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EARLY SCREENING AND MANAGEMENT OF TYPE TWO DIABETES AMONG ADULTS IN URBAN LAHORE, PAKISTAN

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ABSTRACT

Type 2 diabetes mellitus is a rapidly increasing non-communicable disease and a major public health concern in Pakistan. It is characterized by impaired insulin function, insulin resistance, and persistently elevated blood glucose levels, which can lead to serious complications, including cardiovascular diseases, kidney failure, diabetic neuropathy, and vision impairment. Early screening and appropriate disease management are essential for identifying undiagnosed individuals, preventing disease progression, and reducing long-term health complications. In Pakistan, particularly in urban areas such as Lahore, changing dietary habits, sedentary lifestyles, obesity, genetic susceptibility, and limited awareness contribute to the increasing burden of diabetes. This study aims to investigate early screening practices and diabetes management among adults in urban Lahore, Pakistan. The research will examine the prevalence of previously undiagnosed diabetes and prediabetes among screened adults, awareness of diabetes risk factors, utilization of diagnostic services, and adherence to recommended treatment practices. A quantitative descriptive analytical cross-sectional research approach is proposed, involving adults attending selected healthcare facilities in urban Lahore. Data will be collected through structured questionnaires, clinical assessments, laboratory investigations, and relevant medical records. Screening will involve fasting plasma glucose and glycated hemoglobin measurements, with additional confirmatory testing where clinically indicated. The study will also examine lifestyle modifications, medication adherence, regular blood glucose monitoring, follow-up consultations, and screening for diabetes-related complications. Statistical analysis will be conducted to identify demographic, socioeconomic, behavioral, and healthcare-related factors associated with early detection and effective management. The research is expected to provide valuable evidence regarding gaps in diabetes screening and treatment practices among urban adults. Its findings may support improved screening programs, public awareness initiatives, patient education, and accessible diabetes management services in Lahore, Pakistan.

KEYWORDS

Type Two Diabetes, Early Screening, Prediabetes, Diabetes Management, Blood Glucose Monitoring, HbA1c, Lifestyle Modification, Medication Adherence, Urban Population, Lahore, Pakistan.

INTRODUCTION

Type 2 diabetes mellitus is one of the most significant chronic metabolic disorders affecting populations worldwide. It develops when the body becomes resistant to insulin or when pancreatic beta cells cannot produce sufficient insulin to maintain normal blood glucose levels. The condition is associated with several serious health complications, including cardiovascular diseases, chronic kidney disease, diabetic retinopathy, peripheral neuropathy, and premature

mortality. One of the major challenges associated with type 2 diabetes is that individuals may remain undiagnosed for several years because the disease can develop gradually without obvious symptoms. The American Diabetes Association Professional Practice Committee for Diabetes (2026) emphasizes the importance of risk-based screening, appropriate diagnostic testing, and early identification of individuals with prediabetes and diabetes. Early detection provides an opportunity to initiate preventive interventions and reduce the likelihood of long-term complications.Pakistan is facing an increasingly serious diabetes burden, making early screening and effective disease management important priorities for the national healthcare system. The increasing prevalence of obesity, unhealthy dietary practices, physical inactivity, urbanization, and genetic susceptibility has contributed to the growing number of individuals affected by type 2 diabetes. Rapid changes in lifestyle and dietary behavior have particularly affected urban populations, where processed foods, sugary beverages, sedentary occupations, and limited physical exercise are increasingly common. Khan et al. (2026), in their qualitative investigation of endocrinologists' perspectives in Pakistan, identified unhealthy dietary habits, obesity, sedentary lifestyles, financial barriers, and limited health awareness as important factors contributing to the diabetes burden. Their research also highlighted the need for early screening, patient education, and improved access to affordable treatment.Lahore is one of Pakistan's largest metropolitan cities and represents an important setting for investigating early diabetes screening and management practices. The city's growing population, urban development, changing occupational patterns, and increasing dependence on processed and commercially prepared foods have created several health-related challenges. Adults living in urban communities may experience prolonged periods of physical inactivity because of office-based employment, transportation habits, and demanding daily routines. In addition, the availability of healthcare facilities does not necessarily guarantee regular screening, timely diagnosis, or appropriate diabetes management. Differences in income, education, health awareness, and access to laboratory investigations may influence the extent to which individuals utilize preventive healthcare services.

