

	ADA recommendations (2009) [80]	**ICMR recommendations (2005) [81]**
Target risk factors		
Glycosylated hemoglobin	< 7.0% individualize based on patient profile	Ideal <7.0% Satisfactory 7-8%
Fasting plasma glucose	3.9-7.2mmol(70-130mg/dl)	Ideal <110mg/dl Satisfactory 111-125mg/dl
Post-prandial glucose	<180mmol/l(180mg/dl)	Ideal 120-140/dl Satisfactory 140-180mg/dl
Total cholesterol		<180mg/dl

LDL-cholesterol	<2.6mmol/l(100mg/dl); <1.8mmol/l (70mg/dl) if overt CVD	<100mg/dl
HDL-cholesterol	Men:>1.0mmol (40mg/dl) Women:> 1.3mmol(50mg/dl)	>45mg/dl
Triglycerides	<1.7mmol (150mg/dl)	<150mg/dl
Blood pressure control	<130/80mmHg	Ideal <130/80mmHg Satisfactory <140/90mmHg /dl
Body mass index (BMI)	<25 kg/m^2	20-23kg/m^2
Waist-hip ratio		Men <0.9; Women <0.85
Processes		
Physician visits		At least every 3 months
Glycosylated hemoglobin testing	At least twice a year. Every 3 months, if change in therapy or not meeting targets	Every 3-6 months
Lipids	Annually	Annually
Cardiac risk evaluation	Annually	ECG- Annually (if >40 years)
Dilated pupil fundus examination	Annually	Annually
Kidney function tests	Serum creatinine and estimation of GFR –annually	Blood urea/serum creatinine annually
Comprehensive foot exam	Annually	

There are also many government and non-governmental initiatives for diabetes prevention in India. In 2008, the government of India launched National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS) with an overall objective to prevent and control non-communicable diseases [82]. The strategies include prevention through behavior change, early diagnosis and treatment, capacity building of human resource and surveillance, monitoring and evaluation. The NPCDCS will be integrated with existing health care system at the district level and below, ensuring proper staff and health center facilities, including electronic health records with integrated decision-support features and linked information systems. Such a program addresses many of the health system issues to improve chronic disease care, but the program is still in the process of scaling up and tailored implementation is still necessary. Other non-governmental initiatives exist through

private hospitals and international and domestic research organizations [83, 84], pharmaceutical companies [85], and professional associations [86]. These efforts from various sectors and collaborative groups capture the need and scope for involvement in diabetes prevention and control interventions.

Quality of Care

Despite the presence of evidence-based guidelines and standards as well as cost-effective strategies for diabetes prevention, implementation of evidence-based interventions is still far from optimal in India. Studies assessing quality of diabetes care in India are few and only from a few large cities. There have been three population-based studies in India: one study from North India [17] was among middle- and high-income group of urban Delhi in 2006 among 35-65 year age group, and two other studies were from South India – Tamil Nadu [87] and Kerala [88] , among adults more than 20 years and 18 years respectively. These surveys reported that less than 40% of patients achieved adequate glycemic control, 40-75% had deranged lipid profile and two-thirds of patients were with uncontrolled hypertension. This high level of suboptimal quality of care increases the burden of macro- and micro-vascular complications of diabetes.

The prevalence of complications of diabetes had mainly been studied in established diabetes clinics but more recently in population-based studies [89]. These studies reported the prevalence of coronary artery diseases in India at 11-22% [37, 90], peripheral vascular diseases at 6% [91], peripheral neuropathy at 19-27% [92-94], retinopathy at 17-26%[95, 96] and microalbuminuria at 26-36% [97, 98]. With an estimated 40 million diabetes cases in India 2010, this translates to at least 7 million

people with retinopathy, 0.8 million with nephropathy, 10.4 million with neuropathy, 8.5 million with coronary artery disease and 2.5 million with peripheral vascular disease [4].

Inadequate processes of care are ubiquitous in the India. Even among 819 middle- and high-income diabetes patients in Delhi, only 13% had HbA1C tested, 3.1% tested for foot exam, and 16% had dilated eye exam in last year. Also, 32.1% had cholesterol tested, only 3.1% were on lipid lowering drugs and less than 20% taking aspirin [17]. One small study in 2008, at a teaching hospital in West Bengal, showed inadequacy of diabetes treatment [99]. Nearly 50% of the 983 patients were either not getting oral hypoglycemic agents or getting it in inadequate doses despite being indicated. Whether this is due to physician's inertia or patient's factors or the combination is not known.

Barriers to optimal diabetes care in context of Chronic Care Model

Below are some highlighted challenges in reviews of diabetes care in India, which address the multiple players in the Chronic Care Model [21], such as the health care system, provider team, patient, and community.

Health care system and cost: In India, health care delivery is fragmented, comprised of insufficient state-run free government services and a growing private sector, which is preferred by those who can afford it; both of which benefit primarily urban populations [100, 101]. As health insurance is not yet widespread, most Indians continue to pay for private healthcare out-of-pocket, and average annual diabetes-related costs can range from Rs 3,310 for outpatient care to Rs 13,880 for those who require surgical care,

representing 7.7% and 16.3% of income [100]. A direct cost assessment of 556 diabetic subjects from both urban and rural regions of seven states in India conducted from 1998-2005, found total mean expenditure on health care to be higher among urban subjects (Rs 10,000-$227) versus rural subjects (Rs 6,260-$142), although it represented a higher percent of family income for the rural subjects who have approximately one-third of annual family income as urban subjects (Rs 36,000-$142 versus Rs 100,000-$2273) [102]. Estimating an average of the rural-urban cost of $185 for the current estimate of 50.8 million Indians with diabetes equals a total cost of $9.4 billion per year. Moreover, the economic burden of diabetes is only rising as the total urban subject cost increased by 113% from 1998 to 2005 [102].

Patient characteristics, community awareness and perceptions: Level of education appears to have a major effect on diabetes prognosis (complication free-rate of 44.6% college-educated versus 19.5% illiterate), because patients with a higher education level have been shown to have a better understanding of the illness and therefore potentially better self-care, but this could also be confounded by an improved socioeconomic status which allows more access to medical care. Other positive predictors for better care included having employment, higher family income and support, and living in an urban area [103].

Also among patients, the use of complementary/alternative medicine (CAM) has been reported as approximately 70% by two studies at urban hospitals in Northern India, each with approximate 400 diabetes patients of varying socioeconomic strata. The perceived benefit of CAM was 40% and 60% in the two studies. Naturopathy,

acupressure, Ayurveda, and homeopathy were the main forms of CAM used by the respondents. Both studies reported that main use was for early and quick relief of symptoms [104, 105].

