

Barriers and facilitators of providing standard of care diabetes management at primary care level in geriatric population

Pratyush Kumar¹, Abhay Kumar Sinha¹, Ashok Kumar², Md Ejaz Alam²

Department of ¹Geriatric, ²Medicine, Panta Medical College Hospital, Bihar, India

ABSTRACT

Background: Geriatric population is gradually increasing and is expected to grow till 20% by 2050 from the current 8.6%, and so is diabetes prevalence and other comorbidities. To improve diabetes control, better coordination of provider, patient and health system is needed. It has been found that almost half of the diabetes patients do not achieve treatment targets. So, it is essential to assess the perceived barriers as well as facilitators from patients' and physicians' perspectives. The aim of the study was assessment of needs, care, barriers and facilitators to achieve treatment goals for patients and physicians. **Materials and Methods:** This observational, cross-sectional study was conducted by the Department of Geriatrics among 100 elderly diabetes patients and 50 physicians after obtaining ethical approval. All participants were interviewed based on a predefined, structured questionnaire with multiple options to grade or choose from. **Results:** Polypharmacy, mobility issues and dementia were the most common geriatric issues. Hypertension (HTN), arthritis and coronary artery disease (CAD) were the commonest comorbidities. Also, 73% reported that they followed dietary advice, but only 22% accepted that they were doing exercise regularly. Moreover, 5% mentioned that they were taking alcohol, and 15% confirmed of smoking. Also, 47% of patients felt that diabetes was well controlled. Remaining 53% patients gave reasons for poor diabetes control; the most common reason was not following a proper diabetic diet plan in 42% of patients and lack of exercise as instructed was reported by 22% as the reason for their poor diabetic control. Nineteen percent of patients accepted of not measuring their blood glucose as instructed. Among urban doctors, the three most common factors were not being consistent with lifestyle interventions, followed by no regular self-monitoring of blood glucose and no regular follow-up. Top three interventions suggested were to engage or encourage the family members of patients to become involved in diabetes care, provide more convenient diabetes brochures or education materials to patients and improve multidisciplinary and multispecialty collaboration in diabetes control. **Conclusion:** Diabetes in elderly needs proactive health system and coordinated care. Doctor-patient relationship with good communication skills, family support and multidisciplinary care is needed to improve diabetes care. Health education with a focus on diet control, exercise and other lifestyle modifications are essential factors in improving diabetes care.

Keywords: Diabetes, geriatric, primary care

Introduction

Geriatric population is gradually increasing from the current 8.6% and is expected to grow till 20% by 2050 according to the India Ageing Report 2017.^[1] Diabetes in our subset of population has been found to have onset at younger age, higher risk even at lower body mass index (BMI) and higher cardiovascular and stroke risk. So, with earlier onset and longer lifespan, diabetes

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Kumar P, Sinha AK, Kumar A, Alam ME. Barriers and facilitators of providing standard of care diabetes management at primary care level in geriatric population. J Family Med Prim Care 2022;11:6451-7.

Address for correspondence: Dr. Pratyush Kumar, Senior Resident, Department of Geriatrics, Patna Medical College Hospital (PMCH), Patna Bihar - 800 004, India. E-mail: pratyush410@yahoo.co.in

Received: 13-04-2022

Revised: 27-06-2022

Accepted: 29-06-2022

Published: 31-10-2022

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_851_22

may lead to higher prevalence of associated complications in the elderly population.

Existing literature and evidence-based guidelines support and encourage providing standard of care prevention and management for all diabetes patients. However, there are various barriers that are patient, provider and health system based, which may prevent implementing evidence-based guidelines.^[2] Despite evidence from landmark clinical trials on prevention of diabetes complications by controlling the risk factors such as hyperglycaemia^[3] HTN^[4] and dyslipidaemia,^[5] there has not been adherence at various levels in clinical practice.

Key to promote health is preventive health care, which is the cornerstone of primary health care. As non-communicable disease prevalence is increasing rapidly, role of primary care is now more than ever in diabetes prevention, management, timely referral and palliative care services.

Studies have revealed patient-related barriers such as socioeconomic status, accessibility – rural versus urban, insurance and out-of-pocket expenditure, transportation and availability of services and service providers. Physician-related barriers have been studied and have also been referred as ‘physician inertia’ or ‘benign neglect’.^[6]

It has been found that almost half of the diabetes patients do not achieve treatment targets. So, it is essential to assess the perceived barriers as well as facilitators from patients’ and physicians’ perspectives.

