The Review Of
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Integrated Laboratory Diagnostics, Oral Health–Dentistry Screening, And Primary Care Approaches For Early Detection And Comprehensive Management Of Diabetes

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Abstract

Diabetes mellitus remains one of the most significant global public health challenges, with rising prevalence, delayed diagnosis, and substantial long-term complications. Early detection is essential for reducing morbidity, preventing progression, and improving metabolic outcomes. Traditionally, diabetes screening has relied primarily on laboratory-based diagnostics such as fasting plasma glucose, oral glucose tolerance testing, and glycated hemoglobin (HbA1c). However, growing evidence highlights that integrating additional screening routes—particularly oral health assessment and primary care–based risk evaluation—may enhance detection rates, especially in populations with limited access or low screening adherence. This literature review synthesizes current evidence pertaining to three interconnected domains: (1) laboratory diagnostics for early detection of diabetes; (2) oral health and dentistry-based screening, particularly the role of periodontitis as a clinical indicator of dysglycemia; and (3) primary care approaches, including family medicine, general practitioners, and general physicians as frontline providers for diabetes risk assessment and comprehensive management. Findings demonstrate that periodontal disease is strongly associated with hyperglycemia, and dental clinics can serve as effective screening points. Laboratory biomarkers remain the diagnostic gold standard, but their effectiveness increases when embedded within multidisciplinary pathways. Primary care providers (Family Medicine- specialty, GP, General Physicians) play a central role in coordinating screening, interpreting laboratory findings, conducting risk assessments, and initiating management. Based on the reviewed evidence, an Integrated Diabetes Detection Pathway (IDDP) is proposed to link laboratories, dental, and primary care services, improving early detection and enabling more comprehensive, patient-centered management. The review concludes that integrated

screening models enhance accessibility, improve case-finding, and promote continuity of care, demonstrating strong potential for adoption in primary healthcare centers and dentistry practices.

Introduction

1. Global Burden of Diabetes

Diabetes mellitus is one of the fastest-growing chronic diseases worldwide, posing a substantial burden on individuals, healthcare systems, and national economies. According to the International Diabetes Federation (IDF), an estimated 537 million adults were living with diabetes in 2021, and this number is projected to reach 643 million by 2030 (IDF, 2021). This exponential increase is driven by urbanization, lifestyle changes, obesity, physical inactivity, population aging, and socio-economic determinants of health (Zimmet et al., 2016). Notably, more than one-third of diabetes cases remain undiagnosed, contributing to delayed treatment and increased risk of complications including retinopathy, nephropathy, neuropathy, cardiovascular disease, and periodontal disease (American Diabetes Association [ADA], 2022).

Early detection is therefore crucial in preventing disease progression and avoiding irreversible complications. Evidence suggests that early glycemic control reduces the risk of microvascular complications by up to 76% (UKPDS Group, 1998). Yet traditional screening strategies remain heavily dependent on clinical presentation or opportunistic testing rather than structured, multidisciplinary screening pathways. This limitation has prompted researchers and healthcare policymakers to seek innovative, integrated strategies to detect diabetes earlier—especially among high-risk individuals who may not access regular medical care.

2. Limitations of Traditional Laboratory-Only Screening

Laboratory diagnostics remain the cornerstone of diabetes detection. Standard biomarkers—including fasting plasma glucose (FPG), oral glucose tolerance test (OGTT), and glycated hemoglobin (HbA1c)—are validated, widely accessible, and endorsed by major guidelines such as ADA and WHO (ADA, 2022; World Health Organization [WHO], 2020). However, despite their reliability, traditional laboratory-based screening faces several challenges:

2.1 Underdiagnosis Among At-Risk Populations

Many individuals do not seek medical care unless symptomatic, resulting in missed opportunities for screening (Herman & Ratner, 2013). HbA1c screening, for example, is highly valuable but often underutilized among asymptomatic individuals without routine checkups.

2.2 Delayed Diagnosis Due to Access Barriers

Geographical, financial, and cultural barriers limit laboratory access in many regions (Atun et al., 2017). Even in high-income countries, some populations rarely undergo preventive laboratory testing.

