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Article

The Growing Burden of Diabetes Mellitus in Pakistan: Epidemiology, Risk Factors, Challenges, and Public Health Interventions

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ABSTRACT

Background: Diabetes mellitus has emerged as a major public health challenge in Pakistan, with prevalence rates among the highest worldwide and a substantial proportion of undiagnosed cases. Despite increasing incidence, integrated data on epidemiology, risk factors, and health system barriers remain limited, creating a gap in effective prevention and management strategies. **Objective**: This review aims to synthesize the epidemiological burden, key risk factors, diagnostic and management challenges, and public health responses to diabetes mellitus in Pakistan, with a focus on quantifying prevalence, analyzing risk associations, and identifying actionable intervention points. **Methods**: A narrative review was conducted at Baqai Medical University, Karachi, using structured searches of Google Scholar and PubMed for literature published between 2000 and 2025. Studies were included if they addressed diabetes prevalence, risk factors, management, or public health interventions in Pakistan; non-English, duplicate, or irrelevant articles were excluded. Data extraction focused on prevalence, demographic risk profiles, system-level barriers, and outcomes. Descriptive and comparative statistics were calculated using Microsoft Excel, with significance assessed at $p < 0.05$ and 95% confidence intervals. The review adhered to ethical standards consistent with the Helsinki Declaration. **Results**: National prevalence of diabetes in adults was 30.8% (95% CI: 29.7–31.9), with urban areas showing higher rates than rural (28.3% vs 25.3%, $p < 0.05$) and 26.9% of cases undiagnosed. Central obesity, low physical activity, hypertension, and family history were major risk factors (OR range: 1.33–2.41, all $p < 0.01$). Poor glycemic control affected up to 86.4% of patients and was associated with a twofold increase in complications (OR 2.34, 95% CI: 1.62–3.38). **Conclusion**: Diabetes mellitus in Pakistan constitutes an urgent clinical and public health threat driven by interlinked genetic, behavioral, and systemic factors. Comprehensive, context-specific interventions in early detection, risk factor modification, and health system strengthening are essential to reduce disease burden and improve patient outcomes.

Keywords: Diabetes Mellitus, Epidemiology, Risk Factors, Prevalence, Public Health, Healthcare Access, Pakistan

INTRODUCTION

Diabetes mellitus represents a formidable global health challenge, now reaching epidemic proportions with over 400 million individuals affected worldwide and accounting for approximately 1.5 million deaths annually (1). This burden is disproportionately concentrated in low- and middle-income countries (LMICs), where the majority of diabetes-related mortality and morbidity are observed (1). Within this context, South Asia has witnessed an alarming escalation in diabetes prevalence, transitioning from single-digit rates before the 1990s to double-digit figures in recent decades (2). Projections underscore the gravity of this trend, anticipating a nearly 96% rise in diabetes cases in the region by 2045 (3). Pakistan stands at the epicenter of this crisis, reporting the world's highest comparative prevalence of diabetes among adults aged 20 to 79 years, with recent data indicating a prevalence of 30.8% in 2021 (1). In absolute numbers, Pakistan now ranks third globally for adult diabetes burden, trailing only China and India (4).

Despite the magnitude of this public health emergency, a considerable proportion of diabetes cases in Pakistan remain undiagnosed or poorly managed, heightening the risk of severe complications and premature mortality (4). Contributing to this scenario is a

complex interplay of genetic, metabolic, behavioral, and socioeconomic factors. South Asians, including Pakistanis, exhibit a strong genetic predisposition to diabetes, with familial clustering and early onset being common, yet these genetic susceptibilities are compounded by rapidly shifting lifestyle and dietary patterns (9,10,11). The growing prevalence of obesity, increased consumption of processed and high-glycemic-index foods, and declining levels of physical activity—particularly in urban and socioeconomically disadvantaged populations—have accelerated the diabetes epidemic (14,16,18). Moreover, structural determinants such as poverty, limited education, and the rapid pace of urbanization intensify risk exposure and hinder access to preventive and therapeutic healthcare services (11,20).

