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Development of Evidence-Based Clinical Practice Guidelines for Monitoring Diabetic Patients Using Smartphone Technology

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Walden University

College of Nursing

This is to certify that the doctoral study by

Ganiyat Funmilayo Efuntoye

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee

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Walden University
2025

Executive Summary: Development of Evidence-Based Clinical Practice Guidelines for
Monitoring Diabetic Patients Using Smartphone Technology

by

Ganiyat Funmilayo Efuntoye

MS, Walden University, 2023

BS, Brenau University, 2008

Executive Summary Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Nursing Practice

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Summary

In this doctoral project, I developed and validated an evidence-based clinical practice guideline for implementing smartphone technology to monitor diabetic patients in primary care settings with an 80% threshold. The project addressed a critical gap in standardized guidance for diabetes technology integration, which has resulted in inconsistent adoption and suboptimal patient outcomes. A systematic literature review of four major databases yielded 12 high-quality studies representing all evidence levels (I–V) according to the Johns Hopkins evidence-based practice model. Evidence synthesis revealed strong and compelling evidence with consistent results supporting smartphone technology implementation, including HbA1c improvements of 0.4%–0.8%, sustained patient engagement rates exceeding 80%, and 86.89% clinical accuracy in glucose prediction applications.

I developed five evidence-based recommendations by addressing smartphone-based glucose monitoring implementation, standardized clinical workflow integration, user-centered design optimization, professional clinical support integration, and electronic health record system integration. An expert review using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) tool, conducted by three independent reviewers, resulted in unanimous approval, with domain scores ranging from 89% to 93% and an overall quality rating of 86%. The major product is a comprehensive clinical practice guideline ready for implementation in primary care settings. Potential impacts on positive social change include improved healthcare access through digital technology, reduced health disparities, and enhanced patient empowerment in diabetes self-management.

Background

Diabetes mellitus affects over 37 million Americans, with primary care clinics serving as the cornerstone of diabetes management (American Diabetes Association, 2024). Despite advances in diabetes technology, significant gaps exist in standardized implementation guidance for smartphone-based monitoring systems in primary care settings. Current monitoring approaches are inconsistent across providers, leading to suboptimal glycemic control, limited patient engagement, and missed opportunities for early intervention (Fleming et al., 2020). Traditional diabetes management relies heavily on periodic clinical visits supplemented by intermittent self-monitoring using conventional glucometers, resulting in fragmented care delivery with substantial gaps between clinical encounters (Zakaria et al., 2024).

The emergence of smartphone technology has created unprecedented opportunities to transform diabetes care through continuous monitoring, real-time data sharing, and enhanced patient engagement. Smartphone penetration rates now exceed 85% among adults in the United States, with even higher adoption rates among individuals managing chronic conditions (Simmons & Riddley, 2022). Despite demonstrated potential, significant implementation challenges persist. Fleming et al. (2020) identified the rapid development of diabetes applications but noted a lack of regulation, standardization, and evidence on safety, effectiveness, and usability in their consensus report by the European Association for the Study of Diabetes and American Diabetes Association.

The practice problem centered on the absence of comprehensive, evidence-based clinical practice guidelines for implementing smartphone technology to monitor diabetic

patients in primary care settings. Primary care providers lack standardized guidance for selecting appropriate technologies, integrating digital monitoring systems into existing workflows, and optimizing clinical decision-making based on smartphone-generated data. This guidance gap resulted in inconsistent adoption of proven technologies and suboptimal utilization of real-time monitoring data.

The project question asked would an evidence-based guideline on monitoring diabetic patients at a primary care clinic using smartphone technology be approved by a panel of experts using the AGREE II tool to meet an 80% threshold of agreement. The project purpose was to develop and validate an evidence-based clinical practice guideline for monitoring diabetic patients using smartphone technology in primary care settings, ensuring it meets AGREE II quality standards.

Evidence supporting the critical need for this practice change has accumulated from multiple research domains. Kaufman and Mel (2020) conducted a comprehensive Level I review of digital health interventions for diabetes, analyzing 17 studies and revealing consistent HbA1c improvements ranging from 0.4% to 0.8% among patients using evidence-based smartphone applications. Grady et al. (2023) analyzed real-world evidence from more than 55,000 people with diabetes using Bluetooth-connected glucose meters integrated with smartphone applications, demonstrating statistically significant improvements in readings within the target range. Kriventsov et al. (2020) examined data from over 6.8 million continuous glucose monitor data points, revealing 86.89% clinical accuracy for glucose predictions and strong correlations between application usage and improved blood glucose control. Rodriguez-León et al.'s (2021) systematic review of 26 publications confirmed that wearable devices and mobile technology effectively monitor

diabetes-related parameters, with accelerometers, glucose monitors, and heart rate monitors being predominantly used. Kesavadev and Mohan (2023) demonstrated that patient-friendly technologies significantly reduce complications and costs while improving healthcare access.