At the general public level, there are gaps in knowledge about diabetes in India. In the South Indian city of Chennai, one study found that 25% of their sample of 26,000 Chennai adult residents were not aware of a condition called 'diabetes' and 60% of those with diabetes did not know that it further affects the body. Moreover, more than 20% people did not know that diabetes is preventable and what could be done to reduce an individual's risk [106]. Another study of 3681 adults in urban India found that those with higher education or executive jobs or had diabetes were slightly more aware about diabetes (risk factors, symptoms, complications, prevention), but the median score was 16/65 (25%), demonstrating overall poor public awareness and a need to improve education among those with diabetes [107].

Physician and Clinic Practices: A survey published in 1998 of 393 Indian physicians (76 diabetologists, 151 consulting physicians, and 166 general practitioners) who provide diabetes care in 8 cities examined their perceptions about diabetes management and attitudes towards patients. The study found that non-pharmalogical treatment was used twice as much in North India, and general practitioners see patients earlier but are less aggressive about using insulin with patients. There was lack of familiarity with guidelines in terms of medication therapy, and physicians only advised blood glucose monitoring to 70% of patients with Type 1 diabetes, signaling improper understanding about the importance of monitoring. The physicians believed that patients

were fearful of using insulin, while many of the patients did not report this fear. The study concluded that inadequate training for the non-specialist is another barrier for optimal care; the complexity of treatment options can make physicians reluctant to change patient regimens [108]. In terms of healthcare organization, clinic settings are often under-resourced (e.g., staff and equipment/services) and crowded, especially government centers [4]. There are limited studies examining the clinic operations and management resources used for diabetes care in India.

Conclusion

With the rapidly growing burden of diabetes in India, modifiable lifestyle risk factors are a priority to address from clinical to community to policy levels addressing issues like food and drug regulation, community interventions to promote healthy lifestyle, and partnerships between different economic sectors [78]. Clinical care for Type 2 diabetes must be accessible, proactive, patient-centered [109], evidence-based [71, 110, 111] and comprehensive with embedded continuity and accountability [112]. Yet, this is not the case as evidenced by the low quality of care reported in regards to physician adherence to processes and patient meeting targets. Moreover, there are many issues at the patient, community and health systems level that affect the provider's practice, including the provider's own perceptions and knowledge of current standards. The epidemiology and management of diabetes has changed significantly since Indian physician practice studies on diabetes care [113], warranting research to understand the current provider characteristics, including clinic information systems, education resources

and activity, and views on gaps in optimal care, with the aim to identify areas for improvement in diabetes care in India.

CHAPTER III

Methods

Introduction

This chapter describes the methodology used in this survey study to examine the practice and patient characteristics of physicians who provide diabetes care in India and their suggestions to improve diabetes care in India. The chapter describes the study population, the sample, the research design and protocol, the data collection instrument, face and content validity, and methods of data analysis.

Target Population

The target population was physicians who provide diabetes care from the various regions of India, from urban to rural settings, and with varied clinical training and patient profiles. The goal was to have representation of the spectrum of diabetes care providers in India.

Sample

The study sample consisted of physicians attending a national conference addressing diabetes care and research in the city of Ahmedabad, Gujarat in 2009. Approximate 2,000 physicians attend the conference, and they range from general practitioners to endocrinologists who provide diabetes care and hail from all parts of India.

Research Design and Protocol

The design of this research is a cross sectional survey study of physicians in India who provide diabetes care to understand their practices and views to improve diabetes care. A self-administered questionnaire was created with measures or items from previous tools and studies surveying physicians who provide diabetes care [113, 114].

After piloting, the final anonymous questionnaire was distributed at a national diabetes conference in October 2009 over the course of 2 days. Conference organizers placed paper copies of the questionnaire with the study information sheet (waived consent) in participants' bags and the investigator also distributed the questionnaire to participants during break sessions. Announcements were made at the end of major sessions to request attendee participation in the study. Participation was voluntary; no compensation was provided and physicians were not approached individually. The questionnaires were collected from drop-boxes outside the conference rooms at the end of the conference.

The questionnaire was a component of a larger study on diabetes care in India with institutional review board approval from Emory University and approval by the conference organizers and scientific committee.

Data Collection Instrument

The questionnaire was comprised of multiple choice and open-ended questions. There were a total of 35 items, 6 with multiple sub-items. The questionnaire took approximately 20 minutes to complete. The questionnaire covered the following themes:

(1) physician respondent and clinic characteristics, including training level, type and location of practice, clinic schedule, number of diabetes patients seen per day, how diabetes patients are referred to the clinic and how many return for follow-up, patient demographics, and research activity; (2) use of information technology in clinical practice, type of record-keeping, database setup and type of information accessed; (3) resources and services for diabetes management including who provides patient education in the clinic setting, use of patient education resources, guidelines, references, continuing medical education credit description, reminders for patients; (4) clinical targets used and patient performance regarding the clinical targets; (5) use of allopathic and non-allopathic treatments by patients (6) payment types, and (7) open-ended questions about barriers to providing optimal care and suggestions for areas to improve diabetes care in India (see Appendix A).

Face and Content Validity

The principal investigator pilot-tested a draft of the study tool with 14 physicians at a local diabetes research conference in New Delhi, India. These physicians were from urban and rural areas, with varied training and practice characteristics. They were instructed to assess the general ease of filling out the questionnaire (e.g. font size large enough, sufficient space to answer questions, no confusing format), any questions that were difficult to understand or be misinterpreted, suggestions for modifying such questions, and questions that should be removed or added per their experience. Their feedback was incorporated into a first version of the questionnaire, which was reviewed by a smaller set of research colleagues not familiar with the study, to assess general ease

of completing the questionnaire as well as any difficulties understanding questions. The questionnaire underwent minor edits to produce a final second version.

Data Analysis

The investigator and another trained researcher entered the data into Microsoft Excel (Mac 2008). All statistical analysis of quantitative data was performed using SPSS version 17 [115]. Frequencies and descriptive statistics of continuous and categorical variables were determined.

Analysis of qualitative data was done in Microsoft Excel and followed the thematic analysis methodology whereby key themes are identified inductively from the textual data. The investigator read each response and noted themes in additional columns. The themes were reviewed and similar themes were grouped. The responses were re-read, and under each theme column, the frequency of response for the any of the listed themes was marked ("1" for present, "0" for not present). The themes developed were lastly categorized under the Chronic Care Model elements. Themes which had 11-25 numbers in frequency were categorized as medium strength and those over 25 as high strength.

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Original Research Paper

Title: Diabetes care in India: Physician practices and perspectives

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Abstract

Aims: To describe physicians' practice characteristics and views on diabetes care in India in context of the Chronic Care Model and Innovative Care for Chronic Conditions Framework.