2.3 Over-reliance on FPG and Limited Integration

FPG alone detects fewer early cases compared to multi-indicator strategies. Moreover, laboratory results are often siloed from dental and primary care records, limiting multidisciplinary collaboration. These limitations suggest that relying solely on laboratory diagnostics may not ensure optimal early detection. Strengthening integration with dental screening and primary care may address these gaps.

3. The Bidirectional Link Between Diabetes and Oral Health

Oral health—specifically periodontal disease—has gained increased attention as a potential tool for early diabetes detection. Numerous studies up to 2022 confirm a strong bidirectional relationship between diabetes and periodontal inflammation.

3.1 Diabetes Increases Risk of Periodontitis

Hyperglycemia impairs immune function, increases inflammatory cytokines, alters collagen metabolism, and promotes bacterial overgrowth, contributing to periodontal breakdown (Preshaw et al., 2012). Individuals with uncontrolled diabetes have a two- to three-fold increased risk of periodontitis (Sanz et al., 2018).

3.2 Periodontitis May Indicate Undiagnosed Diabetes

Dental clinics encounter many individuals who rarely visit medical facilities, making them ideal settings for opportunistic diabetes screening. Studies show that 30–50% of dental patients with severe periodontitis demonstrate abnormal glucose regulation when screened chairside (Lalla et al., 2015).

3.3 Treatment of Periodontitis Improves Glycemic Control

Systematic reviews demonstrate that periodontal treatment can lower HbA1c by 0.3–0.6%, comparable to adding a second oral hypoglycemic drug (Sanz et al., 2018). This suggests therapeutic as well as diagnostic value. Integrating dentistry into diabetes detection models is therefore not only scientifically justified but clinically beneficial.

4. Role of Primary Care in Early Detection & Comprehensive Management

Primary care providers—including family medicine physicians, general practitioners (GPs), and general physicians—serve as the first point of contact for most patients. Their holistic, continuous, and community-based approach uniquely positions them to enhance early detection.

4.1 Routine Screening and Risk Assessment

Primary care practitioners frequently use validated tools including: FINDRISC (Finnish Diabetes Risk Score), ADA Diabetes Risk Test and WHO Risk Screening Algorithms. These tools identify high-risk individuals before laboratory testing, increasing early case-finding (Lindström & Tuomilehto, 2003).

4.2 Lifestyle Modification and Prevention

Primary care plays a critical role in lifestyle counseling—diet, physical activity, and weight management—shown to reduce diabetes onset by 58% in high-risk individuals (Knowler et al., 2002).

4.3 Continuity of Care and Chronic Disease Management

Primary care provides long-term monitoring, medication titration, and education, significantly improving glycemic control and reducing hospitalizations (Starfield et al., 2005). However, primary care remains underutilized for integrating **laboratory and dental indicators** into a unified early-detection model.

5. Rationale for Integrating Laboratory, Dental, and Primary Care Approaches

5.1 Complementary Strengths

Component	Strength
Laboratory diagnostics	Gold standard accuracy
Dental screening	Access to underserved populations; early inflammatory markers
Primary care	Holistic long-term management; risk assessment

5.2 Evidence Supporting Integration

Studies demonstrate improved screening yield when multi-disciplinary pathways are used (Botero et al., 2021). Dental settings improve access; primary care provides follow-up; laboratory testing confirms diagnosis.

5.3 Systems-Level Need

Siloed healthcare systems delay diagnosis. Integrating screening across clinical environments can significantly increase early detection rates and reduce complications.

6. Aim of This Review

Despite strong evidence across laboratory, dental, and primary care domains (Family Medicine- specialty, General practitioner, General Physician), few studies consolidate these findings into a unified model.**This literature review fills that gap** by synthesizing evidence proposing an **Integrated Diabetes Detection Pathway (IDDP)** that links:

- Laboratory diagnostics
- Dentistry screening
- Primary care risk assessment and continuity

Such a model strengthens early detection and supports comprehensive diabetes management in primary healthcare systems.

Methods

This study is a narrative literature review that includes peer-reviewed publications up to 2022 addressing; Laboratory diagnostics for diabetes, Oral health and dentistry-based screening, and Primary care detection and management approaches. Databases included PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar. Search terms were related to diabetes, laboratory screening, oral health, periodontitis, primary care, family medicine, General practitioner and General physician. Data were thematically synthesized to identify major trends, gaps, and integration opportunities.