Aim of study

1. Assessment of needs, barriers and facilitators for diabetes care by physicians
2. Assessment of needs, care, barriers and facilitators to achieve treatment goals for patients.

Materials and Methods

Study location: This study was done at the Department of Geriatrics (regional geriatric centre), Patna Medical College Hospital in its outpatient department/outreach camps/primary care level and among the physicians of Bihar.

Study population: All consenting adults above 60 years of age fulfilling the inclusion criteria were selected to be part of this study.

Study duration: This study was conducted for a period of 6 months after obtaining ethical approval.

Study design: A cross-sectional, qualitative, observational study was done. All diabetes patients meeting the inclusion criteria were interviewed in person or by phone call to assess barriers. Physicians providing comprehensive geriatrics care including diabetes management were interviewed in person or through phone call.

Sample size

Sample size in patient and physician groups was 50 each. Random sampling methods were used to interview patients. Purposive and snow ball sampling was done for physicians.

Methodology

Written informed consent was taken from all participants at the time of enrolment. Ethical approval was taken before starting this study.

Patient participants were enrolled based on the inclusion and exclusion criteria.

For defining a case of type 2 diabetes mellitus patients, the American Diabetes Association criteria were used.^[7]

A detailed interview was conducted based on a questionnaire developed, which assessed the demographic profile, clinical and biochemical profile, adherence issues and barriers and facilitators in receiving diabetes care. Assessment of care questionnaire and chronic care model (CCM) was used to evaluate the barriers.^[8]

A similar interview was conducted for physicians using a questionnaire to assess the need to improve diabetes care services and barriers in providing standard of care.

The inclusion criteria for patients were as follows:

1. Diabetes mellitus
2. Non-critically ill.

The exclusion criteria for patients were as follows:

1. Language barrier
2. Critically ill.

Statistical analysis

The data was analysed with the help of the statistical software. Descriptive statistics for all the principal variables were calculated. Frequencies and percentages were used for categorical variables. Data was presented in the form of table, figures and pie charts. For maintaining the quality control and quality assurance, piloting of the questionnaire was done in order to prevent the biases of the questionnaire.

Review of literature

Type 2 diabetes mellitus is an important public health issue and needs comprehensive care. Its prevalence has grown over the years, and despite gaining a lot of attention in public discourse, many patients get diagnosed very late with complications and some end up with various complications due to poor glycaemic control.

The problems of poor compliance and barriers to treatment are very complex issues and need to be evaluated from the patient and provider perspectives.

A study conducted in Belgium by Wens *et al.*^[9] entitled ‘general practitioners (GPs)’ perspectives of type 2 diabetes patients’ adherence to treatment: A qualitative analysis of barriers and solutions’ found frustration among physicians because their patients do not achieve the common evidence-based medicine objectives, and the relevant solutions suggested were communication and tailored and shared care.

In a qualitative study done in Croatia by Vinter-Repalust *et al.*^[10] entitled ‘Obstacles which patients with type 2 diabetes meet while adhering to the therapeutic regimen in everyday life: qualitative study’, eight major themes and explanatory models of patient’s perspectives were found, which were confronting the diagnosis, illness-related changes, treatment of illness, social context, relation to the health professionals, self-control, knowledge about the illness and expectations from health professionals.

In a study done by Nagelkerk *et al.*^[11] to assess the perceived barriers to and effective strategies for self-management of adults with type 2 diabetes in a rural setting, it was found that the most frequently reported barriers were lack of knowledge of a specific diet plan, lack of understanding of the plan of care and helplessness and frustration from lack of glycaemic control and continued disease progression despite adherence. Effective strategies identified were developing a collaborative relationship with a provider, maintaining a positive attitude that prompts proactive learning and having a support person who provides encouragement and promotes accountability.

Studies comparing provider and patient views and experiences of self-management within primary healthcare are particularly scarce. In a qualitative study, patient and provider perceptions of self-management were investigated in five socioeconomically disadvantaged communities in Stockholm by Aweko *et al.*^[12] Two overarching themes were identified: adopting and maintaining new routines through practical and appropriate lifestyle choices (patients) and balancing expectations and preconceptions of self-management (providers). The themes were characterised by inherent dilemmas representing confusions and conflicts that patients and providers experienced in their daily life or practice. Patients found it difficult to tailor information and lifestyle advice to fit their daily life. Healthcare providers recognised that patients needed support to change behaviour, but saw themselves as inadequately equipped to deal with the different cultural and social aspects of self-management.