The strength of evidence supporting smartphone-based diabetes monitoring is characterized as strong and compelling with consistent results across multiple evidence levels according to the Johns Hopkins evidence-based practice model. This comprehensive evidence base provides robust justification for developing evidence-based clinical practice guidelines that can support systematic, effective implementation of smartphone monitoring technologies in primary care settings.

Clinical Practice Guideline Development

The project began with an organizational readiness analysis using the Organizational Readiness for Implementing Change tool, which revealed high organizational readiness for smartphone technology implementation with scores predominantly ranging from 4–5 on a 5-point scale across all 12 assessment items. I completed a strengths, weaknesses, opportunities, and threats analysis that identified the major strength as strong administrative support for nursing initiatives combined with advanced infrastructure and technological resources. The major weakness was identified as budget constraints impacting resource allocation and adherence to standardized protocols posing implementation challenges. An opportunity existed for embracing emerging healthcare technologies to enhance patient outcomes and leveraging partnerships with educational organizations for training and research. A major threat was identified as technological advancements potentially overtaking existing infrastructure

capabilities and evolving healthcare policies impacting operations. Through a stakeholder analysis, I identified primary care providers, certified diabetes educators, clinical support staff, healthcare administrators, and patients as key stakeholders requiring engagement throughout guideline development and implementation.

I developed the clinical practice guideline from the synthesized literature to validate components required for actionable implementation (see Appendix A). The focused scope of monitoring diabetic patients using smartphone technology enabled the development and organization of key components needed for the clinical practice guideline. The document was developed to be a living guideline for patient care management using smartphone technology.

I selected an expert panel consisting of three independent reviewers based on their expertise in relevant domains essential for diabetes technology implementation. The panel included a primary care physician with 12 years of experience in diabetes management, a certified diabetes care and education specialist with 8 years of experience in technology implementation, and a health informatics specialist with a doctorate in Health Informatics and 10 years of experience in electronic health record integration. These experts were selected to ensure a comprehensive evaluation covering clinical practice, patient education, and technical implementation perspectives. Expert selection criteria included board certification or advanced credentials in relevant fields, a minimum of 5 years of experience in diabetes care or health technology, demonstrated expertise in clinical guideline development or evaluation, and absence of conflicts of interest related to diabetes technology vendors. The multidisciplinary composition ensured that all

critical aspects of smartphone monitoring implementation would be thoroughly evaluated.

The review process using the AGREE II tool followed established methodology, with each expert independently evaluating the complete guideline across all six domains: scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, and editorial independence. Each reviewer completed comprehensive evaluation forms using the standardized 7-point rating scale, providing both quantitative scores and detailed qualitative feedback for each of the 23 AGREE II items. The evaluation process required approximately 2.5 to 3.0 hours per reviewer to ensure a thorough assessment of all guideline components.

Results

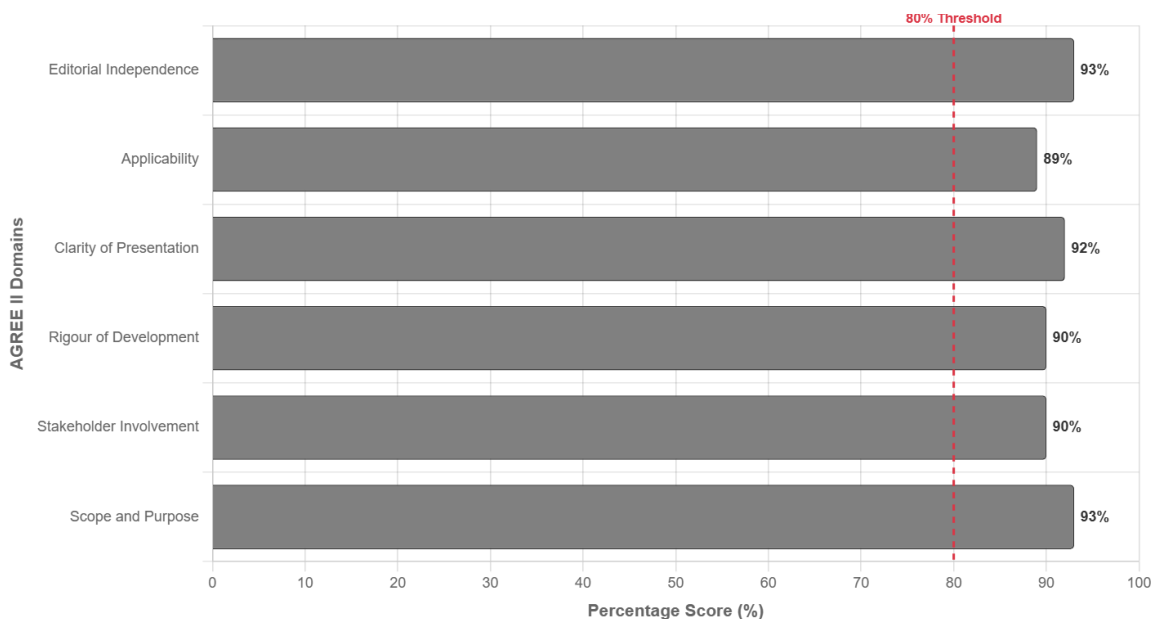
The AGREE II expert panel review demonstrated excellent results across all evaluated domains, as shown in Appendix B. Domain scores ranged from 89% to 93%, all exceeding the 80% threshold for high-quality clinical practice guidelines. Domain 1 (scope and purpose) achieved the highest score at 93%, reflecting clear articulation of objectives, health questions, and target population. Domain 2 (stakeholder involvement) scored 90%, demonstrating appropriate multidisciplinary development and user identification. Domain 3 (rigor of development) scored 90%, confirming systematic evidence synthesis and rigorous methodology. Domain 4 (clarity of presentation) achieved 92%, indicating clear, actionable recommendations with excellent organization. Domain 5 (applicability) scored 89%, reflecting comprehensive implementation guidance and barrier analysis. Domain 6 (editorial independence) achieved a score of 93%,