Methods: 160 physicians attending a national diabetes conference in India in 2009 responded to an anonymous, self-administered paper survey regarding their clinic characteristics, diabetes management resources, clinical targets and patient performance, and barriers and needs for optimal diabetes care.

Results: The voluntary sample of predominantly male, urban, private-practice specialists finds providing optimal care challenging in a resource- and time-constrained setting with high patient loads. Proper patient education, follow-up and self-management are lacking. Conferences, journals, internet, and the pharmaceutical industry are major education sources. Although 77% of physicians report using standardized guidelines, roughly 50% of patients are meeting the targets. At a clinic level, integration of electronic record-keeping (60% are paper only), decision-support, and more non-physician staff are areas of need. At the community level, improving public awareness and access to affordable medications and services are major issues.

Conclusion: Physicians in India are aware of the patient, healthcare organization and community/policy level issues that are resulting in sub-optimal quality of diabetes care. Research associations and training institutions, in collaboration with other sectors and the public, have the capacity and opportunity to provide access to quality resources and training to improve diabetes care delivery, advocate for regional and national quality assurance and capacity-building, and raise public awareness.

Keywords: diabetes, India, quality of care, Chronic Care Model, ICCC Framework

Introduction

Factors such as rapid economic development, changes in lifestyle, and ethnic susceptibility have all been proposed to explain the high and growing diabetes burden in India [1-4]. At the same time, addressing modifiable lifestyle risk factors and proper clinical care following evidence-based guidelines and interventions are effective in preventing diabetes-related morbidity and mortality and reducing costs [5-7]. Yet, studies show suboptimal quality of diabetes care in India with regards to process indicators (e.g., preventive exams) and patient outcomes (e.g., HbA1c, blood pressure, cholesterol); improvements in implementation of strategies en mass are needed [8, 9].

The Chronic Care Model (CCM) provides a conceptual framework of important evidence-based care elements to facilitate patient and provider interactions to produce better outcomes [13]. The CCM elements include community (resources and policies), health system, and 4 cores under health care organization: self-management support, delivery system design, clinical information systems, and decision-support [13]. Interventions with CCM elements have shown to improve patient and clinical outcomes and have been effective in diverse clinical and population settings in mainly developed countries [14-16]. To accommodate the limited resources and sociocultural differences of low and middle-income countries, the World Health Organization (WHO) created the Innovative Care for Chronic Conditions (ICCC) framework (Figure 1), which organizes CCM elements along micro (patient and family), meso (health care organization and community), and macro (policy and financing) levels, emphasizing the roles of the patients, communities, health care providers and policy makers [17]. We conducted a survey of physicians caring for people with diabetes in India to examine physicians'

clinic and patient characteristics, management strategies and views on the barriers and needs for optimal diabetes care in the context of the CCM and ICCC framework.

Methods

This study is a cross-sectional survey of physicians in India who provide diabetes care to understand their practices and views to improve diabetes care. An anonymous self-administered questionnaire was developed with previous measures and items from studies surveying physicians who provide diabetes care [18, 19], and piloted with 14 diabetologists in Delhi. There were a total of 35 items and 6 with multiple sub-items. The questionnaire took approximately 20 minutes to complete. The questionnaire covered the following themes: (1) physician and clinic characteristics, including training level, type and location of practice, clinic schedule, how diabetes patients are referred to the clinic and how many return for follow-up, patient demographics, and research activity; (2) record-keeping and general use of information technology; (3) resources and services for diabetes management including patient education, guidelines, references, continuing medical education, and patient reminders; (4) clinical targets used and patient performance; and (5) use of allopathic and non-allopathic treatments;. In addition, there were open-ended questions about barriers to providing optimal care and suggestions for areas to improve diabetes care in India.

The paper questionnaire with the study information sheet was distributed to physicians attending a 2-day national diabetes research conference in Ahmedabad, Gujarat in 2009. The physician attendees ranged from general practitioners to endocrinologists who provide diabetes care and hail from all parts of India. The

questionnaire was included in 1000 conference bags, and announcements were also made at the end of major sessions. Participation was voluntary; no compensation was provided and neither were physicians approached individually. Filled questionnaires were collected from drop-boxes outside the conference rooms. The questionnaire was a component of a larger study on diabetes care in India with approval by the Emory University Institutional Review Board and the conference organizers.

A total of 160 questionnaires were received, of which 150 (93.8%) were used for analysis, because they were legible or completed beyond the first page. All statistical analyses were performed using SPSS 17.0 [20]. Frequencies and descriptive statistics of continuous and categorical variables were run. Continuous data was expressed as mean and standard deviation (SD), categorical data as percentage.

Analysis of qualitative data followed the thematic analysis methodology whereby key themes are identified inductively from the textual data. The investigator analyzed the data in Microsoft Excel, creating themes and marking their frequency. The themes were categorized under the Chronic Care Model elements. Themes which had 11-25 numbers in frequency were categorized as medium strength and those over 25 as high strength.

Results

Physician, clinic, and patient characteristics

Physician demographics and clinic and patient characteristics are presented in Table 1. The respondents (n=150) are 82% male with an average age of 48.5 (±20.5) years, having provided diabetes care for an average of 15.84 (±8.93) years. 64% of the respondents have specialized training in diabetology, and a majority of the respondents

practice in urbanized areas (94%), with representation from all regions of India. More than half work in a private individual practice, and almost half of those in individual practices also work in a private or hospital setting. 86% report patient payment as out-of-pocket payment, although approximately 30% reported partial or full subsidy by hospital settings. Patients with type 2 diabetes represent half of the physicians' practice on average, while 26% reported type 2 diabetes patients being 90% or more of their load. On average, 50% of patients first present to the physicians on their own, versus being referred by other doctors or through active screening. Yet, almost a quarter of physicians report that 11-20% of patients do not return after the first or second visit (i.e., no follow-up).

Patient demographics varied among the physicians. On average, 54% are male, and most are between the 31-60 year age-range, with an average of 33% in the 41-50 age group. Education was distributed among the levels, with an average of 30% having graduate and higher education. The majority of patients have sedentary (office) jobs or are homemakers. In regards to treatment, most patients do not accept insulin on first suggestion by the physician. Of those on insulin, only a mean of 22% do self-monitoring of blood glucose. On average, almost 25% of patients use non-allopathic treatment, with Ayurvedic and herbal remedies being the most common.

Health care organization

Information regarding information technology use, record-keeping, and other resources and services for diabetes management are presented in Table 2. Paper only record-keeping systems are still predominantly used (60%); only 20% mentioned having an electronic database available at the patient visit. One respondent commented on how

there is no time to access IT while seeing patients in a busy industrial hospital. However, almost 50% of the respondents have regular internet access, which is most commonly used for self-education and accessing journals and websites for updates. Journals, conferences, pharmaceutical industry and internet are the most popular source for updates and formal continuing medical education. 54% of the respondents check for updates at least once a week, although 11% indicated that they rarely check for updates.