Early screening plays a fundamental role in identifying individuals with undiagnosed diabetes and prediabetes before the development of severe complications. Common diagnostic methods include fasting plasma glucose, glycated hemoglobin (HbA1c), and the oral glucose tolerance test. According to the American Diabetes Association Professional Practice Committee for Diabetes (2026), diabetes screening should begin no later than age 35 years for adults, while younger individuals with overweight or obesity and additional risk factors should also be considered for testing. For individuals of Asian ancestry, a body mass index of 23 kg/m² or higher is considered an appropriate threshold when assessing overweight-related diabetes screening risk. The recommended diagnostic thresholds include fasting plasma glucose of 126 mg/dL or higher, HbA1c of 6.5% or higher, and two-hour plasma glucose of 200 mg/dL or

higher during a 75-g oral glucose tolerance test. In the absence of unequivocal hyperglycemia, confirmatory testing is generally required. These diagnostic approaches provide an important foundation for developing systematic screening strategies among adults in Lahore.Recent Pakistani research has demonstrated the importance of identifying diabetes at an early age and improving diagnostic awareness. Khurram et al. (2026) conducted a hospital-based study involving 856 patients with diabetes at five tertiary-care hospitals in Lahore and Kasur. Their research examined the characteristics of individuals diagnosed with diabetes at or before 40 years of age and identified differences in diabetes classification across age groups. The study also reported poor glycemic control, with a mean HbA1c level of 9.1%, demonstrating the importance of improving early identification and subsequent clinical management. This evidence is particularly relevant to Lahore because it highlights the need to strengthen diabetes-related healthcare services and pay attention to younger adults who may develop metabolic disorders earlier in life.

The importance of appropriate diagnostic testing is another major consideration in early diabetes screening. HbA1c provides an indication of average blood glucose levels over approximately the preceding two to three months, whereas fasting plasma glucose measures blood glucose at a particular point after fasting. The use of appropriate laboratory investigations can help healthcare professionals identify individuals with previously unrecognized hyperglycemia and distinguish between normal glucose regulation, prediabetes, and diabetes. The American Diabetes Association Professional Practice Committee for Diabetes (2026) recognizes HbA1c, fasting plasma glucose, and oral glucose tolerance testing as appropriate diagnostic approaches. However, the availability, affordability, standardization, and accessibility of these tests may influence their utilization in different healthcare settings.Effective diabetes management requires a comprehensive approach involving medication, nutritional improvement, physical activity, regular monitoring, and prevention of complications. Lifestyle modification is an essential component of disease management because balanced dietary practices, weight management, regular exercise, and reduced consumption of sugary foods can improve metabolic health. Davies et al. (2026) emphasized that modern type 2 diabetes management should extend beyond controlling blood glucose and include cardiovascular protection, kidney health, weight management, psychological support, and individualized treatment. Their consensus report highlights the importance of coordinated healthcare services and appropriate therapeutic interventions to improve long-term outcomes among individuals living with diabetes.

Medication adherence is another important determinant of successful diabetes management. Patients who discontinue prescribed medication, miss doses, avoid follow-up appointments, or fail to monitor their blood glucose may experience inadequate disease control and increased risks of complications. Financial limitations, fear of medication side effects, inadequate health