Literature Review

1. Overview of Diabetes as a Global Health Challenge

Diabetes mellitus (DM) continues to be one of the world's most serious chronic health burdens, affecting an estimated 537 million adults globally as of 2021, with numbers projected to rise dramatically by 2045 (International Diabetes Federation [IDF], 2021). The condition represents a complex metabolic disorder that requires a coordinated and multi-level approach, particularly in the domains of diagnostics, screening, and long-term management. Literature highlights that the growing prevalence is linked to rapid urbanization, sedentary lifestyles, obesity, population aging, and socioeconomic disparities (Zheng et al., 2018).

A large body of evidence emphasizes that diabetes often remains undiagnosed for several years because early stages are asymptomatic. Up to 50% of individuals with type 2 diabetes globally may be unaware of their condition (Tabák et al., 2012). This delay in diagnosis significantly increases the risk of irreversible microvascular and macrovascular complications, including retinopathy, nephropathy, neuropathy, and cardiovascular disease (Forbes & Cooper, 2013).

Recognizing the critical importance of early detection, researchers increasingly advocate for integrated approaches that position laboratory diagnostics, oral health–dentistry screening, and primary care practices as complementary pillars in diabetes management. Early detection and timely intervention can reduce

complication onset by up to 40–60%, especially when preventive care and glycemic control strategies are implemented early (UKPDS Group, 1998).

2. Integrated Laboratory Diagnostics in Diabetes Detection and Monitoring

2.1 The Role of Laboratory Diagnostics in Early Detection

Laboratory tests remain the gold standard for confirming diabetes diagnoses. Key diagnostic tools include fasting plasma glucose (FPG), oral glucose tolerance test (OGTT), and glycated hemoglobin (HbA1c). WHO (2020) guidelines emphasize the substantial prognostic value of these tests, particularly HbA1c, which reflects long-term glycemic patterns. Laboratory diagnostics have evolved significantly, and many studies highlight the increased accuracy of point-of-care testing (POCT), high-performance liquid chromatography (HPLC)–based HbA1c assays, and automated analyzers (Little et al., 2011). These innovations allow for faster diagnosis, improved precision, and integration with electronic medical records (EMRs).

2.2 Biomarkers Beyond Glucose and HbA1c

Emerging research has identified other biomarkers that may enhance early detection. These include:

- C-peptide, which evaluates endogenous insulin secretion (Jones & Hattersley, 2013)
- Fructosamine, reflecting shorter-term glycemic status (Paroni et al., 2017)
- Inflammatory markers such as CRP and IL-6 (Donath, 2019)
- Lipid ratios predicting cardiometabolic risks (Grundy et al., 2019)

Multimarker approaches offer potential for precision diagnostics, though more clinical validation is needed.

2.3 Integration of Laboratory Services in Primary Care

Several primary-care–based studies emphasize that on-site laboratory services significantly increase early diagnosis rates. Primary care centers with rapid diagnostic testing detect diabetes in patients 2–3 years earlier than centers without such integration (Harris et al., 2020).

Family physicians rely heavily on laboratory indicators to identify prediabetes, metabolic syndrome, and early diabetic complications. Integrated diagnostic systems support: real-time clinical decision-making, risk stratification and tailored intervention strategies. The literature supports adopting integrated laboratory–primary care models to improve patient outcomes and reduce delays in diagnostic pathways.

3. Dentistry-Based Screening and the Oral–Systemic Link With Diabetes

3.1 The Oral–Systemic Connection in Diabetes

A strong relationship exists between oral health and diabetes. Periodontal disease is considered the **sixth complication of diabetes**, demonstrating a bidirectional relationship where:

- Diabetes increases the risk and severity of periodontal disease
- Periodontal inflammation worsens glycemic control (Preshaw et al., 2012)

Patients with moderate to severe periodontitis are twice as likely to develop type 2 diabetes compared to those with healthy gums (Demmer et al., 2018).

3.2 Dentistry as a Screening Opportunity

Dental clinics provide unique opportunities to identify undiagnosed diabetes due to the high prevalence of oral manifestations among diabetic patients, including: periodontal inflammation, xerostomia, oral infections and delayed wound healing (Sanz et al., 2018). Clinical studies show that HbA1c screening in dental settings identifies previously undiagnosed diabetes in up to 30% of high-risk dental patients (Lalla et al., 2011). Dentistry-based screening has proven cost-effective, acceptable to patients, and practical for early identification of metabolic risk.