An international qualitative study using meta-ethnography (EUROBSTACLE) on obstacles to adherence in living with type-2 diabetes^[13] failed to determine variables which consistently explain adherence or non-adherence to treatment recommendations. Meta-ethnography was later applied to make a qualitative meta-analysis. Obstacles to adherence are common across countries and seem to be less related to issues of the healthcare system and more related to patients’ knowledge about diabetes, beliefs and attitudes and the relationship with healthcare professionals. The resulting key themes are course of

diabetes, information, person and context, body awareness and relationship with the healthcare provider.

Results

After obtaining the informed consent of geriatric patients with type 2 diabetes, they were interviewed at the clinic or at their home in the presence of their caregiver. A total of 100 consenting geriatric patients were recruited for conducting a detailed interview for this study. Fifty-eight out of 100 were in the age group of 60–65 years. Also, 61% of diabetes patients were male. Out of 100 patients, 43 were from rural areas, 25 were from urban areas and the remaining 32 were from semi-urban areas. History regarding duration of diabetes was noted. Twenty-two patients gave history of diabetes for more than 10 years. 31 had diabetes for 5–10 years, and 47 had diabetes for less than 5 years.

Diabetes patients were evaluated for any comorbidity. Detailed history was taken, and clinical examination and relevant tests were done. Commonest comorbidity was HTN observed in 50% of all patients, followed by osteoarthritis in 21%, coronary artery disease (CAD) in 13%, chronic kidney disease (CKD) in 11% and tuberculosis in 7% [Figure 1].

Common geriatric health issues were also evaluated. Vision, hearing, urinary incontinence, mobility, falls, dementia and polypharmacy were assessed. It was found that 48% of patients had complaints of vision-related problems, mobility was of concern for 56% of patients, polypharmacy was observed in 58%, 52% suffered with dementia, history of fall was given by 29% of patients, urinary incontinence was there in 27% of patients and 26% complained of hearing problems [Figure 2].

Educational background was assessed; 45% of patients had attended only up to primary school and below and 37% had gone up to middle and high school. Only 18% had completed college education and above.

Socioeconomic background was assessed; 20% of patients belonged to upper class, whereas majority of patients were from upper middle class (40%) and remaining 32% were from lower middle class.

Patients’ diabetic history including lifestyle and addiction to alcohol and smoking was evaluated; 73% reported to be following dietary advice, but only 22% accepted that they were doing exercise regularly. Also, 5% reported to be taking alcohol and 15% confirmed of smoking. They were counselled regarding cessation of alcohol and smoking and are being followed up to maintain the positive change [Figure 3].

Survey of factors related with poor diabetes control was done in detail; 47% of patients felt that diabetes was well controlled and the remaining 53% of patients gave reasons for poor diabetes control, of which the most common was not following a proper diabetic diet plan, which was seen in 42% of patients, and 22% believed that poor diabetes control was due to lack of exercise

as instructed. Also, 19% of patients accepted of not measuring their blood glucose as instructed [Figure 4].

Barriers and facilitators of providing standard of care diabetes management at a primary care level in geriatric population were evaluated among 100 geriatric patients and 50 primary care physicians/geriatricians.

These interviews were conducted after obtaining their informed consent at the point of first contact in outpatient department/rural clinic. Doctors included young doctors/early career professionals (within 5 years of their post-graduate training in general practice/geriatrics) and other experienced physicians who consented to be interviewed.

Among physicians, 46% were young doctors and the remaining 54% of doctors included chief medical officers and medical college faculty (assistant/associate professors).

Forty percent of doctors were working in rural areas, whereas 12% were working in semi-urban areas and 48% were working in urban areas.

Work location was analysed, which showed that 38% were working in private stand-alone clinics, whereas 20% were working in public hospitals and 42% in teaching medical colleges.

On the basis of clinical experience, they were asked to choose the top three factors for uncontrolled diabetes. Among urban doctors, the three most common factors were not being consistent with lifestyle interventions, followed by no regular self-monitoring of blood glucose and no regular follow-up.