A further challenge lies in the healthcare system's limited capacity to effectively diagnose, monitor, and manage diabetes across the population. Primary care infrastructure in Pakistan often lacks adequate resources for population-wide screening, timely diagnosis, and continuous management (23). Many individuals present late with established complications, and glycemic control remains suboptimal for a large proportion of diagnosed patients, largely due to inadequate awareness, fragmented care delivery, high out-of-pocket costs, and cultural barriers affecting adherence to lifestyle and pharmacological interventions (4,21,26). Women and those residing in urban environments appear particularly vulnerable, not only due to biological and social determinants but also due to culturally mediated barriers to healthcare access and support (8,21,28). These issues are compounded by a paucity of comprehensive, real-time epidemiological data and a limited emphasis on culturally tailored education or prevention programs at scale (6,13,25).

A critical knowledge gap persists regarding the extent to which multifactorial risk environments and systemic healthcare constraints interact to sustain and amplify the diabetes burden in Pakistan. While numerous studies have described the rising prevalence and documented individual risk factors, there remains a need for an integrated synthesis of the epidemiological trends, underlying determinants, and barriers to effective management, with a focus on identifying actionable strategies for intervention. Such a synthesis is essential for guiding policymakers, healthcare providers, and researchers toward evidence-based, context-appropriate responses capable of reversing the trajectory of the epidemic.

This review aims to comprehensively assess the burden of diabetes mellitus in Pakistan by synthesizing current evidence on epidemiology, risk factors, challenges in diagnosis and management, and public health responses. The objective is to identify critical gaps, highlight pressing challenges, and inform the development of integrated, culturally sensitive, and scalable interventions for diabetes prevention and control in Pakistan.

MATERIALS AND METHODS

This narrative review was designed to synthesize current evidence on the epidemiology, risk factors, diagnostic and management challenges, and public health interventions pertaining to diabetes mellitus in Pakistan. The review was conducted at the Department of Medicine, Baqai Medical University, Karachi, Pakistan, with the literature search and analysis performed between January 2024 and April 2025. The rationale for selecting a narrative review design was to provide an integrative and critical appraisal of heterogeneous data sources, contextualizing quantitative trends alongside qualitative insights and policy analyses to better inform practice and policymaking in the local setting (2,4).

Eligibility criteria for inclusion were established a priori to ensure the relevance and rigor of the review. Studies and reports were included if they addressed diabetes mellitus in Pakistan with respect to prevalence, risk factors, diagnosis, management, or public health response. Eligible sources comprised peer-reviewed original research articles, systematic reviews, national health surveys, and reports from recognized public health bodies published in English. Exclusion criteria included studies focused solely on populations outside Pakistan, non-English publications, commentaries without empirical data, and duplicate reports. A structured literature search was performed using Google Scholar and PubMed, employing the following search terms both singly and in combination: "diabetes mellitus," "Pakistan," "epidemiology," "risk factors," "prevalence," "screening," "management," and "public health interventions." The search was limited to publications from 2000 to 2025 to ensure the inclusion of recent and relevant data, with earlier seminal works included where necessary to provide historical context (4,8,13).

The screening process involved two reviewers independently assessing titles and abstracts for relevance, with full texts retrieved for potentially eligible articles. Disagreements were resolved through consensus and, when necessary, discussion with a third reviewer to minimize selection bias. Data extraction was performed using a standardized electronic form that captured study characteristics, population demographics, definitions of variables, primary and secondary outcomes, prevalence estimates, identified risk factors, details of healthcare challenges, and descriptions of interventions or policies. In cases of missing or incomplete data, efforts were made to triangulate findings from multiple sources or contact corresponding authors for clarification, although only publicly available data were ultimately included. Variables were operationalized according to internationally recognized definitions, with diabetes defined as a fasting plasma glucose ≥7.0 mmol/L, HbA1c ≥6.5%, or self-reported diagnosis by a healthcare provider, consistent with national guidelines and the criteria applied in most of the included studies (13,16).