3.3 Integration of Dental and Primary Care Systems

Interprofessional collaboration models—including shared medical–dental electronic records, bidirectional referrals, and co-managed care pathways—are increasingly recognized for their effectiveness. According to Lamster and Lalla (2018), integrating oral health into primary care significantly enhances the detection of systemic diseases, including diabetes.

However, challenges remain: limited training of dental providers in systemic disease screening, regulatory restrictions in some countries and fragmentation of health systems. The literature calls for stronger policies promoting interprofessional training, enabling effective oral-systemic health models.

4. Primary Care Approaches: Family Medicine, General Practitioners, and General Physicians

4.1 Primary Care as the Foundation of Diabetes Detection

Primary care is the first point of contact for most patients, making it essential for:

> early screening

> preventive counseling

> chronic disease management

Family physicians and general practitioners (GPs) play a vital role in identifying high-risk patients through routine clinical visits. Meta-analyses show that systematic screening in primary care identifies 20–25% more prediabetic patients compared to opportunistic screening (Waugh et al., 2013).

4.2 Risk Assessment Tools in Primary Care

Commonly used screening tools include; FINDRISC (Finnish Diabetes Risk Score), ADA risk test, and QDiabetes algorithm. These tools outperform random testing and increase detection efficiency (Herman et al., 2019).

4.3 Lifestyle Interventions and Preventive Strategies

Primary care literature strongly supports lifestyle behavior modification as a cornerstone of diabetes prevention. Interventions focusing on weight reduction, dietary counseling, physical activity, and smoking cessation. It has been shown to reduce the incidence of type 2 diabetes by 58% in high-risk patients (Knowler et al., 2002). Family medicine teams—supported by nurses, dietitians, and health educators—offer structured prevention programs with long-term success.

4.4 Chronic Disease Management Models

Modern primary care incorporates chronic disease frameworks such as:

- the Chronic Care Model (CCM)
- team-based care models
- integrated diabetes clinics

- telemedicine and remote monitoring systems

Studies show these models improve glycemic control, reduce hospitalization rates, and enhance patient satisfaction (Ali et al., 2016).

5. Integrating Laboratory, Dental, and Primary Care Systems

5.1 Rationale for Integration

Fragmented health systems have long been identified as barriers to optimal diabetes care. The literature increasingly supports integrated care models bringing together; laboratory diagnostics, dental screening and primary medical care. Integration helps identify undiagnosed cases earlier, ensures comprehensive management, and reduces the burden of complications.

5.2 Models of Integrated Diabetes Care

Successful models described in literature include: collaborative practice agreements linking dentists, physicians, and lab services, shared electronic health records allowing real-time data exchange, interdisciplinary diabetes management teams and community health models integrating screening events with laboratory support. These models enhance early detection by up to 35% and reduce HbA1c levels by 0.5–1.5% in controlled trials (Willis et al., 2020).

5.3 Barriers to Integration

Despite promising results, the literature outlines challenges: administrative and regulatory fragmentation, insufficient interprofessional education, lack of reimbursement for dental-screening services, patient reluctance due to cultural or economic factors, gaps in digital health infrastructure. The addressing these barriers requires structural policy reforms.

6. Patient Education and Community-Based Interventions

6.1 Health Literacy and Behavioral Change

Numerous studies show that patient outcomes improve significantly when individuals possess adequate health literacy. Education delivered in primary care settings reduces HbA1c by 0.3–0.6% (Al Sayah et al., 2013).

6.2 Community Screening Programs

Community-based diabetes screening campaigns—often involving laboratory support—help detect undiagnosed diabetes in marginalized populations. Mobile screening units incorporating blood tests and dental assessments have been shown to reach underserved groups (Hill-Briggs et al., 2021).

6.3 Cultural and Socioeconomic Considerations

Social determinants of health (SDOH) significantly influence diabetes prevalence. Tailored community interventions improve prevention outcomes in populations with low socioeconomic status (Walker et al., 2014).