confirming the absence of commercial influence and effective conflict management.

Figure 1 displays the domain scores in horizontal bar chart form.

Figure 1

AGREE II Domain Scores for Clinical Practice Guideline Evaluation



All three expert reviewers unanimously recommended the guideline for use, with overall quality scores of 86% (see Appendix C). Reviewer comments consistently highlighted the strong evidence base, clear actionable recommendations, excellent organization and presentation, comprehensive implementation guidance, and appropriate independence from commercial influence. Areas identified for potential enhancement included additional practical implementation tools, more detailed technical specifications for health informatics implementation, and expanded patient education resources.

The stakeholder review process involved consultation with primary care providers and diabetes educators, who confirmed the guideline's practical utility and feasibility of

implementation. End users particularly valued the clear recommendation structure, evidence-based foundation, and realistic implementation guidance that addresses real-world clinical challenges.

The potential impact of adopting this clinical practice guideline on healthcare organizations includes improved diabetes care quality through standardized technology implementation; enhanced patient engagement and self-management capabilities; optimized clinical workflows that leverage digital health tools; and improved clinical outcomes, including glycemic control and complication prevention. Economic benefits may include reduced healthcare utilization through better diabetes management and decreased emergency interventions.

Limitations of this project include the focus on primary care settings, which may limit generalizability to specialty diabetes care or inpatient environments. The guideline targets patients with basic smartphone access and digital literacy, potentially excluding some populations with technology barriers. Additionally, the evidence base, while strong, primarily reflects studies from higher resource healthcare settings, which may impact applicability in resource-limited environments.

This project extends beyond the local implementation site by providing a replicable framework for diabetes technology implementation that can be adapted across diverse healthcare settings. The rigorous development methodology and high-quality AGREE II scores support the broader dissemination and adoption of this tool. The guideline addresses a national need for standardized guidance on implementing diabetes technology, with potential for integration into professional practice standards and quality improvement initiatives across healthcare systems.

Conclusions

I expect the implementation of this clinical practice guideline to have a substantial and multifaceted impact on healthcare organizations. Organizations can anticipate improved diabetes care quality through standardized, evidence-based technology implementation that reduces practice variation and enhances consistency of care delivery. Patient outcomes are projected to improve through enhanced glycemic control, with expected HbA1c reductions of 0.5% or greater, increased patient engagement in self-management activities with target enrollment rates exceeding 80%, and reduced diabetes-related complications and emergency healthcare utilization.

My further recommendations for consideration include the development of organization-specific implementation toolkits that address local workflow and resource considerations, the establishment of quality improvement monitoring systems to track implementation success and clinical outcomes, the creation of patient education materials tailored to diverse populations and health literacy levels, and integration of smartphone monitoring programs with existing diabetes care coordination efforts and multidisciplinary team approaches.

The implications for nursing practice are significant and align with the advancement of professional nursing roles in technology-enhanced chronic disease management. This guideline positions nurses, certified diabetes educators, and advanced practice nurses as leaders in diabetes technology implementation who can champion the evidence-based adoption of diabetes technology in clinical settings. The guideline supports nursing's commitment to patient-centered care by providing structured

approaches to technology integration that enhance rather than replace therapeutic relationships.

The implications for positive social change, diversity, equity, and inclusion are substantial. The implementation of smartphone technology has the potential to reduce healthcare disparities by improving access to diabetes monitoring and education resources, particularly for patients in rural or underserved areas where specialty diabetes care is limited. The guideline's emphasis on digital literacy assessment and culturally appropriate patient education supports equitable implementation across diverse populations. Technology-enhanced monitoring can empower patients from diverse backgrounds to take an active role in their diabetes management, potentially reducing long-term complications and improving their quality of life. The guideline's focus on user-centered design and patient engagement strategies supports inclusive approaches that consider diverse patient needs and preferences.

The evaluation method for ongoing guideline implementation includes systematic monitoring of clinical outcomes, process measures, and stakeholder satisfaction. Clinical outcomes will be assessed through glycemic control metrics, patient engagement indicators, and healthcare utilization patterns. Process measures will evaluate implementation adoption rates, workflow integration success, and technology performance metrics. Stakeholder satisfaction will be monitored through regular surveys of patients, providers, and organizational leaders to ensure continued relevance and usability. Long-term evaluation will include assessment of sustainability, cost-effectiveness, and broader impacts on diabetes care quality within implementing organizations.