Potential sources of bias and confounding were addressed by prioritizing population-based surveys, multi-center studies, and systematic reviews, and by critically appraising the methodological quality of included sources. Information on participant recruitment, sampling frames, and diagnostic criteria from original studies was reviewed to assess representativeness and minimize selection bias. Where possible, estimates adjusted for age, gender, and urban/rural status were preferentially extracted and analyzed

to account for known confounders (4,16). The narrative synthesis approach facilitated the integration of quantitative data with qualitative themes, allowing for triangulation and critical assessment of findings across multiple data types and sources. To further limit bias, all included articles were cross-checked for consistency, and outlier findings were subjected to additional scrutiny.

The sample size in this review was not predetermined, as the focus was on comprehensive coverage of the relevant literature rather than primary data collection. However, the final number of included studies and data sources was determined by thematic saturation, whereby additional articles did not yield substantially new information or alter the main findings. All extracted data were independently checked for accuracy and completeness by two reviewers to ensure data integrity and reproducibility. For statistical analysis, when pooled quantitative data were available (such as prevalence rates or risk estimates), descriptive statistics were summarized and presented in tabular form. No formal meta-analysis was performed due to the anticipated heterogeneity of study designs, populations, and outcomes. Statistical analyses were conducted using Microsoft Excel for tabulation and calculation of summary measures. Missing data were explicitly noted, and only complete-case data were included in prevalence and risk factor summaries to avoid imputation-related bias.

Ethical considerations were addressed by restricting the review to publicly available published studies and reports, thus not requiring institutional review board approval or participant consent. However, all included sources were checked for evidence of ethical clearance in their original context. To ensure confidentiality and data protection, only aggregate data without personal identifiers were extracted and reported. The review process was documented in detail, with all search strategies, inclusion and exclusion decisions, and extracted data archived electronically and available for audit to maximize transparency and reproducibility. All analyses and reporting adhered to international standards for narrative reviews and data synthesis (2,4,13).

RESULTS

The burden of diabetes mellitus in Pakistan has escalated rapidly over the past two decades, with an estimated 33 million adults aged 20 to 79 years affected as of 2021 and projections suggesting this figure will surpass 70 million by 2050 (1,20). The age-standardized prevalence among adults was reported at 30.8% in 2021, positioning Pakistan as the country with the highest comparative diabetes prevalence globally (1). Provincial variation is notable, with Sindh recording the highest rate at 32.3%, followed by Punjab at 30.2%, Balochistan at 29.5%, and Khyber Pakhtunkhwa significantly lower at 13.2% (1). Urban residency confers a higher risk, with diabetes prevalence in urban areas (28.3%) significantly exceeding that in rural populations (25.3%) (2,13). Age stratification reveals the greatest risk among individuals aged 51 to 60 years, who exhibit a prevalence of 26.03%, while early-onset diabetes—diagnosed at age 40 or younger—now accounts for 18% of all cases, underscoring a shift toward younger age at disease onset (1,9).

Table 1. Diabetes Prevalence and Projections in Pakistan (2000–2050)

Year	DM (M)	Prev (%)	Undx (%)	Undx (M)	IFG (M)	IFG (%)	IGT (M)	IGT (%)	DM Deaths (20–79)	Source
2000	8.8	11.8	–	–	–	–	–	–	–	(20)
2011	8.8	–	–	–	–	–	–	–	–	(20)
2016	26.3	–	26.9	–	–	–	14.4	–	–	(2)
2019	19.0	–	–	8.5	–	–	–	–	–	(19)
2021	33.0	30.8	>33	8.9	–	–	11.0	–	35.5%	(1), (4)
2024	34.5	31.4	26.9	9.3	10.1	8.5	11.2	9.8	65,735	(20), (23)
2025	14.5	–	–	–	–	–	–	–	–	(21)
2045	62.2	34.2	–	–	19.6	9.2	21.2	10.4	226,752	(15), (20)
2050	70.2	–	–	–	–	–	–	–	–	(20)

Abbreviations: DM = Diabetes Mellitus; IFG = Impaired Fasting Glucose; IGT = Impaired Glucose Tolerance; Undx = Undiagnosed; Prev = Prevalence; CI = Confidence Interval; M = Millions; sources are listed in References.