knowledge, and cultural misconceptions can influence treatment adherence. Aamir et al. (2026), in their research conducted at a tertiary-care hospital in Lahore, identified patient resistance, fear of hypoglycemia, cultural beliefs, limited resources, and inadequate education as important barriers affecting insulin utilization. Their findings emphasize the importance of effective communication, patient counseling, diabetes education, and regular clinical follow-up.Healthcare professionals also play an essential role in early diagnosis and the continuing management of type 2 diabetes. Primary healthcare physicians, endocrinologists, pharmacists, nurses, and laboratory professionals contribute to screening, diagnosis, treatment planning, patient education, and complication prevention. Maaz et al. (2026) investigated diabetes-related knowledge and clinical practices among medical practitioners at Medical Teaching Institute Mardan, Pakistan. Their findings identified important gaps in diagnostic knowledge, routine complication screening, and adherence to clinical protocols. The study also highlighted financial limitations, poor patient compliance, and restricted access to specialist services as barriers to effective diabetes care. Such evidence demonstrates the importance of strengthening healthcare professional training and improving the quality of diabetes-related services.Socioeconomic conditions and psychological factors also influence diabetes management and patient participation in preventive healthcare. Individuals with limited financial resources may experience difficulties obtaining regular laboratory investigations, purchasing prescribed medicines, and attending follow-up appointments. Educational background and health literacy may influence understanding of diagnostic procedures, dietary recommendations, medication requirements, and potential complications. Asmat et al. (2026), in a systematic review and meta-analysis of diabetes distress among adults with type 2 diabetes in Pakistan, reported a pooled diabetes distress prevalence of 66.8% across seven included studies. Their findings identified inadequate self-care, low income, limited social support, and suboptimal glycemic control among important associated factors. These findings demonstrate that effective diabetes management should address both physical and psychological aspects of the disease.

Despite increasing awareness regarding diabetes prevention and treatment, significant gaps remain in early screening, timely diagnosis, and continuing management among adults in Pakistan. In urban Lahore, further research is needed to examine the proportion of adults who receive appropriate screening, the identification of previously undiagnosed diabetes, and the factors influencing treatment adherence and follow-up practices. Healthcare-based research can provide useful information regarding the availability of diagnostic services, patient awareness, lifestyle practices, and existing management challenges. Therefore, the present study aims to investigate early screening and management of type 2 diabetes among adults in urban Lahore, Pakistan. The research is expected to contribute to improved preventive healthcare practices, strengthen early diagnosis, and support the development of accessible and evidence-based

diabetes management strategies.

RESEARCH OBJECTIVES

1. To assess early screening practices and identify previously undiagnosed type 2 diabetes and prediabetes among adults in urban Lahore, Pakistan.
2. To examine the effectiveness of existing diabetes management practices, including medication adherence, blood glucose monitoring, dietary modification, and physical activity.
3. To identify demographic, socioeconomic, behavioral, and healthcare-related factors influencing early diabetes screening and appropriate disease management.

RESEARCH QUESTIONS

1. What proportion of adults attending selected healthcare facilities in urban Lahore have previously undiagnosed type 2 diabetes or prediabetes?
2. To what extent are adults with type 2 diabetes following recommended management practices, including medication adherence, blood glucose monitoring, and lifestyle modification?
3. Which demographic, socioeconomic, behavioral, and healthcare-related factors influence early diabetes screening and effective management among adults in urban Lahore?

LITERATURE REVIEW

Type 2 diabetes has become an important subject of international public health research because of its increasing prevalence, long-term complications, and substantial impact on healthcare systems. Recent research emphasizes that early screening and timely intervention are essential for reducing the burden of diabetes, particularly in countries experiencing rapid urbanization and changing lifestyle patterns. The American Diabetes Association Professional Practice Committee for Diabetes (2026) provides updated recommendations for identifying individuals at risk of diabetes and establishing appropriate diagnostic procedures. The guidelines recommend screening adults according to age and individual risk factors, with particular attention to individuals experiencing overweight, obesity, family history of diabetes, hypertension, and other metabolic risk conditions. This evidence establishes the importance of implementing systematic screening programs within primary healthcare facilities.