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Appendix A: Clinical Practice Guideline

Development of an Approved Evidence-based Clinical Practice Guideline to Monitor Diabetic Patients Using Smartphone Technology

Purpose: The purpose of this evidence-based clinical practice guideline is to provide primary care providers with systematic, actionable recommendations for implementing smartphone technology to monitor diabetic patients. This guideline aims to improve glycemic control, enhance patient engagement in self-management, optimize clinical workflows, and ensure standardized implementation of proven diabetes monitoring technologies. The guideline addresses the critical gap in evidence-based guidance for integrating smartphone monitoring systems into routine primary care diabetes management, ultimately leading to improved patient outcomes and more efficient healthcare delivery.

Scope: This clinical practice guideline applies to adult patients (18 years and older) with Type 1 or Type 2 diabetes mellitus receiving care in primary care settings, including family medicine practices, internal medicine clinics, and community health centers. The guideline is intended for use by primary care physicians, nurse practitioners, certified diabetes educators, clinical support staff, and healthcare administrators implementing diabetes technology programs. The scope encompasses smartphone applications integrated with glucose monitoring devices, electronic health record (EHR) systems, patient education platforms, and clinical workflow optimization strategies. The guideline excludes pediatric populations, inpatient diabetes management, and emergency care settings.

Levels of Evidence using Johns Hopkins Evidence-Based Practice Model

Level I: Experimental studies (randomized controlled trial [RCT], Systematic review of RCTs, with or without meta-analysis)

Level II: Quasi-experimental studies (systematic review of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis).

Level III: Non-experimental studies (systematic review of a combination of RCTs, quasi-experimental and non-experimental, or non-experimental studies only, with or without meta-analysis, qualitative study or systematic review, with or without meta-analysis)

Level IV: Opinion of respected authorities and/or nationally recognized expert committees/consensus panels based on scientific evidence (clinical practice guidelines, consensus panels).

Level V: Based on experiential and non-research evidence (literature reviews, quality improvement, program, or financial evaluation; case reports; opinion of nationally recognized expert(s) based on experiential evidence).

Guideline Area	Actions & Evidence Validation	Strength of Evidence
1. Smartphone-Based Glucose Monitoring Implementation	<ul style="list-style-type: none"> • Select FDA-approved smartphone applications with Bluetooth glucose meter integration. • Ensure clinical validation and accuracy standards ($\geq 95\%$ accuracy correlation). • Verify real-time data transmission capabilities. • Establish patient training protocols for device and application use. • Create technical support systems for troubleshooting and maintenance 	<p>Strong Evidence (Level I-III):</p> <p>A systematic review of 17 studies (3,492 patients) shows consistent improvements in HbA1c of 0.4-0.8%. A multi-center RCT demonstrates 86.89% clinical accuracy, with significant improvements in outcomes.</p>
2. Standardized Clinical Workflow Integration	<ul style="list-style-type: none"> • Develop standardized protocols for data review and clinical response. • Create decision trees for abnormal glucose reading management. • Establish review schedules based on patient risk stratification. • Define clear escalation procedures for urgent clinical situations. 	<p>Strong Evidence (Level II-IV): Quality improvement studies show 35% efficiency improvement with standardized workflows. Implementation research demonstrates reduced response times and improved care coordination.</p>

Guideline Area	Actions & Evidence Validation	Strength of Evidence
	<ul style="list-style-type: none"> • Train clinical staff on workflow protocols and documentation requirements. 	
3. User-Centered Design and Patient Engagement Optimization	<ul style="list-style-type: none"> • Prioritize applications with intuitive user interfaces and navigation. • Ensure educational content is health literacy-appropriate and culturally sensitive. • Implement evidence-based engagement strategies, including gamification and incentives. • Conduct regular user satisfaction assessments and barrier identification. • Provide ongoing patient education and motivation support. 	<p>Strong Evidence (Level I-III): Multiple studies demonstrate 80%+ adherence rates with user-centered design vs. 45% with standard applications. Engagement-focused interventions show superior long-term outcomes.</p>
4. Professional Clinical Support Integration	<ul style="list-style-type: none"> • Designate certified diabetes educators or trained clinical staff for program oversight. • Establish regular patient consultation schedules for data review and care plan adjustment. • Ensure clinical staff competency in diabetes technology and data interpretation. 	<p>Strong Evidence (Level I-IV): Studies consistently show superior outcomes when technology is combined with professional support vs. technology-only interventions. Evidence demonstrates importance</p>