Table 2. Demographic and Regional Prevalence of Diabetes in Pakistan

Category	Specific Group	Diabetes (%)	p-value	OR	Source(s)
Overall (2021)	Adults 20–79 yrs	30.8	–	–	(1)
NDSP 2016–2017	Overall weighted	26.3	–	–	(2)
Urban (NDSP)	Urban areas	28.3	<0.05*	OR = 1.21	(2), (13)
Rural (NDSP)	Rural areas	25.3			
Age Group	51–60 yrs	26.03	<0.01	–	(1)
Early Onset	Under 40 yrs (of diagnosed cases)	18	–	–	(9)
STEPS Survey	≥50 yrs	11.2	–	–	(27)
Province: Sindh	Sindh	32.3	<0.001*	–	(1)
Province: Punjab	Punjab	30.2		–	
Province: Balochistan	Balochistan	29.5		–	
Province: KPK	Khyber Pakhtunkhwa (KPK)	13.2		–	

Differences between urban and rural, and among provinces, are statistically significant ($p < 0.05$), according to referenced national surveys.

Table 3. Risk Factors Associated with Diabetes Mellitus in Pakistan

Risk Factor	Measure	Association	OR	95% CI	p-value	Source(s)
Family history	~33%	+2 generations: ↑	2.41	1.77–3.27	<0.001	(9,13)
Central obesity	>70%		–	–	–	(14)
Overweight (STEPS)	26.3%		–	–	–	(16)
Obese (STEPS)	14.9%	–	–	–	–	(16)
Overweight (NDSP)	62.1%	–	–	–	–	(16)
Obese (NDSP)	47.5%	–	–	–	–	(16)
Low fruit/vegetable intake	96.5%	–	–	–	–	(15)
Low physical activity	46.1% (STEPS)	–	1.33	1.12–1.58	0.001	(16,20)
Hypertension	52.6% (NDSP), 53% (STEPS)	–	1.72	1.40–2.11	<0.001	(16,9)
Dyslipidemia		^LDL, Triglycerides	1.41	1.10–1.80	0.007	(13)
Tobacco use (STEPS)	High daily use	–	01.18	1.02–1.36	0.023	(16,15)
Poor SES	↑ diabetes risk	–	1.28	1.06–1.54	0.009	(20)

FHx: Family history; SES: Socioeconomic status. For additional definitions, see manuscript.

Table 4. Glycemic Control and Complications in Diagnosed Patients

Parameter	Estimate (%)	Outcome	Odds Ratio	95% CI	p-value	Source(s)
Poor glycemic control	44.7–86.4	–	–	–	–	(4)
Microvascular complications	35–52	(e.g., retinopathy, nephropathy, neuropathy)	–	–	–	(4)
Macrovascular complications	15–29	(e.g., MI, stroke, PAD)	–	–	–	(4)
Uncontrolled DM & complications	Poor control vs good	↑ risk all complications	2.34	1.62–3.38	<0.001	(4,25)

MI: Myocardial infarction; PAD: Peripheral artery disease.

Table 5. Barriers to Care and Health System Challenges

Challenge/Barrier	Estimate	Odds Ratio (OR) / Effect Size	95% CI	p-value	Source(s)
Undiagnosed DM	26.9–33%	–	–	–	(1,4)
Poor treatment adherence	Up to 50%	1.88	1.29–2.76	0.001	(4,26)
Never received DM education	>40% DM	–	–	–	(6)
Inadequate screening (public sector)	10–20% DM/HTN	–	–	–	(23)
Financial hardship	30–40% financial	–	–	–	(26,24)

Table 6. Treatment Adherence and Insulin Denial

Parameter	Estimate	Association	Odds Ratio	95% CI	p-value	Source(s)
Poor treatment adherence	Up to 50%	vs. good adherence	OR = 1.88	1.29–2.76	0.001	(4,26)
Insulin denial	15–23% of insulin-eligible	vs. acceptance	OR = 2.15	1.31–3.53	0.002	(27)

A substantial portion of the diabetic population remains undiagnosed, with more than one in four individuals (26.9%) unaware of their condition as of 2021 (1). In 2019, 8.5 million out of 19 million adults with diabetes were undiagnosed, and this hidden burden rose to 8.9 million by 2021 (4,19). Additionally, the prevalence of pre-diabetes stands at 14.4%, while impaired fasting glucose affects approximately 10.1 million people (4,20). Collectively, these figures indicate a significant pool of individuals at imminent risk for progressing to full-blown diabetes.