Research conducted in Pakistan has highlighted the increasing importance of diabetes prevention

and early diagnosis. Khurram et al. (2026) investigated early-onset diabetes among 856 patients attending five tertiary-care hospitals in Lahore and Kasur. Their research demonstrated that diabetes can affect individuals at relatively young ages and that clinical characteristics differ according to age at diagnosis. The study also identified poor glycemic control across different age groups, emphasizing the need for timely diagnosis and continuous monitoring. These findings provide important regional evidence for investigating diabetes screening and management among adults in Lahore. However, because the research focused on hospital patients diagnosed at or before 40 years of age, its findings should not be interpreted as population-wide prevalence estimates.The diagnostic accuracy of screening procedures is another important area of diabetes research. The American Diabetes Association Professional Practice Committee for Diabetes (2026) identifies HbA1c, fasting plasma glucose, and the oral glucose tolerance test as appropriate methods for diagnosing diabetes and prediabetes. These investigations provide complementary information regarding glucose regulation and help healthcare professionals identify individuals requiring further assessment or clinical intervention. Early identification is particularly important because individuals with prediabetes may benefit from lifestyle interventions designed to prevent or delay progression to type 2 diabetes. Therefore, the availability of reliable laboratory investigations and standardized diagnostic procedures is essential for effective screening programs.

Recent clinical guidance has also emphasized the need for comprehensive and individualized diabetes management. Samson et al. (2026), in the American Association of Clinical Endocrinology's updated consensus statement, presented an evidence-based management algorithm addressing prediabetes, diabetes classification, glucose control, obesity, cardiovascular risk factors, and diabetes-related complications. Their recommendations emphasize that treatment decisions should consider individual clinical characteristics, associated health conditions, and patient preferences. The updated guidance also highlights lifestyle modification and weight management as important components of diabetes prevention and treatment. This approach is relevant to urban Lahore, where obesity, physical inactivity, and unhealthy dietary practices may contribute to metabolic disorders.Davies et al. (2026) further examined comprehensive type 2 diabetes management through a consensus report developed by the American Diabetes Association and European Association for the Study of Diabetes. Their research emphasized a holistic approach that addresses blood glucose control, weight management, cardiovascular health, kidney protection, and associated long-term conditions. The report also supports appropriate use of glucose-lowering therapies, including sodium-glucose cotransporter-2 inhibitors and glucagon-like peptide-1-based treatments where clinically indicated. It highlights the importance of structured healthcare delivery, patient-centered treatment decisions, psychological support, and equitable access to appropriate therapies. These recommendations demonstrate that effective diabetes management requires more than

prescribing medication and must involve continuous monitoring and comprehensive preventive healthcare.Research on healthcare professionals' knowledge and clinical practices has also identified important challenges affecting diabetes management in Pakistan. Maaz et al. (2026) conducted a cross-sectional study at Medical Teaching Institute Mardan and examined diabetes-related knowledge and clinical practices among medical practitioners. Their findings indicated that only 52.8% of participating practitioners correctly identified the diagnostic HbA1c threshold, while 51.1% routinely performed diabetic foot examinations. High treatment costs, poor patient compliance, limited specialist access, and the absence of clinical protocols were identified as important barriers. These findings highlight the importance of strengthening professional education, standardizing clinical practices, and improving access to appropriate diagnostic and monitoring facilities across Pakistan.Patient adherence and access to treatment are additional determinants of effective diabetes management. Aamir et al. (2026) investigated insulin-prescribing challenges and physician-suggested interventions at a tertiary-care hospital in Lahore, Pakistan. Their cross-sectional research involved 808 physicians and identified patient resistance, fear of hypoglycemia, cultural beliefs, treatment complexity, and limited resources as important barriers affecting insulin utilization. The study emphasized the importance of patient education, regular follow-up, effective communication, and improved healthcare support. These findings are particularly relevant to the present research because they demonstrate that even when appropriate treatment is available, individual beliefs and healthcare-related barriers may affect the continuity and quality of diabetes management.

Psychological well-being and diabetes-related distress have also become important considerations in contemporary diabetes research. Asmat et al. (2026) conducted a systematic review and meta-analysis examining diabetes distress among adults with type 2 diabetes in Pakistan. Their analysis included seven studies involving 1,560 adults and reported a pooled diabetes distress prevalence of 66.8%. Frequently identified associated factors included inadequate self-care, poor glycemic control, longer disease duration, lower educational attainment, limited income, and insufficient social support. Their findings demonstrate that psychological and socioeconomic factors can influence treatment adherence and disease management. Integrating patient counseling, culturally appropriate education, and psychosocial support into routine diabetes services may therefore improve long-term disease management.Overall, the reviewed literature demonstrates that early diabetes screening and effective management depend on appropriate diagnostic procedures, healthcare accessibility, professional knowledge, patient education, and continuous treatment adherence. Recent 2026 research provides important evidence regarding diabetes among Pakistani populations, particularly in Lahore and other urban healthcare settings. However, further investigation is required to understand the relationship between early screening practices, previously undiagnosed diabetes, healthcare utilization, and treatment adherence among adults in urban

Lahore. The proposed study will address this research need by examining screening practices, clinical measurements, lifestyle characteristics, and diabetes management indicators within selected healthcare facilities.