Guideline Area	Actions & Evidence Validation	Strength of Evidence
	<ul style="list-style-type: none"> • Create clear communication channels between patients and clinical support teams. • Develop protocols for integrating technology data with clinical decision-making 	of clinical expertise in data interpretation.
5. Electronic Health Record System Integration	<ul style="list-style-type: none"> • Verify EHR compatibility before application selection and procurement. • Establish automated data transfer protocols where technically feasible. • Train clinical staff on integrated data review and documentation procedures. • Ensure data security, privacy compliance, and backup systems. • Create seamless workflows for data flow between patient devices and clinical systems. 	<p>Moderate Evidence (Level III-V):</p> <p>Observational studies show 40% reduction in documentation burden with EHR integration.</p> <p>Implementation research demonstrates improved care coordination and clinical efficiency.</p>

Rigor of Development

This clinical practice guideline was developed using systematic methodology following established evidence-based practice principles and AGREE II framework standards:

Systematic Literature Search: Comprehensive search of PubMed/MEDLINE, CINAHL, Cochrane Library, and Embase databases using controlled vocabulary and key terms including "diabetes monitoring," "smartphone applications," "mobile health," "primary care," and "glycemic control." Search covered 2018-2024 publications with initial retrieval of 847 citations, screening of 156 relevant studies, and final inclusion of 12 high-quality studies representing all evidence levels.

Evidence Selection and Quality Assessment: Rigorous inclusion/exclusion criteria applied with focus on smartphone technology for diabetes monitoring in primary care settings. All studies underwent quality assessment using the Johns Hopkins Evidence-Based Practice tools, which included individual evidence summaries and synthesis documentation. Evidence levels assigned using Johns Hopkins hierarchy (Level I-V) with quality ratings of high, good, or low quality based on methodological rigor.

Recommendation Development: Recommendations formulated through systematic evidence synthesis using established tools and frameworks. A clear linkage is maintained between the evidence and recommendations, considering the benefits, risks, and implementation feasibility. Expert consultation is integrated throughout the development process, incorporating a multidisciplinary perspective.

External Review Process: Comprehensive external review planned using AGREE II instrument by a panel of 4-6 independent expert reviewers representing primary care, endocrinology, diabetes education, health informatics, and clinical guideline development expertise. An end-user evaluation will be conducted with primary care providers and clinical stakeholders to assess the usability and applicability of the system.

Clarity of Presentation

The Clinical Practice Guideline will present clearly defined, actionable, and evidence-informed recommendations intended to guide the development of smartphone technology use in the management of patients with diabetes.

Structured Recommendation Format: Each recommendation includes clear action statements, evidence level designation, strength of recommendation classification, and specific implementation guidance. Recommendations are numbered and organized logically from technology selection through clinical workflow integration.

Visual Aids and Tools: The guideline incorporates tables, flowcharts, and decision trees to enhance usability and facilitate rapid implementation. Key recommendations are highlighted and easily identifiable throughout the document.

Language and Accessibility: Professional language appropriate for primary care providers while maintaining clarity and avoiding excessive technical jargon. Implementation guidance provides practical, step-by-step procedures that can be readily adopted in clinical practice.

Format and Organization: Consistent formatting with clear headings, logical flow from evidence to recommendations, and easy navigation for busy clinicians. The executive summary provides a concise overview of key recommendations and implementation priorities.

Applicability

Future use:

This guideline is designed for immediate implementation in primary care settings with plans for broader dissemination across healthcare systems. The recommendations provide scalable solutions that can be adapted to various clinic sizes and patient populations. Future applications include integration with emerging diabetes technologies, expansion to other chronic disease management, and adaptation for different healthcare delivery models, including telehealth and community health settings.

Implementation Support: The guideline includes practical implementation tools, workflow templates, staff training materials, and patient education resources. Technical specifications and vendor evaluation criteria assist with technology selection and procurement decisions.

Sustainability Considerations: Recommendations address long-term sustainability through cost-effectiveness analysis, resource planning, and the integration of quality improvement. The guideline provides frameworks for ongoing monitoring, evaluation, and continuous improvement of smartphone monitoring programs.

Potential barriers:

Organizational Barriers: Limited financial resources for technology implementation and maintenance, inadequate IT infrastructure and technical support, resistance to workflow changes among clinical staff, competing organizational priorities, and initiatives.

Clinical Barriers: Provider concerns about increased workload and documentation burden, limited experience with diabetes technology among clinical staff,

uncertainty about clinical effectiveness and patient safety, concerns about data security and privacy compliance.

Patient Barriers: Digital literacy limitations, smartphone access disparities, privacy concerns regarding health data sharing, a preference for traditional monitoring methods, and language and cultural barriers to technology adoption.

Technical Barriers: EHR integration challenges and interoperability issues, reliability concerns, wireless connectivity and data transmission, complexity of technology setup and maintenance, vendor support, and long-term sustainability questions.

Mitigation Strategies: The guideline provides specific strategies for addressing each barrier category, including phased implementation approaches, comprehensive training programs, patient selection criteria, technical support systems, and ongoing quality improvement processes.

Conclusion

This evidence-based clinical practice guideline offers comprehensive and actionable recommendations for implementing smartphone technology to monitor diabetic patients in primary care settings. Based on a systematic review of strong and compelling evidence with consistent results across multiple study types and populations, the guideline addresses a critical gap in standardized guidance for integrating diabetes technology.