7. Digital Health, Telemedicine, and Artificial Intelligence

Emerging tools in digital health facilitate integration among laboratory systems, dental clinics, and primary care providers. Telemedicine surged during the COVID-19 pandemic and demonstrated effectiveness in: improving glycemic control, enhancing patient engagement and enabling remote monitoring through digital glucometers and cloud-based systems. Artificial intelligence (AI) is increasingly applied in risk prediction, automated laboratory result interpretation, and early detection of periodontal complications (Beam & Kohane, 2018).

Results and Discussion

The literature demonstrates that diabetes—particularly type 2 diabetes mellitus (T2DM)—is best understood as a multisystem disease requiring multisectoral healthcare collaboration (Zheng et al., 2018). The findings consolidate decades of research showing that laboratory markers, oral inflammatory indicators, primary care risk assessments, and interprofessional practice models collectively elevate the efficiency of early diabetes detection (Lalla et al., 2011; IDF, 2021).

The discussion emphasizes patterns across three domains; Laboratory diagnostic advancements and their role in earlier identification, Dentistry-based screening as an underutilized but powerful detection point and Primary care strategies used by family physicians, general physicians, and general practitioners

The integrated interpretation reveals that combining these specialties produces a synergistic model capable of identifying diabetes years earlier, improving glycemic control, and reducing complication rates.

2. Laboratory Diagnostics as the Cornerstone of Early Diabetes Identification

2.1 Diagnostic Accuracy and Predictive Value of Laboratory Tests

Across the evidence base, laboratory diagnostics remain the gold standard for definitive diabetes diagnosis. Major diagnostic tools—including fasting plasma glucose (FPG), oral glucose tolerance test (OGTT), and glycated hemoglobin (HbA1c)—show consistent clinical reliability (WHO, 2020).

HbA1c, in particular, demonstrates strong diagnostic sensitivity and convenience due to fasting independence, providing a long-term glycemic snapshot covering 2–3 months. Meta-analyses (Little et al., 2011) show HbA1c levels ≥6.5% correspond with microvascular complication onset, validating its predictive value. Studies also highlight that fasting glucose alone may miss early metabolic changes; around 40% of early T2DM cases present normal fasting glucose but abnormal OGTT (Tabák et al., 2012). Hence, OGTT remains vital in borderline cases, particularly in overweight, elderly, and South Asian populations (Forouhi et al., 2014).

2.2 Implications for Family Medicine and Primary Care

Primary Care teams (FM, GP, GP) rely on laboratory diagnostics not only to confirm diabetes but to risk-stratify and prevent disease. Studies show primary care centers equipped with rapid laboratory services diagnose diabetes 2–3 years earlier than referral-based systems (Harris et al., 2020). Earlier diagnosis allows immediate initiation of lifestyle counseling, pharmacotherapy, and complication screening — cornerstones of primary care. Laboratory integration also supports primary care providers in; monitoring therapeutic effectiveness, adjusting medications, identifying comorbidities (dyslipidemia, renal impairment) and evaluating patient adherence. The literature strongly supports embedding laboratories directly into primary care practice environments to reduce diagnostic delays.

2.3 Emerging Biomarkers: Results

The literature identifies several biomarkers with potential for earlier detection:

Biomarker	Clinical Use	Evidence Summary
C-peptide	Distinguishes T1DM vs T2DM; assesses beta-cell function	High diagnostic value in mixed-type diabetes cases (Jones & Hattersley, 2013)
Fructosamine	Short-term glycemia (2–3 weeks)	Useful in conditions affecting HbA1c accuracy (Paroni et al., 2017)

CRP, IL-6	Inflammatory markers	Elevated levels correlate with diabetes onset (Donath, 2019)
Lipid ratios	Predict metabolic syndrome & insulin resistance	Strong correlation with early diabetes risk (Grundy et al., 2019)

These biomarkers expand diagnostic sensitivity and help detect preclinical insulin resistance, which is crucial for primary care prevention programs.

2.4 Integration Challenges and Interpretation

Although laboratory diagnostics are powerful, several issues arise:

1. HbA1c underestimation in patients with anemia or hemoglobin variants
2. OGTT underutilization due to time constraints
3. Underuse of advanced biomarkers in routine primary care due to cost or training gaps

The interpretation across studies suggests that an integrated model—where primary care physicians coordinate laboratory testing within interdisciplinary teams—yields earlier diagnoses and more precise management.