Among semi-urban doctors, the most common factor was not being consistent with lifestyle interventions, followed by no regular self-monitoring of blood glucose and uneducated use of herbal medicine or health products.

Among rural doctors, not being consistent with lifestyle interventions, uneducated use of herbal medicine or health products, inconvenient to purchase drugs and no regular self-monitoring of blood glucose were the top factors for uncontrolled diabetes.

We evaluated role of government/policymaker/physicians from public health perspective in order to improve diabetes control. Overall top three interventions suggested were to engage or encourage the family members of patients to become involved in diabetes care, provide more convenient diabetes brochures or education materials to patients and improve multidisciplinary and multispecialty collaboration in diabetes control.

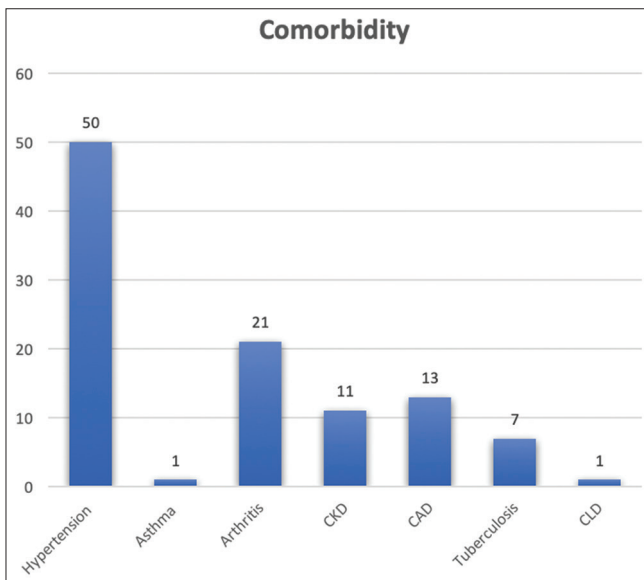


Figure 1: Comorbidities

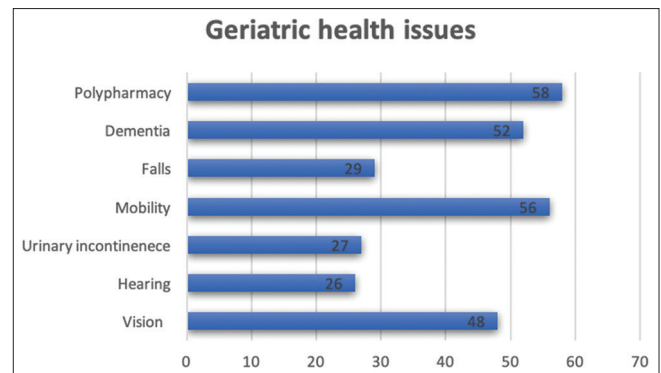


Figure 2: Geriatric Health issues

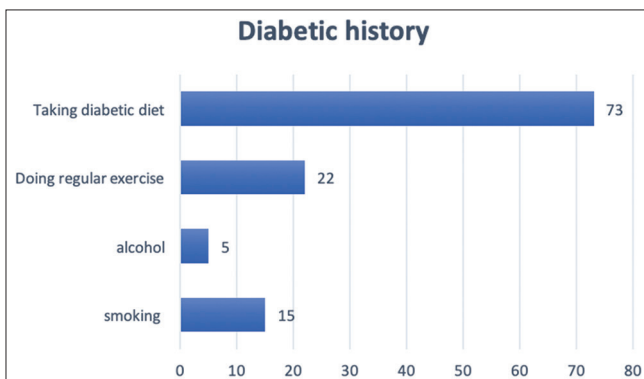


Figure 3: Diabetes diet and personal history

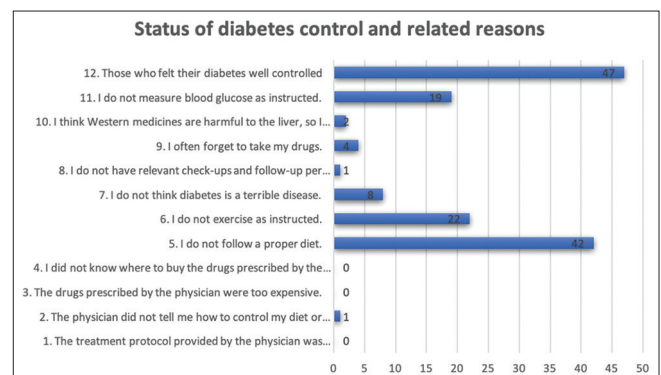


Figure 4: Diabetes control Status

Other suggestions which were given priority were to regulate media campaigns and eliminate false advertising about diabetic drugs and nurses' training.