Standardized patient education material is used by 57% of the physicians. The types ranged from computer presentations (e.g., slides, audiovisual CDs), television in the patient's language to printed visual aides, pamphlets and information cards. Sources of material included those that were self-made (e.g., tailored to local languages), Diabetes Care (journal), Harrison's medical reference, and pharmaceutical companies. In terms of providing patient education, approximately 80% reported regular physician involvement, while 60% reported frequent referral to a nurse, educator, or case manager. Patient reminders for self-care (e.g., taking medications) or follow-up are used by 28% of the respondents, with phone calls being the most common method, and only a quarter of these have automated reminders.

Of the respondents, 77% reported using standardized diabetes management guidelines. The predominant source reported is the American Diabetes Association (ADA), followed by World Health Organization, International Diabetes Federation, European Association for the Study of Diabetes, Association of Physicians of India and Research Society for the Study of Diabetes in India. Table 3 shows the percentage of physicians following ADA diabetes care targets from their reported values, and the estimated patient performance of meeting the designated targets. For all targets except

diastolic blood pressure, 90% or more of the physicians' responses meet the ADA guidelines. Despite this high knowledge of awareness regarding diabetes care targets by the physicians, the average reported proportion of patients meeting these targets range between 45 to 58%.

Barriers to optimal diabetes care and areas for improvement

Table 4 lists the themes from the questions on barriers and areas for improvement for optimal diabetes care, classified by the Chronic Care Model elements.

- *Community:* Lack of public awareness about diabetes and health promotion is a frequent theme, which can be improved by effective use of media for health promotion and mass community and school-based interventions to facilitate healthy living. The high cost or unaffordability of medications and health services is another strong theme, for which cost-sharing with pharmaceuticals and improved subsidies, along with food and drug industry regulation was suggested. One idea suggested as a financing scheme was to provide a subsidized and prioritized plan for diabetes patients, where they are given a diabetes card and could then come to the clinic freely.
- *Healthcare systems:* Optimal care is not possible without proper healthcare services, including sufficient clinic facilities and an adequate number of providers, particularly those who can provide patient counseling. As a result, not enough time is spent per patient to provide counseling and quality care. Thus, a major need is to provide "health personnel, lab facilities, optimum drugs at least up to taluk [county] levels." This also requires creating more integrated care with links to labs and referral centers, inter-sector collaboration, and more local research to inform policies and programs.

- *Healthcare delivery design:* Provider and patient communication is not optimal, whether it is due to the lack of time or issues with hierarchy or not tailoring care to the patient's understanding/situation. Cultural competency is of the sub-elements under healthcare deliver design, and several main themes were mentioned as barriers: the negative perception of treatment such as the fear of insulin and use of alternative therapies before allopathic treatments, and perceptions of the disease where it only affects the rich or not accepting the condition until complications occur. At a community level, general public awareness about diagnosis and treatment is necessary. At a clinic level, providers can be more sensitive to patient needs and adopting a patient-centered care strategy and possibly case management support services.
- *Self-management:* Poor adherence to self-care and follow-up were issues mentioned as expressed in this response, "[where patients have a] lack of education and affluence all of sudden, lack of physical activity and eating more than required…some eccentric think nothing shall happen to them until they have complications." Cited areas for improvement included basic literacy level and "diabetes education and awareness as part [the] of treatment."
- *Clinical information systems:* Only a few respondents mentioned insufficient clinic record-tracking systems as a barrier to optimal care. To address this gap, responses included implementation of electronic medical records with flow-sheets to provide reminders and assist with individual care planning over time, and shared record systems among organizations (incorporating elements of healthcare delivery design, health systems).

- *Decision-support: "[Lack of]* awareness with providers who do not know the latest guidelines and treatment" and adherence to such guidelines are a moderate theme under barriers. Other issues affecting physician performance cited were "physicians under the influence of pharmaceuticals to be sent to the ADA [American Diabetes Association conference]" and "unethical practices." To improve clinical decision-support, moderate themes included training for providers through regular continuing medical education credits and improving regular dissemination of latest clinical guidelines to providers.

Discussion

This descriptive study provides a current depiction of diabetes care in India and corroborates the suboptimal quality of diabetes care reported in previous studies where biochemical and process indicators targets are met by only about 50% of patients evaluated [9, 21, 22]. The volunteer sample of physicians, who are largely urban, private-practice specialists, find providing optimal care challenging in a time- and resource-constrained environment with high patient loads and poor patient self-management and follow-up, which are the status-quo in India [12, 23]. In context of the ICCC framework (Figure 1), these issues span micro- (patient), meso- (healthcare organization and community) and macro-level (policy/regulatory) changes [17].

The physicians recognize the need to improve healthcare organization tailored for chronic disease management, such as: investing in integrated lab and referrals, effective record-keeping systems (e.g., electronic health records [24]) and having non-physician staff (e.g. nurse, diabetes educator) who educate and empower patients for proper self-

management, coordinate care (e.g., record-keeping, send reminders) and improve clinical efficiency and patient outcomes [7, 25]. They may also serve as patient liaisons and health promoters in the community, which has shown to improve patient self-care and physiologic measures in other ethnic groups [26]. Non-physician health workers have been effectively integrated in India by diabetes care centers [27, 28] and local community screening and awareness initiatives [29, 30]. In July 2010, the Indian government approved the scale-up of the National Programme for prevention and control of Cancer, Diabetes, Cardiovascular diseases and Stroke (NPCDCS) from 7 to 100 districts across 15 states; activities include: healthy lifestyle promotion including mass media education, early screening for NCDs, establishing NCD clinics, and training new health personnel [31]. These efforts support the necessary medical shift from an acute, hospital-based treatment to a patient-centered, integrated chronic disease care model [17]. Patients must be collaborators in understanding and managing their care plans and be provided the skills and support to engage in appropriate behaviors for optimal self-management.

Regarding training, formal internationally-certified programs exist in major cities in India for diabetes educators [32, 33] and medical graduates (e.g., diploma in diabetology) [33, 34]. Yet, this study shows that there is variation in knowledge and resources for diabetes care among healthcare providers: 33% of the physician respondents do not use standardized guidelines and 11% rarely check for updates on diabetes care/research and 35% only once a month. Thus, training institutions and organizations that provide oversight and accreditation (e.g. Medical Council of India) must work together to ensure uniformity and quality of evidence-based training programs for physicians and diabetes educators. Forums for continuing medical education and

update material should include journals, conferences, and websites – considering more than 50% of the physicians reported having access to the internet, although to what extent it is used was not fully assessed. Pharmaceutical companies also have significant influence on physician practices, as physicians commonly use their resources for updates and CME; often pharmaceuticals are major funders of conferences and provide sponsorship and gifts to physicians [35]. Considering this variation in provider training and CME, government [36] and non-government organizations must collaborate to ensure consensus and effective, timely dissemination of guidelines and resources. Providing such decision-support and delivery improvement resources also serves as a quality assurance strategy, when linked with proper monitoring and evaluation. Quality assurance measures for equitable diabetes management should be integrated into national policy (e.g. Medical Council of India ethics code [37]), especially in context of the financial impact of healthcare on patients with chronic diseases [38].