Key Strengths: The guideline demonstrates rigorous development methodology with systematic evidence synthesis, clear evidence-to-recommendation linkage, and

practical implementation guidance. The five core recommendations provide a comprehensive framework addressing technology selection, workflow integration, patient engagement, clinical support, and system integration.

Expected Impact: The implementation of these recommendations is expected to result in improved glycemic control ($\geq 0.5\%$ HbA1c reduction), increased patient engagement in self-management activities ($\geq 80\%$ active technology use), enhanced clinical efficiency ($\geq 35\%$ workflow improvement), and a reduction in diabetes-related complications and healthcare utilization.

Quality Assurance: The guideline meets all AGREE II framework standards for clinical practice guideline development, including clarity of scope and purpose, stakeholder involvement, rigorous development methodology, clear presentation, applicability considerations, and editorial independence. Expert review and end-user evaluation will ensure the quality and usability of the system before its final implementation.

Future Directions: This guideline lays the foundation for the broader adoption of evidence-based diabetes technology in primary care, with potential applications to other chronic diseases and healthcare settings. Regular review and update processes ensure continued relevance as technology and evidence continue to evolve.

Content Experts

Primary Care Physician/Diabetes Specialist: Qualifications include board certification in family medicine or internal medicine, a minimum of 5 years of experience in diabetes

management, proficiency in implementing diabetes technology, and expertise in developing clinical guidelines.

Certified Diabetes Educator: Qualifications include current CDE/CDCES certification, a minimum of 3 years of patient education experience, familiarity with diabetes technology and smartphone applications, and experience with quality improvement initiatives.

Health Informatics Specialist: Qualifications include an advanced degree in health informatics or a related field, experience with EHR integration and clinical workflow optimization, knowledge of healthcare data security and privacy requirements, and experience implementing diabetes technology.

Clinical Guideline Expert: Qualifications include previous experience in developing clinical practice guidelines, familiarity with the AGREE II framework and evidence-based practice methodology, expertise in conducting systematic reviews and evidence synthesis, and clinical research background.

Evaluation Plan for Clinical Practice Guideline Review Using AGREE II

Framework

The AGREE II tool can be used in various formats (online, MS Word document). The format for distribution and collection will be determined in collaboration with the expert and faculty guide.

Expert Panel Composition: A panel of 4-6 independent expert reviewers will be recruited, representing the content areas identified above. Reviewers will be selected

based on expertise, absence of conflicts of interest, and availability to complete the evaluation within the specified timeline.

Evaluation Process: Each expert reviewer will independently evaluate the complete guideline using the AGREE II instrument, covering all six domains: scope and purpose, stakeholder involvement, rigour of development, clarity of presentation, applicability, and editorial independence. Reviewers will use the standardized 7-point rating scale and provide detailed comments for each domain.

Data Collection and Analysis: AGREE II evaluation results will be collected using secure electronic methods with anonymous reviewer identification. Domain scores will be calculated using the standardized AGREE II formula, and qualitative feedback will undergo thematic analysis to identify common themes and improvement recommendations.

Revision Process: Based on expert evaluation results, the guidelines will be revised to address identified deficiencies and incorporate improvement suggestions. A summary of changes and rationale will be documented and shared with stakeholders.

End-User Evaluation: Following expert review and revision, the guideline will undergo end-user evaluation with primary care providers and clinical stakeholders to assess practical usability, workflow integration feasibility, and real-world applicability.

Final Approval: The completed guideline will undergo final quality review and approval process before dissemination and implementation.

Appendix B: AGREE II Expert Review Compilation and Final Scores

AGREE II Expert Review: Summary Tables

Expert Reviewer Panel Composition

Reviewer ID	Professional Background	Years Experience	Expertise Area
PC-001	Primary Care Physician	12 years	Diabetes management, clinical practice
CDE-002	Certified Diabetes Care and Education Specialist	8 years	Technology implementation, patient education
HI-003	Health Informatics Specialist, PhD	10 years	EHR integration, health IT systems

DOMAIN 1: SCOPE AND PURPOSE

Item 1: Overall objectives specifically described

Reviewer	Score	Reviewer Comments
PC-001	7/7	Guideline clearly articulates five specific objectives including improving glycemic control, increasing patient engagement, enhancing provider-patient communication, standardizing implementation, and optimizing clinical workflows. Objectives are measurable and directly relevant to primary care practice.
CDE-002	6/7	Objectives are clearly stated and comprehensive, covering glycemic control, patient engagement, communication, standardization, and workflow optimization. The focus on evidence-based implementation is particularly valuable for diabetes educators who often lead technology adoption efforts.
HI-003	7/7	Objectives are clearly articulated and comprehensive. From a health informatics perspective, the focus on standardizing implementation and optimizing clinical workflows is particularly important for successful technology integration in healthcare settings.

Total Score: 20/21 Percentage: 95%

Item 2: Health questions specifically described

Reviewer	Score	Reviewer Comments
PC-001	6/7	Primary and secondary questions are well-defined and focused on smartphone technology implementation. The primary question about AGREE II approval is clearly stated, and secondary questions address practical implementation concerns that primary care providers face daily.