Survey of clinical diagnosis and treatment was done. Around 10% of all doctors have received any special training on diabetes guidelines. Also, 100% of doctors in this survey said to be able to routinely give lifestyle and/or diet advice to new diabetic patients. Moreover, 98% of all doctors confirmed that they can clinically diagnose and treat according to the diabetes guidelines. Only 8% of doctors confirmed involvement of specialised nutritionists or diabetes nurses involved in their diabetes practice. Also, 28% of doctors said to have paid attention routinely to and intervene in the mental stress of new diabetic patients.

Discussion

India is sadly being recognised as a diabetes capital with home to 69.1 million people with diabetes mellitus. Globally, the share of the population aged 65 years or over is expected to increase from 9.3% in 2020 to around 16.0% in 2050.^[14] There is growing evidence of rising incidence across all classes and age groups, both among the affluent and the poor in India. In financial terms, the global burden of diabetes mellitus (DM) is enormous, with an estimated annual expenditure of 673 billion US dollars in 2015, which constituted 12% of global health spending for that year.^[15] Ageing along with rising population, urbanisation, dietary changes and unhealthy lifestyle are the factors responsible for the increasing prevalence. Historically, it was considered a disease of the affluent class, but it is gradually being seen in middle class and the working poor. Indians are believed to have stronger genetic predisposition and insulin resistance.

An European study has found that 20% of old people have DM and a similar proportion have undiagnosed DM.^[16] Also, 30% of old people have impaired glucose regulation, which means an increased risk for DM.^[17] Various Indian studies have reported the prevalence of type 2 DM to be 14.6% in rural Uttarakhand, 17.75%^[18] each in Nagpur and Madhya Pradesh and 36% in Salem, Tamil Nadu among the elderly.

Data from the National Sample Survey Organization's (NSSO) 71st round survey in 2014 gives prevalence of self-reported diabetes mellitus as 6.5% in people aged 60–64 years, 6.1% in those aged 65–69 years, 4.9% in people aged 70–74 years and 4.6% in those of 75 years and above age group.^[19]

Numerous studies have demonstrated that glucose tolerance (GT) deteriorates with advancing age. The renal threshold for glucose increases with age, and thirst mechanisms are impaired in elderly. DM typical semiology (i.e. polyuria and polydipsia) is usually lacking in old people.^[20]

Death from hyperglycaemic crisis and risk of hypoglycaemia is higher in the elderly compared to their younger counterparts.

Age-related insulin resistance appears to be primarily associated with adiposity, sarcopenia and physical inactivity, which may partially explain the disproportionate success of the intensive lifestyle interventions in older participants in the Diabetes Prevention Programme (DPP)^[21]

Keeping the above epidemiology, pathophysiology and changing clinical scenario, our study evaluated barriers and facilitators of providing standard of diabetes care at a primary care level.

To understand the barriers and facilitators, viewpoints of patients and physicians were important to suggest suitable interventions and bridge healthcare gaps. There are two groups of diabetics among the elderly: incidental diabetics are those diagnosed after 60 years of age and others with long-standing diabetes. In our study, around half of the diabetes patients were diagnosed within the last 5 years.

HTN was the commonest comorbidity found among 50% of our study patients with diabetes. Prevalence of HTN in general geriatric population has been around 50%. A study by Radhakrishna *et al.*^[22] showed the overall prevalence of diabetes among the study population was 36% and the prevalence of HTN was 59%. Prevalence of HTN among geriatric population was found to be 67.2% in Delhi^[23] and 63.6% in Assam.^[24]

Assessment of age-specific barriers is recommended for management of diabetes in older adults. Diabetes management in elderly with diabetes is complicated by the presence of coexisting chronic conditions, including cognitive dysfunction, depression, physical disabilities and polypharmacy. Although these conditions, collectively referred to as geriatric syndrome, are not specifically associated with diabetes, they may act as barriers by interfering with patients' abilities to perform self-care tasks such as glucose monitoring, understanding the role of diet and exercise on glucose excursions and following complex insulin regimens.^[25] Unaddressed barriers in older adults may lead to non-adherence with diabetes self-care recommendations, treatment complications such as hypoglycaemia and an overall decline in health and quality of life.