As recommended by organizations like the World Health Organization [17, 39] , International Diabetes Federation [5], and World Bank [40] and summarized in the literature [41], the physician respondents recognize that policy is needed to improve healthcare and facilitate healthy lifestyles to prevent and manage chronic diseases like diabetes. Important policy considerations include: healthcare financing since many patients self-pay, integrated infrastructure and manpower for health services, affordable drug and food pricing, access to nutritious food and enabling environments for physical activity, and programs for school/work/neighborhood health promotion and public awareness about diabetes (e.g. media, campaigns). The ICCC framework highlights other important policy areas: leadership and advocacy, strengthening partnerships, and

supporting legislative frameworks [17]. For example, professional physician associations and training institutions are well-positioned to unite and advocate for standardization and quality improvement mechanisms to ensure optimal diabetes care at a national level. Globally, leadership and advocacy by low and middle-income countries are crucial with the upcoming United Nations Summit special session on non-communicable diseases (NCDs) [42], to ensure decisions on international food and drug trade are in their best interest.. However, until such policies take effect, leadership through research [43] and community-empowerment is growing, and has multi-sectoral, domestic and international collaboration from: government (e.g. UK Medical Research Council and Indian Council of Medical Research [44]), academia, research associations and the private sector (e.g. National Heart Lung Blood Institute-United Health and Public Health Foundation of India/St Johns Research Institute [45]; Emory University, Madras Diabetes Research Foundation, International Diabetes Federation with funding from Eli Lilly [46]; Research Society for the Study of Diabetes in India [47]; Novo Nordisk [48]).

There are several limitations of this study. The study had a small sample size which limited the capacity to do sub-group analyses. Moreover, selection and response biases were likely as only those physicians who could afford and were interested in the conference attended, and a small sub-set of attendees completed the questionnaire voluntarily. Despite piloting the questionnaire, there were still questions that were misinterpreted or systematically skipped. In the open-ended questions, most respondents focused on community and patient level barriers, and not as much on provider or clinic level issues. Thus, future studies on this subject should include a more thorough piloting for usability such as formatting and reading-level, adding more questions related to

systems level issues, and expanding the recruitment to other conferences and networks of diabetes care providers and purposive sampling to capture physician sub-groups (e.g., by facility and sector). A clinic-based assessment, like "IMPROVE control" by Novo Nordisk [48], would allow comparison of physician self-reported performance with actual quality of care (clinic processes, patient performance and outcomes) and provides baseline data for interventions. Question areas to expand include: listing of existing clinic staff, content and time distribution of patient clinical encounters, cost estimates for patients and providers, eliciting barriers at multiple actor levels (e.g. patient, provider, health systems, community, policy), and rankings of the areas for improvement.

Providers are aware of the multi-level challenges and needs to provide proper diabetes care in India, as presented in the Chronic Care Model and Innovative Care for Chronic Conditions framework. At a clinic level, improvements in healthcare delivery (e.g., ancillary staff, electronic record-keeping, decision-support) are necessary to ensure patient-centered care with sufficient self-management education. At the community/policy level, areas for change include raising public awareness of diabetes, and improving access to health services and the goods, infrastructure and programs that facilitate healthy living. As diabetes continues to increase, regional and national quality assurance bodies are needed to ensure delivery of optimal diabetes care especially considering the varied settings of care in India. Professional associations and training institutions have the power to advocate and organize for such quality improvement measures and resources. Improving chronic disease control and prevention in India involves a multi-sectoral, collaborative approach and translation of successful, systematic implementation [13, 47, 48] and quality assurance [49] to the local context.

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Tables and Figures

Table 1: Physician demographics and clinic and patient characteristics		
physician/clinic/patient variable	**n**	**value**
Male (%)	149	81.9
Age (years)	142	48.5 (20.5)
Year clinical training completed (mode, range)	133	1992, 1967-2010
Years provided diabetes care	147	15.84 (8.93)
Specialty (%)	150	
Diabetology interest		64.0
Medicine		17.3
General		6.0
Endocrinology interest		4.0
Other/Mixed		8.7
Location (%)	149	
Metro		30.9
Town		63.1
Rural		6.0
Region (%)	144	
West		30.6
South		28.5
North		26.4
East		14.6

Facility (%)[a]	144	
Private individual		58.7
Private/corporate hospital		36.0
Government hospital		20.7
Charity hospital		7.3
Private group		7.3
Multiple facilities[b]		24.4
Patient payment type (%)	145	
Out-of-pocket		85.5
Employer		20.0
Insurance		13.8
Subsidized partly by clinic/hospital		20.0
Fully paid by clinic/hospital		11.0
Clinic patients with T2DM (mean %)	147	50.3 (34.1)
Total T2DM patients per day	143	18.4 (17.8)
New T2DM patients in day	132	3.8 (3.2)
Patients present to clinic (mean %)	132	
By self		57.6 (27.0)
Physician referral		21.5 (18.3)
Active screening		19.2 (18.1)
% patients who do not return to clinic after 1st or 2nd visit(%)	144	24.3
0-5%		24.3

	6-10%		24.3
	11-20%		27.8
	21-30%		11.8
	31-40%		6.3
	41-50%		2.1
	51%+		3.5
Patient Gender (mean %)		144	
	Male		54.1 (10.2)
	Female		45.3 (10.2)
Patient Age (mean %)			
	<20	92	4.0 (4.3)
	21-30	115	8.9 (8.1)
	31-40	130	21.7 (13.0)
	41-50	138	33.3 (15.0)
	51-60	130	23.9 (12.4)
	>60	121	15.6 (11.4)
Patient Education (mean %)			
	Graduate & higher	136	30.4 (20.8)
	Secondary	134	26.1 (15.0)
	Basic	129	22.2 (15.4)
	Illiterate	124	20.9 (16.6)
Patient Occupation (mean %)			
	Manual	126	17.2 (13.2)