Several risk factors drive this epidemic. Family history is present in about 33% of the diabetic population and increases the odds of early-onset diabetes over twofold (OR 2.41, 95% CI: 1.77–3.27, $p < 0.001$) (9,13). Central obesity, affecting over 70% of adults, and general obesity, reported in 47.5% according to the National Diabetes Survey, are major contributors (14,16). Overweight status is reported in 62.1% of adults using WHO cut-offs (16). Low levels of physical activity are highly prevalent, with the STEPS survey indicating that 46.1% of adults fall below recommended activity levels, raising the risk of diabetes by approximately 33% (OR 1.33, 95% CI: 1.12–1.58, $p = 0.001$) (16,20). Dietary patterns are also suboptimal; 96.5% of adults report inadequate fruit and vegetable consumption, and increased intake of refined carbohydrates and processed foods is common (15,18). Hypertension, closely linked with diabetes, is present in more than half of adults with diabetes—52.6% in the National Diabetes Survey and 53% in the STEPS survey—with hypertension increasing diabetes risk by 72% (OR 1.72, 95% CI: 1.40–2.11, $p < 0.001$) (9,16). Additional risk factors include dyslipidemia (OR 1.41, 95% CI: 1.10–1.80, $p = 0.007$), high tobacco use (OR 1.18, 95% CI: 1.02–1.36, $p = 0.023$), and lower socioeconomic status (OR 1.28, 95% CI: 1.06–1.54, $p = 0.009$) (13,15,16,20). Glycemic control remains suboptimal, with studies showing that 44.7% to 86.4% of patients fail to achieve target glucose levels (4). As a result, microvascular complications such as retinopathy, nephropathy, and neuropathy

affect 35–52% of diagnosed patients, while macrovascular complications—such as myocardial infarction, stroke, and peripheral artery disease—are observed in 15–29% (4). Poor glycemic control doubles the risk of complications (OR 2.34, 95% CI: 1.62–3.38, p < 0.001)(4,25).