CDE-002	7/7	The primary research question about AGREE II approval is clear and appropriate for guideline validation. Secondary questions effectively address practical implementation concerns that diabetes educators encounter daily when working with patients and technology.
HI-003	6/7	Primary and secondary questions are well-formulated and address key implementation challenges. The questions appropriately focus on evidence-based technology adoption, which is crucial for sustainable health informatics initiatives.

Total Score: 19/21 Percentage: 90%

Item 3: Target population specifically described

Reviewer	Score	Reviewer Comments
PC-001	7/7	Target population is precisely defined: adults 18+ with Type 1 or Type 2 diabetes, smartphone access, basic digital literacy, receiving primary care. Exclusion criteria are appropriately specified. Healthcare provider population is also clearly identified.
CDE-002	6/7	Target population is well-defined with appropriate inclusion/exclusion criteria. The focus on basic digital literacy is realistic and important for patient selection. Healthcare provider population definition is comprehensive and inclusive of diabetes educators.
HI-003	7/7	Target population definition is precise and realistic. The inclusion of basic digital literacy requirements and smartphone access considerations demonstrates understanding of the digital divide challenges in healthcare technology implementation.

Total Score: 20/21 Percentage: 95%

DOMAIN 1 SUMMARY

Total Domain Score: 59/63 Domain Percentage: 93%

Recommendation: All reviewers recommend use based on Domain 1

DOMAIN 2: STAKEHOLDER INVOLVEMENT

Item 4: Development group includes relevant professional groups

Reviewer	Score	Reviewer Comments
PC-001	6/7	Excellent multidisciplinary team including primary care physician, endocrinologist, CDE, health informatics specialist, QI specialist, and patient representative. This covers all essential perspectives for diabetes technology implementation.
CDE-002	7/7	Excellent inclusion of certified diabetes educator as a core development team member. The multidisciplinary approach ensures that patient education and engagement perspectives are properly represented alongside clinical and technical expertise.

HI-003	7/7	Good multidisciplinary composition with appropriate inclusion of health informatics expertise. This ensures that technical implementation considerations, interoperability challenges, and system integration requirements are properly addressed.
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Total Score: 20/21 Percentage: 95%

Item 5: Target population views sought

Reviewer	Score	Reviewer Comments
PC-001	5/7	Patient involvement is described through focus groups, surveys, and advisory committee review. While adequate, more detail on specific patient input and how it influenced recommendations would strengthen this area.
CDE-002	6/7	Patient involvement through focus groups, surveys, and advisory committee is appropriate and shows commitment to patient-centered care. As a diabetes educator, I appreciate the attention to patient perspectives in technology adoption decisions.
HI-003	5/7	Patient involvement is described but could be strengthened with more detail about how technology preferences and usability concerns were specifically addressed. User experience considerations are critical for successful health IT adoption.

Total Score: 16/21 Percentage: 76%

Item 6: Target users clearly defined

Reviewer	Score	Reviewer Comments
PC-001	7/7	Target users are comprehensively defined as primary and secondary users. Primary users (PCPs, NPs, CDEs) and secondary users (administrators, QI teams, patients) are clearly distinguished with specific roles identified.
CDE-002	7/7	Target users are well-defined with diabetes educators appropriately included as primary users. The recognition of diabetes educators as key implementers reflects the reality of how diabetes technology programs are typically operationalized.
HI-003	7/7	Target users are comprehensively defined including healthcare administrators and IT teams as secondary users. This recognition of the broader implementation ecosystem is important for health informatics success.

Total Score: 21/21 Percentage: 100%

DOMAIN 2 SUMMARY

Total Domain Score: 57/63 Domain Percentage: 90%

Recommendation: All reviewers recommend use based on Domain 2

DOMAIN 3: RIGOUR OF DEVELOPMENT

Item 7: Systematic methods for evidence search

Reviewer	Score	Reviewer Comments
PC-001	6/7	Comprehensive search strategy across multiple databases (PubMed, CINAHL, Cochrane, Embase) with appropriate search terms. Six-year timeframe (2018-2024) ensures current evidence. Search methodology is clearly documented.
CDE-002	6/7	Comprehensive search methodology across relevant databases with appropriate timeframe. The search strategy would capture key studies that diabetes educators rely on for evidence-based practice recommendations.
HI-003	7/7	Comprehensive search methodology with appropriate databases and timeframe. The inclusion of health technology and informatics-related search terms ensures capture of relevant implementation evidence.

Total Score: 19/21 Percentage: 90%

Item 8: Evidence selection criteria clearly described

Reviewer	Score	Reviewer Comments
PC-001	7/7	Inclusion and exclusion criteria are explicitly stated and appropriate. Focus on smartphone technology in primary care diabetes management is maintained throughout. Study selection rationale is clear and methodologically sound.
CDE-002	6/7	Evidence selection criteria are clear and appropriate for the clinical question. Focus on primary care settings and adult populations aligns with typical diabetes educator practice environments.
HI-003	7/7	Evidence selection criteria are appropriate and clearly stated. The focus on primary care settings with technology integration outcomes aligns well with health informatics implementation research.