Sedentary (office)	131	36.8 (16.2)
Homemaker	126	24.6 (12.8)
Retired	130	17.3 (10.6)
Unemployed	91	8.9 (6.7)
Student	88	3.6 (3.8)
Patients receiving allopathic medication (mean %)		
Oral agents only	99	61.19 (16.74)
Oral agents and insulin	94	24.29 (12.90)
Insulin only	88	13.34 (10.49)
Patients accepting insulin at first suggestion (mean %)	98	26.41 (26.46)
Of those on insulin, self-monitor blood glucose regularly (mean %)	97	22.63 (22.85)
Patients using non-allopathic treatment[c] (mean %)	91	24.18 (21.06)
Major types of non-allopathic treatment patients use (%)	63	
Ayurveda		83.9
Herbal		25.4
Homeopathy		19.0
Naturopathy		6.3
Yoga		7.0

T2DM= Type 2 Diabetes Mellitus

Categorical data are expressed as %, continuous data as mean (±SD)

[a]Percentages add up to greater than 100 because of responses in multiple categories

[b]Multiple facilities of practice include an individual practice and at least one hospital

setting

[c]Non-allopathic treatment includes herbs, ayurveda, yoga, naturopathy, homeopathy and other alternative/complementary systems

Table 2: Physician IT use, record system, education and research

variable	n	value
Record system (%)	145	
Paper		60.0
Mixed paper and electronic		37.2
Electronic		2.8
Use prepared flow-sheets[a] (%)	141	40.4
Have electronic database (%)	139	25.9
Have electronic database available at patient visit (%)	139	18.7
Regular internet access (%)	143	47.6
Frequency of updating self on diabetes care/research (%)	137	
Every day		13.3
Few times per week		19.6
Once a week		21.0
Once a month		35.0
Rarely		11.2

Preferred references for updates (%)		
Journals	145	86.2
Conferences	141	84.4
Pharmaceutical company	134	74.6
Books	140	65.0
Websites	141	63.1
Email lists	137	27.7
Types of Continuing Medical Education used (mean %)		
Conferences/Meetings	136	39.2 (21.1)
Journals	113	28.8 (17.3)
Pharmaceutical companies	120	24.1 (16.8)
Internet	96	23.5 (18.9)
Other	15	20.0 (20.3)
Research activity[b] (%)	141	
Not involved		46.8
Investigational drugs		17.7
Traditional drugs		11.3
Registry/Survey		13.5
Surveillance (active)		11.3
Internal for clinic		25.5
Lifestyle		10.6
Clinic management		9.2
Use standardized education material for patients (%)	137	56.9

Education (often/always) provided by (%)		
Physician	107	82.2
Nurse/Educator/Case Manager/Other	103	60.2
Both	103	54.4
Send patient reminders[c]	143	28.0
Types of reminders (%)		
Phone	40	72.5
Mail	40	42.5
SMS	40	22.5
Email	40	22.5
Automated	35	25.7
Use standardized management guidelines (%)	137	77.4

Categorical data are expressed as %, continuous data as mean (±SD)

[a]Flow-sheets are prepared forms/templates for record-keeping.

[b]Percentages add up to greater than 100 because of responses in multiple categories

[c]Patient reminders include mailings, email, phone call, or text messages

Table 3: Physician use of patient clinical targets compared to ADA 2009 guidelines and reported proportion of patients meeting designated targets

	Physicians following targets		Proportion of patients meeting own targets	
ADA target[a]	**n**	**%**	**n**	**mean (±SD)**
Systolic blood pressure (130mmHg)	119	92.4	119	57.1 (21.0)
Diastolic blood pressure (80mmHg)	113	82.4	116	56.8 (21.7)
LDL cholesterol (<100 mg/dL)	115	89.6	109	57.0 (24.2)
Retinal exam at least once/year	115	100.0	108	45.1 (29.9)
Urine protein screening at least once/year	117	100.0	108	56.6 (30.4)
Monofilament foot exam at least once/year	109	100.0	96	58.4 (33.3)
HbA1c < 7%	94	91.4	90	44.5 (21.5)

ADA=American Diabetes Association

[a]ADA targets per 2009 guidelines for diabetes management

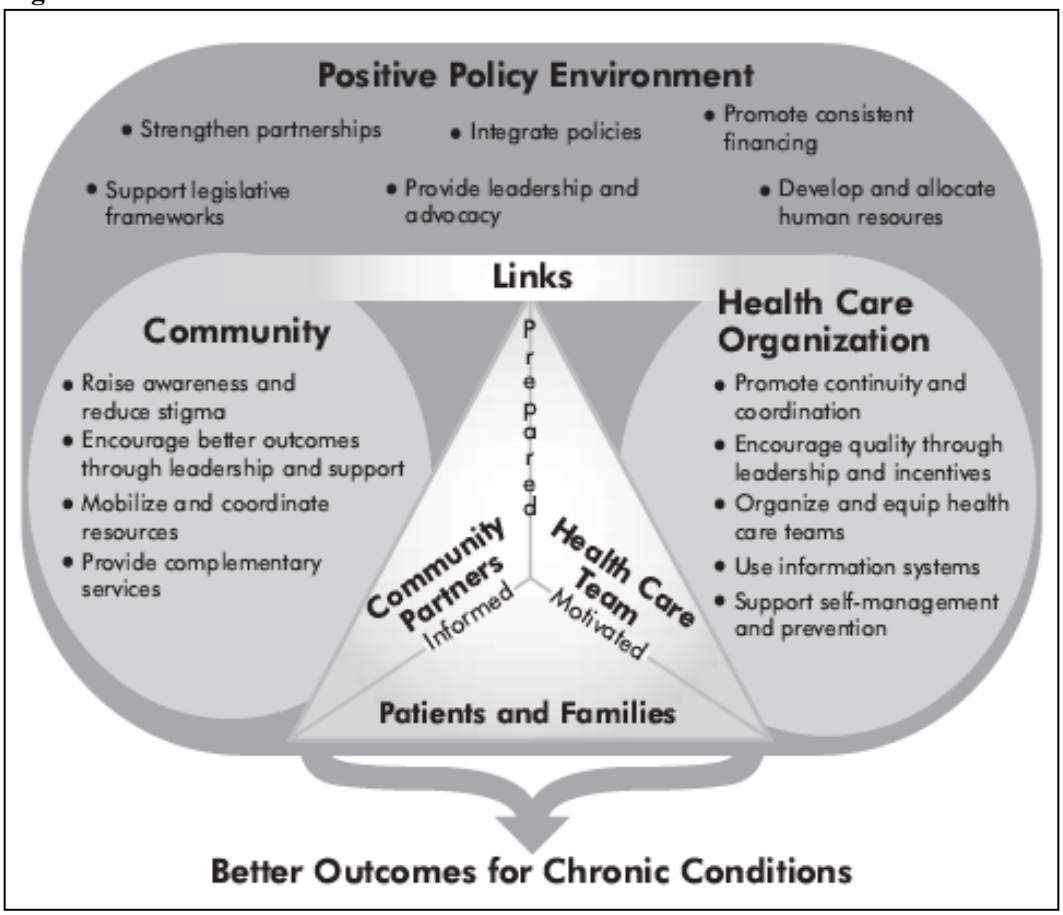
Table 4: Physician-reported barriers for optimal diabetes care and areas for improvement categorized according to Chronic Care Model (CCM)[a] elements