Similar to other studies, our study found several barriers related to diet, exercise, forgetfulness impacting drug compliance, cost of medicine and so on. On the other hand, patients' dexterity is limited and their eyesight is generally poor, which affect their ability to monitor blood glucose levels and insulin doses.

The ideal care of old diabetics demands help from their families and a multidisciplinary approach in order to reduce the risk factors and increase their life expectancy with a high quality of life. The CCM has been shown to be an effective framework for improving the quality of diabetes care.^[26]

There is often a reactive rather than proactive approach to patient care: instead of continued observation, education and preventative care, patients can receive irregular care in response to symptomatic illness.

Our study evaluated physicians' perspectives about the barriers related to diabetes care and has revealed important information regarding system issues hampering continuity of care and lack of clinical training by most of the physicians, which need urgent attention, although most physicians felt confident and competent in managing diabetes. In a study by Khairnar *et al.*,^[27] physicians' perceived barriers that contributed to clinical inertia included cost of medications, lack of patient motivation and knowledge, non-compliance with diet and medications, polypharmacy and lack of time and social support. Our study also had similar response from patients as well as physicians.

Facilitators to improve diabetes control need coordination of provider, patient and health system. Effective physician-patient communication, proactive health system and family support are some of the most effective facilitators. Health education is an important tool to help patients learn about good healthy practices and self-monitoring of blood glucose. Another major facilitator is multidisciplinary collaboration, although the collaboration with certain professional groups (i.e. dieticians, physical therapists and pharmacists) could be further improved, as also the collaboration between primary and secondary care. Our study showed there is huge gap in multidisciplinary collaboration. Majority of physicians do not have a nutritionist involved in their daily practice.

A limitation of the current study is the selectivity of the sample among physicians as well as patients. No randomisation was done. Due to its small sample size, some divergent views on some aspects of care were received. Additionally, this study did not focus much on the role of health system in diabetes care. There was also not any intervention group.

Our study can, however, provide information regarding the barriers and facilitators of diabetes care from patients' as well as physicians' perspectives at a primary care level among the geriatric population.

Conclusion

Comorbidities and other complexities make diabetes care in the elderly very challenging. Lifestyle modifications and diet control were the major barriers perceived by the elderly population. Other barriers were economic reasons, lack of follow-up and poor compliance to medication. Facilitators were family support, health education and doctor-patient communication. Physicians' perspectives regarding barriers were lack of continuity of care, economic reasons, poor lifestyle and lack of diet control. Multidisciplinary collaboration and health system strengthening could be facilitators in improving diabetes care.

Recommendations

1. There is a need to do cross-sectional studies with a larger sample size.
2. A case-control study may help evaluate various factors related with poor glycaemic control.
3. A prospective study with suitable interventions, as suggested