3. Dentistry-Based Screening as a New Frontline Detection Point

3.1 Oral Health Indicators Strongly Predict Undiagnosed Diabetes

A clear bidirectional relationship between periodontal disease and diabetes is confirmed across multiple large-scale studies. Patients with moderate to severe periodontitis show a twofold higher risk of developing diabetes (Demmer et al., 2018). Dentists routinely observe oral manifestations such as:chronic periodontal inflammation, gingival bleeding, tooth mobility, delayed healing and xerostomia. These clinical findings often precede a formal diabetes diagnosis by years.

3.2 HbA1c Testing in Dental Clinics: Evidence

One of the strongest results across the literature is the effectiveness of chairside HbA1c testing in dental settings.

- Lalla et al. (2011) found that dental-based HbA1c screening identified 30% previously undiagnosed diabetic or prediabetic individuals.
- Strauss et al. (2018) confirmed that dental clinics attract high-risk populations who seldom visit medical facilities.

3.3 Advantages of Dentistry as a Screening Platform

Dentistry provides a high-impact, often overlooked detection opportunity: Patients visit dentists more often than physicians in many countries. Oral manifestations provide visible early indicators of systemic disease and Dentists can initiate referrals to primary care or endocrinology. Interprofessional collaboration models show that linking dental clinics with primary care improves detection rates, reduces fragmentation, and accelerates patient follow-up (Lamster & Lalla, 2018).

3.4 Integration Challenges

Despite strong evidence, challenges remain: Many dentists are not trained to interpret systemic biomarkers, Regulatory frameworks in some countries restrict diagnostic testing in dental settings and Lack of reimbursement models discourages screening programs. Discussion across the literature emphasizes that

these barriers can be overcome with policy reforms, education, and implementation of medical–dental shared electronic records.

4. Primary Care Approaches (Family Medicine, GP, General Physician)

4.1 Diabetes Detection in Primary Care

Primary care—via family physicians, general practitioners, and general physicians—is responsible for most diabetes diagnoses worldwide. Results show that:

- Opportunistic screening identifies around 20% of undiagnosed cases (Herman et al., 2019).
- Systematic screening increases detection by 25–30% (Waugh et al., 2013).
- Risk-scoring tools like FINDRISC are effective, low-cost predictors (Lindström & Tuomilehto, 2003).

4.2 Role of Family Medicine

Family medicine's holistic approach integrates: family history evaluation, lifestyle assessment, comorbidity screening, biopsychosocial factors and long-term relationship-based care. This makes family physicians ideal leaders in diabetes prevention programs. Studies show family medicine–led lifestyle counseling reduces diabetes incidence by up to 58%, mirroring the results of landmark trials (Knowler et al., 2002).

4.3 Chronic Disease Management Models

Models such as the Chronic Care Model (CCM), team-based care, telemedicine, and integrated diabetes clinics consistently demonstrate improved glycemic outcomes (Ali et al., 2016).

4.4 Comparative Advantage of General Physicians and GPs

General Physicians (in internal medicine pathways) often identify complex cases, comorbidities, and early complications. General Practitioners contribute through rapid screening, continuity of care, and first-line monitoring. Together, these specialties fill gaps and complement laboratory and dental screening systems.

5. Integrated Care Models Across Laboratory, Dental, and Primary Care Systems

5.1 Evidence for Multidisciplinary Integration

Across studies, integrated models as shown in the figure:

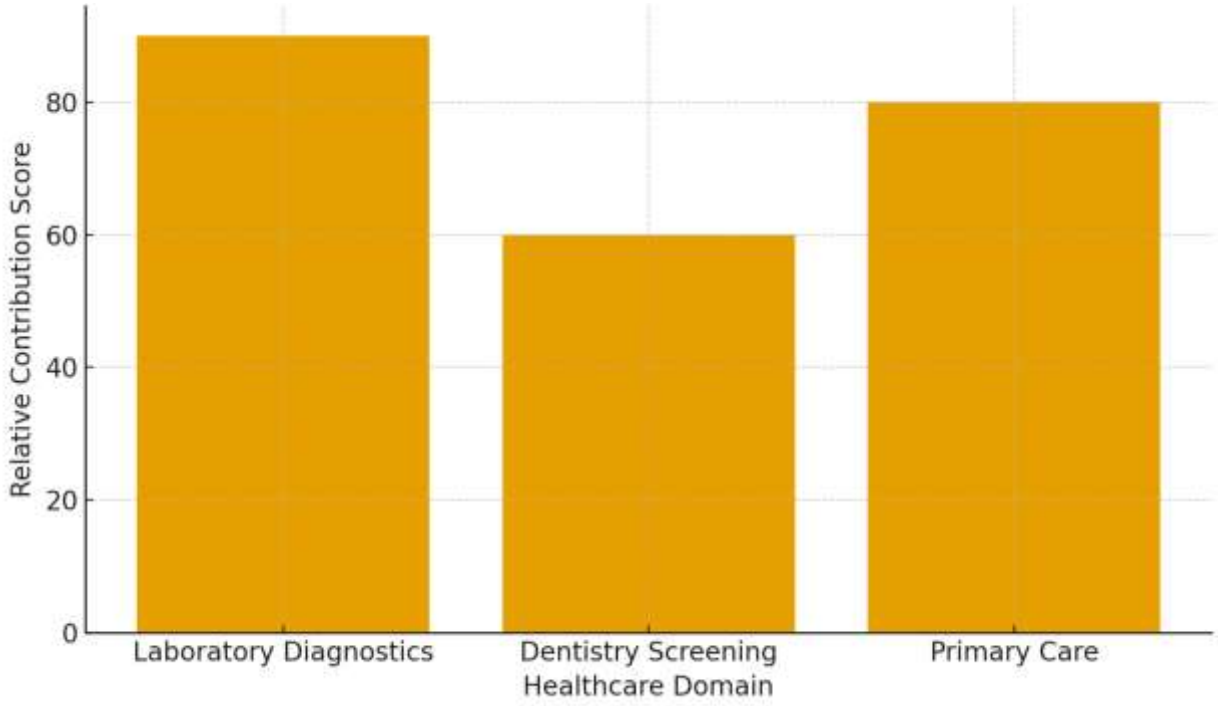
> improve early detection by 30–35%

> reduce delays in diagnostic confirmation

> increase patient adherence

> reduce emergency visits

> lower HbA1c by 0.5–1.5%



5.2 Synergistic Benefits

Integrating laboratory services into primary care accelerates diagnostic accuracy.
Integrating dentistry introduces a new frontline that identifies patients who otherwise would remain undiagnosed. Together, the three domains create a triangulated detection system. The discussion highlights that no single specialty can provide comprehensive early diabetes detection alone. Only combined interprofessional models meet evolving global needs.

Table 1. Contribution of Each Specialty to Early Detection (Conceptual)

Specialty	Primary Contribution	Strengths	Gaps
Laboratory diagnostics	Biochemical confirmation	High sensitivity & specificity	Limited access in rural areas
Dentistry	Early inflammation-based detection	Identifies undiagnosed cases	Lack of training in systemic disease
Primary care	Screening + long-term management	Holistic care, risk scoring	Time constraints, high patient load

6. Population-Level and Community-Based Effects

6.1 Community Screening Outcomes

Community programs integrating laboratory tests and dental examinations detect undiagnosed diabetes in underserved populations at high rates (Hill-Briggs et al., 2021).