CCM element	Barriers	Area for Improvement
Community (resources & policies)	• **Lack of public awareness of risk factors/prevention, general health promotion[a]** • **Cost of medications & healthcare services[a]**	• **Improving public awareness, effective use of media[a]** • *Community-based interventions: screening camps in colonies and work interventions[b]* • School-curriculum health promotion[b] • Environment change-more parks and walking lanes and community physical activity centers • Cost: Cost-sharing by pharmaceutical companies, insurance schemes, sliding-scale payment plans and subsidies • Food and drug industry regulation
Health systems	• *Lack of quality healthcare services[b]* • Limited human resources in clinic setting	• Increase providers at government level • Increase diabetes educators • Collaboration between government

	• Insufficient clinic facilities (e.g. labs) • Time constraints for patient visit and education • Lack of evidence/research	and non-governmental sector: For-profit and non-profit • Integrated care, links with lab facilities and other referrals • Research/epidemiological studies to back policies and programs
Healthcare delivery design	• *Perception of treatment (fear of insulin)*[b] • *Cultural/social perceptions of disease*[b] • Patient not accepting of condition • Less communication between doctor and patient	• Improving doctor-patient relationship through better communication and patient-centered care
Self-management	• *Lack of proper self-care*[b] • *Lack of regular follow-up*[b]	• *Self-management awareness, health literacy*[b] • *Basic Education-literacy*[b]
Clinical information systems	• Insufficient clinic record-tracking systems	• Implementation of electronic medical records, flow-sheets • Shared record systems between organizations
Decision-support	• *Insufficient knowledge of clinical guidelines and*	• *Training, Regular continuing medical education credits*[b]

enforcement[b]	• *Improving access to/dissemination of clinical guidelines*[b]
CCM=Chronic Care Model [a]Wagner, E. H. (1998). "Chronic disease management: what will it take to improve care for chronic illness?" Effective clinical practice **1**(1): 2. [a]Themes which have high response strength (>25 frequency) [b]Themes which have medium response strength (11-25 frequency)	

Figure 1: Innovative Care for Chronic Conditions (ICCC) Framework, World Health Organization



Appendix A

Physician Diabetes Management Questionnaire

This brief (10-15 minute) questionnaire seeks to understand the views of physicians on diabetes care in India, and identify areas for improvement in diabetes management and prevention in India. This questionnaire is anonymous and will not affect your practice in any way. The results will be shared with RSSDI. See Information Sheet for more details.

Please mark an 'X' in the appropriate boxes. Write numbers/words in spaces. Please provide honest responses.

When completed, place in any DROP-BOX labeled: PHYSICIAN Questionnaire

We would first like to know about you.

(1) Your main specialty:

1☐ General Practice
2☐ General Internal Medicine
3☐ Internal Medicine with interest in Diabetology
4☐ Endocrinology
5☐ Other (specify)_____

(2) Year you finished specialty training:

_ _ _ _

(3) Number of years you have provided diabetes care:

_ _ years

(4) Gender: 1☐ Female 2☐ Male

(5) Birth: Month _ _ Year 1 9 _ _

(6) Location where you practice:

1☐Metro 2☐Town 3☐Rural

City _____ State _____

(7) Type of facility you see your diabetes patients at (check all that apply):

1☐ Individual Practice – Private
2☐ Group Practice – Private
3☐ Hospital – Government
4☐ Hospital – Charity
5☐ Hospital – Private/Corporate
6☐ Other, specify: _____

(8) Type 2 diabetes patients comprise what % of all the patients you see?

_____ %

(9) How do diabetes patients present to your clinic:

By physician referral	_____ %
By self	_____ %
Active screening (e.g. family, community)	_____ %
Other, specify:	_____ %

(10) Number of clinic days per week: _____ days

(11) Number of hours per clinic day: _____ hours

(12) Approximate total number of type 2 diabetes patients during:

A clinic day: _____ patients

The past month: _____ patients

(13) Approximate number of newly registered type 2 diabetes patients during:

A clinic day: _____ patients

The past month: _____ patients

(14) % of new patients with diabetes that do not return to the clinic after 1st or 2nd visit (i.e. do not follow-up):

1☐ 0-5%	5☐ 31-40%
2☐ 6-10%	6☐ 41-50%
3☐ 11-20%	7☐ 51-60%
4☐ 21-30%	8☐ 61% and higher

(15) Approximate % of type 2 diabetes patients you see in the following:

a) Education

Graduate & higher	_____ %
Secondary	_____ %
Basic	_____ %
Illiterate	_____ %

b) Age

< 20 years	_____ %
21 – 30 years	_____ %
31- 40 years	_____ %
41- 50 years	_____ %
51- 60 years	_____ %
> 60 years	_____ %

c) Sex

Female	_____ %
Male	_____ %

d) Occupation

Manual	_____ %
Sedentary (office)	_____ %
Homemaker	_____ %
Retired	_____ %
Unemployed	_____ %
Student	_____ %

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(16) % of your type 2 diabetes patients with the following complications:

Nephropathy _____ %
Retinopathy _____ %
CVD event (MI, stroke) _____ %
Amputation _____ %
Impotence _____ %
Other, specify:
_____ _____ %

(17) Are you involved in research and, if yes, which kind (check all that apply):

1☐ Not applicable
2☐ Internal for clinic
3☐ Trial – investigational drugs
4☐ Trial – traditional drugs/therapies
5☐ Trial – lifestyle change
6☐ Trial – management intervention
7☐ Survey/Registry
8☐ Surveillance (active data collection)
9☐ Other, specify: _____

The next items are about *IT use, record-keeping, and electronic databases.*

(18) Does your practice have regular internet access?

1☐ Yes → 2☐ No 3☐ Don't know

If YES, how is internet used in your practice?

_____
_____

(19) What type of record system do you use in your practice?

1☐ Paper only
2☐ Electronic only
3☐ *Mixed*: Paper and Electronic

(20) Do you use prepared flow-sheets for record-keeping?

1☐ Yes → 2☐ No 3☐ Don't know

If YES, who created the flow-sheets?

1☐ Local (clinic/hospital)
2☐ Outside company/group
3☐ Don't know

(21a) Is any electronic database available to you?

1☐ Yes
2☐ No *(skip to question 22 →)*
3☐ Don't know *(skip to question 22 →)*

(21b) Is any of the electronic database information available to you at the time of the patient visit?