in this study, and a larger sample size may give fair idea of its practical significance.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Caring for Our Elders: Early Responses India Ageing Report – 2017. India.unfpa.org. 2019. Available from: <https://india.unfpa.org/sites/default/files/pub-pdf/India%20Ageing%20Report%20-%202017%20%28Final%20Version%29.pdf>. [Last accessed on 2019 Feb 27].
2. Zgibor JC, Songer TJ. External barriers to diabetes Care: Addressing personal and health systems issues. *Diabetes Spectrum* 2001;14:23-8.
3. Diabetes Control and Complications Trial Research Group, Nathan DM, Genuth S, Lachin J, Cleary P, Crofford O, *et al.* The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *N Engl J Med* 329:977-86.
4. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *Br Med J* 1998;317:703-13.
5. Randomized trial of cholesterol-lowering in 4444 patients with coronary heart disease: The Scandinavian Simvastatin Survival Study (4S). *Lancet* 1994;344:1383-9.
6. Ross S. Breaking down patient and physician barriers to optimize glycemic control in type 2 diabetes. *Am J Med* 2013;126:S38-48.
7. Classification and diagnosis of diabetes: Standards of medical care in diabetes—2018. *Diabetes Care* 2017;41(Suppl 1):S13-27.
8. Glasgow RE, Orleans TC, Wagner EH, Curry SJ, Solberg LI. Does the chronic care model serve also as a template for improving prevention? *Milbank Q.* 2001;4:579-612.
9. Wens J, Vermeire E, Van Royen P, Sabbe B, Denekens J. GPs' perspectives of type 2 diabetes patients' adherence to treatment: A qualitative analysis of barriers and solutions. *BMC Fam Pract* 2005;6. doi: 10.1186/1471-2296-6-20.
10. Vinter-Repalust N, Petricek G, Katić M. Obstacles which patients with type 2 diabetes meet while adhering to the therapeutic regimen in everyday life: Qualitative study. *Croat Med J* 2004;45:630-6.
11. Nagelkerk J, Reick K, Meengs L. Perceived barriers and effective strategies to diabetes self-management. *J Adv Nurs* 2006;54:151-8.
12. Aweko J, De Man J, Absetz P, Östenson C, Swartling Peterson S, Mölsted Alvensson H, *et al.* Patient and provider dilemmas of type 2 diabetes self-management: A qualitative study in socioeconomically disadvantaged communities in stockholm. *Int J Environ Res Public Health* 2018;15:1810.
13. Vermeire E, Hearnshaw H, Rätsep A, Levasseur G, Petek D, van Dam H, *et al.* Obstacles to adherence in living with type-2 diabetes: An international qualitative study using meta-ethnography (EUROBSTACKLE). *Prim Care Diabetes*

- 2007;1:25-33.
14. United Nations Department of Economic and Social Affairs, Population Division. World Population Ageing 2020 Highlights Available from: https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/undesa_pd-2020_world_population_ageing_highlights.pdf.
 15. International Diabetes Federation. IDF Diabetic Atlas 7th Edition. Available from: <http://www.idf.org/idf-diabetes-atlas-seventh-edition>.
 16. Sinclair A, Morley JE, Rodriguez-Mañas L, Paolisso G, Bayer T, Zeyfang A, *et al.* Diabetes mellitus in older people: Position statement on behalf of the International Association of Gerontology and Geriatrics (IAGG), the European Diabetes Working Party for Older People (EDWPOP), and the International Task Force of Experts in Diabetes. *J Am Med Dir Assoc* 2012;13:497-502.
 17. Crandel J. Pharmacotherapy in older adults. ADA. 2014. Available from: <http://www.professional.diabetes.org/admin/UserFiles/CE/PG/Crandall%20%20ADA%20post%20grad%202014.pdf>. [Last accessed on 2015 Sep 04].
 18. Singh J, Saoji AV, Kasturwar NB, Pitale SP, Deoke AR, Nayse JG. Epidemiological study of diabetes amongst geriatric population in an urban slum, Nagpur. *Natl J Community Med* 2011;2:204-8.
 19. Kutty VR, Dilip TR, Archana AR, Gopinathan S, Ramanathan M. Shifting pattern of diabetes among the elderly in India: Evidence from the national sample survey organization's data, 2004-2014. *Int J Non-Commun Dis* 2018;3:67-74.
 20. Chau D, Edelman SV. Clinical management of diabetes in the elderly. *Clin Diabetes* 2001;19:172-5.
 21. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, *et al.* Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346:393-403.
 22. Radhakrishnan S, Balamurugan S. Prevalence of diabetes and hypertension among geriatric population in a rural community of Tamilnadu. *Indian J Med Sci* 2013;67:130-6.
 23. Goswami AK, Gupta SK, Kalaivani M, Nongkynrih B, Pandav CS. Burden of hypertension and diabetes among urban population aged ≥60 years in South Delhi: A community based study. *J Clin Diagn Res.* 2016;10:LC01-5.
 24. Hazarika NC, Biswas D, Mahanta J. Hypertension in the elderly population of Assam. *J Assoc Physicians India* 2003;51:567-73.
 25. Araki A, Ito H. Diabetes mellitus and geriatric syndromes. *Geriatr Gerontol Int* 2009;9:105-114.
 26. Stelfox M, Dipnarine K, Stopka C. The Chronic Care Model and diabetes management in US primary care settings: A systematic review. *Prev Chronic Dis* 2013;10:E26.
 27. Khairnar R, Kamal KM, Giannetti V, Dwibedi N, McConaha J. Primary care physician perspectives on barriers and facilitators to self-management of type 2 diabetes. *J Pharm Health Serv Res* 2019;10:117-23.