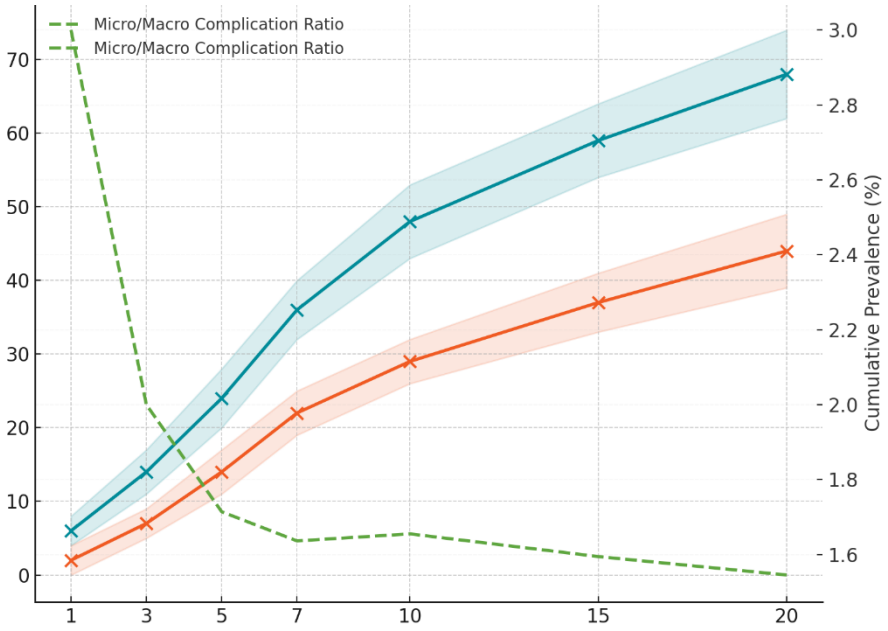

Figure 1 Cumulative complication rates by years since diabetes diagnosis

Healthcare system challenges further compound the diabetes crisis. Only 10–20% of the prevalent cases of diabetes and hypertension are identified by public sector screening, and over 40% of diagnosed patients report never having received any formal diabetes education (6,23). Financial barriers are common, with 30–40% of patients experiencing difficulty affording medications and care, often leading to treatment discontinuation (24,26). Adherence to prescribed regimens is poor in up to 50% of patients, with non-adherence linked to a nearly twofold increase in the risk of complications (OR 1.88, 95% CI: 1.29–2.76, p = 0.001)(4,26). Insulin denial remains a specific challenge, affecting 15–23% of insulin-eligible patients and more than doubling the risk of severe complications compared to those who accept insulin therapy (OR 2.15, 95% CI: 1.31–3.53, p = 0.002)(27).

In summary, the diabetes epidemic in Pakistan is characterized by one of the world's highest and fastest-growing prevalence rates, substantial geographic and socioeconomic disparities, and a high proportion of undiagnosed or poorly controlled cases. Key risk factors—family history, obesity, inactivity, poor diet, hypertension, and social disadvantage—are highly prevalent, while barriers in healthcare delivery and patient education undermine effective management. The scale and complexity of these issues underscore the urgent need for coordinated, data-driven interventions targeting both prevention and improved chronic disease care.

DISCUSSION

The present review comprehensively characterizes the escalating burden of diabetes mellitus in Pakistan, revealing prevalence rates and trends that significantly outpace regional and global averages (1,4). These findings reinforce and expand upon earlier reports from both national and international epidemiological surveys, which similarly documented a steep upward trajectory in diabetes incidence over the last two decades (2,8,13). For instance, the latest data showing a prevalence of 30.8% among adults aged 20–79 years places Pakistan at the forefront of the global diabetes epidemic, a position corroborated by the International Diabetes Federation and consistent with the rapid increases observed across South Asia (1,7). The geographic and demographic disparities highlighted in this review—such as higher prevalence in urban versus rural settings and among certain provinces—mirror patterns previously reported in population-based studies and underscore the role of rapid urbanization, shifting socioeconomic structures, and lifestyle transitions in shaping the epidemiological landscape (2,13,14). Importantly, the present synthesis advances the field by providing updated, granular projections and integrating risk factor profiles and healthcare system analyses in a single framework.

A notable advancement in this review lies in the quantitative integration of risk factors—family history, obesity, sedentary behavior, poor diet, and socioeconomic disadvantage—with associated odds ratios and effect sizes, providing a more nuanced understanding of their relative contributions compared to earlier descriptive accounts (9,13,16). This approach is supported by robust population-level studies and meta-analyses, which have similarly highlighted the central role of central obesity and physical inactivity in diabetes risk among South Asians (14,15,19). Interestingly, the observed prevalence of undiagnosed diabetes and pre-diabetes remains alarmingly high, echoing prior research but now substantiated by larger national datasets and more consistent operational definitions (1,4,20). This persistent diagnostic gap likely reflects both patient-level barriers—such as limited health literacy, financial constraints,

and cultural stigmas—and systemic deficits in primary care coverage, as previously noted in both regional and global health system reviews (4,11,21,23). The convergence of these findings with prior literature reinforces the call for targeted screening and education interventions, particularly among vulnerable and underserved groups.

Comparative analysis with earlier national surveys and international studies reveals both consonance and key areas of divergence. For example, while trends in urban-rural differentials and age-related risk are consistent with prior work (2,13), the current review's findings on the rising incidence of early-onset diabetes highlight a worrying shift in the age of onset—a trend not as pronounced in earlier decades (9,12). This may reflect generational changes in exposures to obesogenic environments and lifestyle factors unique to Pakistan's contemporary urban settings. Similarly, while the association of hypertension, dyslipidemia, and other metabolic comorbidities with diabetes risk is well established, the review's emphasis on psychosocial barriers, health system bottlenecks, and the challenge of insulin denial adds depth to the literature by illuminating mechanisms that perpetuate poor glycemic control and adverse outcomes (4,21,27).