1☐ Yes 2☐ No 3☐ Don't know

(21c) Approximate % of your type 2 diabetes patients captured by the electronic database:

_____% 1☐ Don't know

(21d) How are you notified about information in the electronic database?

Yes	*No*	
☐	☐	Flag for the medical records of all diabetic patients
☐	☐	Diabetes-specific flow-sheets for individual patients (flow-sheets list dates of diabetes-specific service provided for each patient)
☐	☐	Individualized alerts for the medical records on the day of a visit
☐	☐	Master list of patients with needed services identified
☐	☐	Other (specify)_____

(21e) What clinical information is captured by the electronic database?

Yes	*No*	*Don't Know*	
☐	☐	☐	A1C results
☐	☐	☐	Lipid Results
☐	☐	☐	Microalbumin results
☐	☐	☐	Blood pressure
☐	☐	☐	Dilated eye exam performed
☐	☐	☐	Foot exam performed
☐	☐	☐	Date of last referral to DM-related physician specialist
☐	☐	☐	Influenza vaccines with appropriate indications
☐	☐	☐	Smoking cessation counseling performed
☐	☐	☐	Insulin use
☐	☐	☐	Oral agent use
☐	☐	☐	Monofilament test
☐	☐	☐	Aspirin use

(21f) Are patients grouped according to risk or status of complications in the database? (for example, whether or not they have hypertension)

1☐ Yes 2☐ No 3☐ Don't know

(22) Describe any other IT use at your practice:

_____
_____
_____

The next items are about use of resources and services for diabetes management in your practice.

(23) Are the following services available to help your patients manage their diabetes and if so, how often do you refer to each of these services for each patient?

	1 Not Available	2 Never Refer	3 Rarely Refer	4 Sometimes Refer	5 Often Refer	6 Always Refer	7 Don't Know
Group diabetes education classes	☐	☐	☐	☐	☐	☐	☐
Diabetes disease management (Program that identifies persons with diabetes, monitors quality of care, provides risk-level specific interventions)	☐	☐	☐	☐	☐	☐	☐
Individual diabetes counseling by:							
Physician (self)	☐	☐	☐	☐	☐	☐	☐
Assistant Medical Officers	☐	☐	☐	☐	☐	☐	☐
Nurse	☐	☐	☐	☐	☐	☐	☐
Dietician	☐	☐	☐	☐	☐	☐	☐
Diabetes case manager	☐	☐	☐	☐	☐	☐	☐
Other, specify: _____	☐	☐	☐	☐	☐	☐	☐

(24) Do you use any standardized material for diabetes education?

1☐ Yes, specify all: _____

_____

2☐ No

(25) Do you follow any standardized diabetes management guidelines?

1☐ Yes, specify all: _____

_____

2☐ No

(26a) How often do you receive updates or check on diabetes research/guidelines?

1☐ Every day
2☐ Few times a week
3☐ Once a week
4☐ Once a month
5☐ Rarely

(26b) Where/how do you receive updates or check on diabetes research/guidelines? (Please specify)

1☐ Journals: _____

_____

2☐ Books: _____

3☐ Websites: _____

4☐ Email lists: _____

5☐ Conferences: _____

6☐ Pharma representatives

7☐ Other: _____

(26c) What proportion of your CME needs are met by:

Conferences/Meetings _____ %
Pharma companies _____ %
Journals _____ %
Internet _____ %
Other: _____ _____ %

(27a) Do your diabetes patients receive *reminders*? (reminders=information directly sent to the patients for care needed, appointments, etc.)

1☐Yes 2☐No *(skip to question 28, next pg)*

(27b) Type(s) of reminders (check all that apply):

1☐ Mailing
2☐ Phone call
3☐ SMS
4☐ Email
5☐ Other, specify: _____

(27c) Are these reminders automated?

1☐ Yes 2☐ No 3☐ Don't know

(27d) Items that are included in the patient reminders:

Yes	No	Don't Know	
☐	☐	☐	Upcoming clinic appointment already made
☐	☐	☐	To schedule clinic appointment
☐	☐	☐	A1C due
☐	☐	☐	Lipid screen due
☐	☐	☐	Dilated eye exam due
☐	☐	☐	Kidney test due
☐	☐	☐	Foot exam due
☐	☐	☐	Flu shot due
☐	☐	☐	Obtain medications

Other, specify: _____

The next questions ask about treatment goals, treatment distribution, payment, and barriers.

(28a) Treatment goals for the typical diabetes patient whom you see in your practice:	(28b) What % of diabetic patients in your practice achieve each goal?
Systolic blood pressure ___ mmHg	___ %
Diastolic blood pressure ___ mmHg	___ %
LDL cholesterol ___ mg/dL	___ %
Retinal exam at least every ___ months	___ %
Urine protein screening at least every ___ months	___ %
Monofilament foot exam at least every ___ months	___ %
HbA1c ___.__ %	___ %

(29a) What % of your type 2 diabetes patients are on the following treatment regimens?

Lifestyle change _____ %
Oral agents only _____ %
Oral agents and insulin _____ %
Insulin only _____ %

(29b) What % of your patients accept insulin at first suggestion?

_____ %

(29c) Of those on insulin, what % self-monitor their blood glucose levels on a regular daily basis?

_____ %

(29d) What % of your patients use other forms of traditional or alternative medicine?

_____ %; Common types used: _____

_____

(30) Who pays for patient treatment? (check all that apply)

1☐ Patient out-of-pocket only
2☐ Subsidized partly by clinic/hospital
3☐ Fully paid by clinic/hospital
4☐ Employer
5☐ Insurance, specify type: _____
6☐ Other, specify: _____

(31) Statement that best describes how you make treatment decisions with MOST of your diabetes patients:

1☐ Patients usually leave the decision to me.
2☐ I make the final decision about appropriate treatments, but seriously consider patients' opinions.
3☐ I share responsibility with patients for deciding which treatment is best for them.
4☐ Patients make the final decision about treatment after seriously considering my opinion.
5☐ Patients make the final selection about which treatment to follow with minimal input from me.

(32) What are the major barriers for optimal diabetes management with your patients?

(33) Where/how should efforts be focused for diabetes management and prevention in India?

(34) How active is your local RSSDI? 1☐ Very 2☐ Moderate 3☐ Little
Describe activities of local RSSDI in the past year:

(35) What further support from RSSDI would be useful to improve diabetes management/prevention (resources, events, training, research, funding, etc):

Thank you for completing the questionnaire! Please deposit in any DROP-BOX labeled: PHYSICIAN Questionnaire.
If you want more information or would be interested in participating in an interview to share effective practices, please contact seemadshah@gmail.com (see Information Sheet).