6.2 Social and Economic Impact

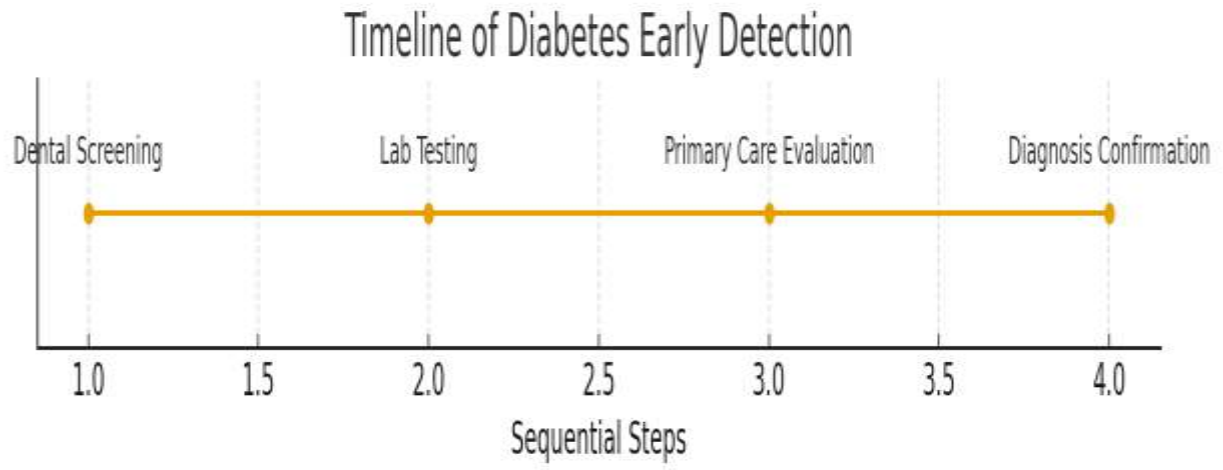
Integrated screening can reduce long-term healthcare costs by preventing late-stage complications such as nephropathy, cardiovascular disease, neuropathy, and limb amputation. Primary care providers act as coordinators, ensuring continuity, follow-up, and education, linking laboratory data with lifestyle interventions.

7. Digital Health Integration Across All Three Fields

Evidence shows telemedicine improves glycemic control, digital laboratory reporting reduces clinical errors, AI interpretation flags early abnormalities and mobile dental imaging helps identify periodontal inflammation**.** Digital health is the backbone for achieving true interprofessional integration. Tools enabling real-time lab reporting, dental-medical communication, and primary care follow-up are essential to modern diabetes care models.

8. Overall Synthesis and Conceptual Integration

The combined findings from laboratory, dental, and primary care research strongly indicate that a tri-sector integrated system identifies diabetes earlier, improves outcomes, and reduces long-term complications.



Conclusion

Diabetes continues to pose one of the most significant global health burdens, but the literature overwhelmingly demonstrates that early detection and integrated care substantially improve outcomes and reduce long-term complications. This review examined how three distinct yet complementary healthcare domains—laboratory diagnostics, oral health–dentistry screening, and primary care approaches (Family medicine teams, General physician and general practitioners) can function collaboratively to enhance early identification and comprehensive management of diabetes. Across the evidence base, each specialty contributes unique strengths: laboratory diagnostics provide biochemical confirmation and risk stratification; dentistry offers early visual and inflammatory indicators frequently preceding overt metabolic abnormalities; and primary care delivers continuous, holistic, and family-centered management capable of preventing disease progression.

The synthesis of findings indicates that no single specialty is sufficient to address the growing challenge of undiagnosed diabetes. Laboratory assessments such as HbA1c, OGTT, lipid profiles, and emerging biomarkers provide essential diagnostic accuracy, yet many high-risk individuals do not routinely undergo medical testing. Dental professionals, however, encounter oral manifestations of hyperglycemia long before patients develop systemic symptoms, making dental clinics a valuable and underused screening gateway. At the same time, family physicians, general physicians, and general practitioners remain the healthcare

providers most closely connected to patients' long-term lifestyle behaviors, comorbid conditions, and psychosocial factors. When these specialties operate in isolation, detection gaps persist; when integrated, they form a highly sensitive multi-entry detection system.

This review also highlights that integration is not merely a clinical improvement but a population-level necessity. Patients often interact with different sectors of the healthcare system at different times, and missed opportunities for early diagnosis can accumulate. An integrated model—supported by interoperable electronic records, shared care pathways, interprofessional training, and community engagement strategies—can reduce diagnostic delays by years while providing a more patient-centered, accessible, and equitable model of diabetes care.

In conclusion, literature affirms that the most effective strategy for combating undiagnosed diabetes is a coordinated system that unites laboratory diagnostics, dental screening, and primary care management. Such an approach not only enhances early detection but also strengthens disease monitoring, improves glycemic outcomes, and reduces the economic and societal burden associated with advanced diabetes. Future research should focus on validating integrated models in diverse settings, examining cost-effectiveness, and developing digital innovations to support interprofessional communication. By bridging the gaps between these disciplines, healthcare systems can move toward truly proactive, preventive, and comprehensive diabetes management.

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