METHODOLOGY

The proposed study will employ a quantitative research methodology to investigate early screening and management of type 2 diabetes among adults in urban Lahore, Pakistan. The target population will consist of adults aged 18 years and above attending selected public and private healthcare facilities, including outpatient departments, medical clinics, and primary healthcare centers. A sample of approximately 400 participants will be considered, subject to formal sample-size calculation based on expected undiagnosed diabetes prevalence, confidence level, precision, and anticipated non-response. Participants will be recruited through consecutive sampling or another appropriate probability-based method where facility records permit. Individuals who provide informed consent and meet the eligibility criteria will be included, while individuals with conditions that prevent reliable clinical assessment or questionnaire completion will be excluded where appropriate. Data will be collected through structured questionnaires, clinical measurements, laboratory investigations, and relevant medical records. The questionnaire will obtain information regarding age, gender, educational background, employment, household income, family history of diabetes, dietary practices, physical activity, smoking, previous screening, and healthcare-seeking behavior. Clinical assessments will include body mass index, blood pressure, fasting plasma glucose, and HbA1c where available. Participants will be classified according to established diagnostic criteria for normal glucose regulation, prediabetes, and diabetes. Individuals with abnormal screening results will be referred for appropriate confirmatory clinical assessment rather than being considered definitively diagnosed on the basis of an unconfirmed screening result. Participants with previously diagnosed diabetes will also be assessed regarding medication adherence, dietary modification, physical activity, blood glucose monitoring, follow-up attendance, and screening for diabetes-related complications. Ethical approval will be obtained from the relevant institutional review committee and participating healthcare facilities. Informed consent, confidentiality, voluntary participation, and secure management of personal and medical information will be maintained throughout the research process.

RESEARCH DESIGN

A descriptive analytical cross-sectional research design will be adopted to examine early diabetes screening and management practices among adults in urban Lahore. This design is appropriate

because it enables the collection of demographic, socioeconomic, clinical, and behavioral information from a defined population during a specific period. The research will be conducted at selected healthcare facilities representing different urban communities and socioeconomic backgrounds. The sampling strategy will aim to include adults from different age groups, genders, educational categories, and income levels to provide a broad understanding of screening practices and healthcare utilization. The independent variables will include age, gender, family history, body mass index, educational attainment, income, dietary habits, physical activity, and healthcare accessibility. The principal outcome variables will include screening status, previously undiagnosed diabetes or prediabetes, and indicators of diabetes management among individuals with an established diagnosis. Additional management indicators will include HbA1c monitoring, medication adherence, lifestyle modification, regular medical consultations, and complication screening. Standardized questionnaires and clinical measurement procedures will be used to improve data reliability. A pilot study will be conducted to assess the clarity and suitability of the research instruments before full-scale data collection. The study will also distinguish between newly detected abnormal screening results and clinically confirmed diabetes diagnoses. This design will help identify associations between screening practices, individual characteristics, and management indicators, although it will not establish causal relationships or directly measure long-term treatment effectiveness.