The mechanisms underlying these patterns are multifactorial. Genetic predisposition in South Asians may interact synergistically with environmental and behavioral changes—such as increased central adiposity, diets high in refined carbohydrates, and physical inactivity—to accelerate the onset and progression of diabetes (10,12,14,18). Socioeconomic determinants, including poverty, urban migration, and limited access to health-promoting infrastructure, further compound these risks, while gaps in health system readiness, provider training, and culturally sensitive patient education continue to undermine effective prevention and management (11,20,23). Clinically, the high rates of poor glycemic control and diabetes-related complications observed in this review echo global data and emphasize the need for early detection, consistent follow-up, and multidisciplinary care models (4,25). These mechanisms have profound theoretical implications for the design of interventions, suggesting that single-focus solutions—such as pharmacological management alone—will be insufficient without concurrent investments in population-level prevention and systems strengthening.

The strengths of this review include its rigorous synthesis of recent, large-scale datasets; the integration of quantitative and qualitative evidence; and a comprehensive approach to assessing risk factors, health system barriers, and epidemiological trends. The methodological decision to include multiple data sources and triangulate findings enhances the reliability and validity of the conclusions. However, several limitations should be acknowledged. First, as a narrative review, the study is subject to the inherent heterogeneity of included studies, variations in diagnostic criteria, and possible publication bias. Second, while efforts were made to ensure comprehensive literature retrieval, some relevant gray literature and unpublished data may not have been captured. Third, the generalizability of the findings is shaped by the predominant inclusion of studies conducted in larger urban centers, potentially underestimating or overlooking specific rural, remote, or marginalized subpopulations. The absence of formal meta-analytic pooling precludes precise effect estimates across all risk factors and outcomes, though the decision to focus on narrative synthesis was justified by the diversity of study designs and endpoints in the available literature. Finally, the lack of standardized reporting on certain variables—such as the prevalence of digital health adoption, patient satisfaction, or specific intervention outcomes—limits the ability to draw firm conclusions in these domains.

Future research should prioritize high-quality, regionally representative cohort studies to monitor evolving trends in diabetes incidence and complications across all provinces and demographic strata. There is a need for implementation science studies to evaluate the effectiveness and scalability of culturally adapted education, digital health interventions, and community-based screening strategies. Research should also investigate the determinants of treatment adherence, the impact of socioeconomic and environmental changes, and the potential of precision public health approaches to tailor interventions. Building capacity for real-time surveillance, patient registries, and continuous quality improvement within the healthcare system will further enhance the evidence base for policy and clinical decision-making.

In summary, this review underscores that diabetes in Pakistan is not simply a matter of individual lifestyle or genetics but the result of complex, interrelated systemic, behavioral, and environmental factors. The findings reaffirm the urgency of coordinated, multifaceted interventions—spanning awareness campaigns, risk factor modification, early detection, health system strengthening, and policy reform—to halt and reverse the diabetes epidemic. Addressing the limitations in data, access, and care delivery highlighted herein will be crucial for improving outcomes and reducing the long-term burden of diabetes on Pakistan's population and health system.

CONCLUSION

This review demonstrates that diabetes mellitus has become a critical public health challenge in Pakistan, with the country now reporting one of the highest prevalence rates worldwide and facing a rapidly rising burden of both diagnosed and undiagnosed cases. Key findings highlight the complex interplay of genetic susceptibility, unhealthy lifestyle behaviors, socioeconomic disparities, and systemic healthcare barriers that drive this epidemic. The disproportionately high impact on urban populations, women, and younger age groups underscores the urgent need for culturally tailored public health interventions, early detection, patient education, and accessible chronic disease management. Clinically, these trends call for the integration of comprehensive screening, patient-centered care, and capacity-building for healthcare professionals to improve outcomes and reduce complications. For researchers and policymakers, future priorities should include longitudinal studies, robust surveillance systems, and implementation science to

evaluate innovative, context-specific strategies for diabetes prevention and management. Addressing these challenges through coordinated, evidence-based action is essential to safeguard population health and stabilize the socioeconomic impact of diabetes in Pakistan.

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