DATA ANALYSIS

The collected data will be coded, entered, cleaned, and analyzed using the Statistical Package for the Social Sciences (SPSS) or an equivalent statistical software program. Descriptive statistical methods will be applied to summarize participants' demographic characteristics, socioeconomic backgrounds, clinical measurements, and diabetes-related healthcare practices. Frequencies and percentages will be calculated for categorical variables, while means and standard deviations will be used for continuous variables where appropriate. The proportion of participants with previously undiagnosed diabetes and prediabetes will be calculated using the applicable diagnostic criteria, with appropriate distinction between screening-positive results and confirmed diagnoses. Separate estimates will be presented according to age, gender, body mass index, family history, and socioeconomic characteristics to identify differences in screening outcomes among population groups.Inferential statistical techniques will be used to examine relationships between early screening, diabetes risk factors, and management practices. Chi-square tests will be applied to assess associations between categorical variables, while independent-sample t-tests or appropriate non-parametric alternatives will be used to compare continuous measurements. Binary logistic regression will be conducted to identify independent factors associated with previously undiagnosed diabetes, while additional regression models will examine factors associated with appropriate diabetes management among participants with an established

diagnosis. Adjusted odds ratios and 95% confidence intervals will be reported to demonstrate the strength and precision of observed associations. Statistical significance will be determined using a conventional p-value threshold of less than .05. The analysis will also examine medication adherence, regular blood glucose monitoring, dietary modification, physical activity, follow-up attendance, and diabetes complication screening. Missing observations will be assessed before statistical testing, and appropriate procedures will be selected according to their extent and distribution. These analytical procedures will provide a comprehensive understanding of early screening practices and diabetes management among adults attending selected healthcare facilities in urban Lahore.

FINDINGS

Since the proposed study has not yet involved actual participant recruitment, laboratory investigations, or primary data collection, its findings cannot be presented as observed research results. The expected findings are anticipated to provide important information regarding early screening practices and the identification of previously undiagnosed type 2 diabetes and prediabetes among adults in urban Lahore. Based on recent Pakistani research, the study may identify important differences in screening utilization according to age, body mass index, family history, educational attainment, and socioeconomic background. Individuals with obesity, limited physical activity, unhealthy dietary practices, and a family history of diabetes may demonstrate a greater likelihood of abnormal glucose measurements. The research is also expected to identify gaps in routine screening and awareness regarding the importance of early diagnosis among adults who do not regularly utilize preventive healthcare services.The study is further expected to provide information regarding diabetes management among individuals with an established diagnosis. Medication adherence, regular HbA1c monitoring, dietary modification, physical activity, and follow-up consultations may vary according to educational attainment, household income, healthcare accessibility, and patient awareness. Some participants may experience difficulties maintaining recommended treatment practices because of medication costs, limited availability of diagnostic services, cultural misconceptions, and insufficient patient counseling. The research may also identify differences in diabetes management between participants attending public and private healthcare facilities. These anticipated findings may help healthcare professionals identify weaknesses in existing screening and management practices and develop appropriate interventions. However, all expected relationships and patterns will require confirmation through actual data collection and statistical analysis.

CONCLUSION

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Type 2 diabetes represents a growing public health challenge in Pakistan, particularly in urban populations experiencing rapid lifestyle and socioeconomic changes. Its gradual development, frequently unnoticed early symptoms, and potential for serious long-term complications make early screening and appropriate disease management essential components of preventive healthcare. The proposed study aims to investigate early screening practices and diabetes management among adults in urban Lahore, Pakistan, with particular attention to previously undiagnosed diabetes, prediabetes, lifestyle-related risk factors, medication adherence, and healthcare utilization. By examining demographic, socioeconomic, clinical, and behavioral characteristics, the research will provide an opportunity to understand the factors influencing timely diagnosis and appropriate disease management.The study is expected to contribute to improving diabetes prevention and healthcare practices by identifying gaps in screening utilization, diagnostic awareness, and treatment adherence. Strengthening routine glucose screening, improving access to reliable laboratory investigations, promoting healthy dietary habits, encouraging physical activity, and providing continuous patient education may help reduce the burden of diabetes-related complications. Healthcare institutions should also emphasize regular follow-up, individualized treatment planning, appropriate medication use, and routine screening for cardiovascular, kidney, eye, and neurological complications. Furthermore, collaboration between healthcare professionals, public health authorities, and community organizations may support the development of accessible and sustainable diabetes prevention programs. Overall, this research may provide valuable evidence for improving early detection, strengthening clinical management, and promoting better long-term health outcomes among adults in urban Lahore, Pakistan.

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