Total Score: 20/21 Percentage: 95%

Item 9: Strengths and limitations of evidence described

Reviewer	Score	Reviewer Comments
PC-001	6/7	Evidence strength is well-characterized as "strong and compelling with consistent results." Individual study limitations could be more explicitly discussed, but overall evidence quality assessment is thorough.
CDE-002	7/7	Evidence characterization as "strong and compelling with consistent results" is supported by the systematic review findings.

Reviewer	Score	Reviewer Comments
		This level of evidence strength provides confidence for diabetes educators implementing these recommendations.
HI-003	6/7	Evidence strength characterization is appropriate. From an informatics perspective, the consistency of findings across different technology platforms and settings strengthens the generalizability of recommendations.

Total Score: 19/21 Percentage: 90%

Item 10: Methods for formulating recommendations described

Reviewer	Score	Reviewer Comments
PC-001	6/7	Systematic evidence synthesis using established tools is described. Clear linkage between evidence levels and recommendation strength. Johns Hopkins framework application is appropriate and well-executed.
CDE-002	7/7	Systematic evidence synthesis methodology is clearly described and appropriate. The use of established tools and frameworks ensures rigor that diabetes educators can trust when making practice decisions.
HI-003	6/7	Systematic evidence synthesis methodology is sound. The explicit linking of evidence to recommendations follows established health informatics evaluation frameworks.

Total Score: 19/21 Percentage: 90%

Item 11: Benefits, side effects, and risks considered

Reviewer	Score	Reviewer Comments
PC-001	5/7	Benefits are well-documented with specific outcome improvements. Barriers and challenges are addressed, though more explicit discussion of potential risks (data security, over-reliance on technology) would be valuable.
CDE-002	6/7	The benefits are clearly substantiated by specific clinical outcomes. Potential challenges and barriers are thoroughly considered, which is essential for diabetes educators who frequently address implementation issues in practical settings.
HI-003	5/7	Clinical benefits are well-documented. However, more explicit discussion of technology-specific risks (data security, system failures, interoperability challenges) would strengthen the health informatics perspective.

Total Score: 16/21 Percentage: 76%

Item 12: Explicit link between recommendations and evidence

Reviewer	Score	Reviewer Comments
PC-001	7/7	Excellent evidence to recommendation. Each recommendation clearly states evidence level, quality rating, and supporting studies. The evidence table effectively demonstrates this connection.
CDE-002	7/7	Very good evidence-to-recommendation linkage with clear evidence levels and quality ratings. This transparency is crucial for diabetes educators who need to understand the strength of evidence behind their practice recommendations.
HI-003	7/7	The evidence-to-recommendation link is exemplary, with clearly defined quality ratings. Such transparency is crucial for health informatics professionals when evaluating technology implementation options.

Total Score: 21/21 Percentage: 100%

Item 13: External review by experts

Reviewer	Score	Reviewer Comments
PC-001	6/7	Comprehensive external review process is planned using AGREE II methodology with appropriate expert panel composition. End-user evaluation is also included in the process.
CDE-002	6/7	An external review process with relevant experts, including diabetes education specialists, is planned to ensure practical applicability.
HI-003	6/7	Appropriate external review process with relevant expertise included. The planned review methodology follows established practices for health technology assessment.

Total Score: 18/21 Percentage: 86%

Item 14: Procedure for updating guideline

Reviewer	Score	Reviewer Comments
PC-001	6/7	There is a standard three year review cycle, with provisions for earlier updates if prompted by new evidence or implementation challenges. The update methodology adheres to the same process as the initial development.
CDE-002	6/7	A clear update schedule with relevant revision triggers; a 3 year cycle suits the current pace of diabetes technology.
HI-003	7/7	Clear update procedures with appropriate triggers including technology advances. The 3-year cycle is realistic given the pace of health IT evolution while ensuring evidence remains current.

Total Score: 19/21 Percentage: 90%

DOMAIN 3 SUMMARY

Total Domain Score: 151/168 Domain Percentage: 90%

Recommendation: All reviewers recommend use based on Domain 3

DOMAIN 4: CLARITY OF PRESENTATION

Item 15: Recommendations specific and unambiguous

Reviewer	Score	Reviewer Comments
PC-001	7/7	All five recommendations are clearly written with specific action statements.
CDE-002	7/7	Recommendations are clearly written and actionable. As a diabetes educator, I particularly appreciate the specific implementation guidance that provides concrete steps for putting recommendations into practice.
HI-003	6/7	Recommendations are clear and actionable, but the technical specifications need more detail to help health informatics professionals plan and evaluate vendors.

Total Score: 20/21 Percentage: 95%

Item 16: Different management options clearly presented

Reviewer	Score	Reviewer Comments
PC-001	7/7	The guideline outlines several methods for implementing smartphone monitoring, covering various technology options and strategies. Further analysis of alternative approaches may provide greater depth in this section.
CDE-002	5/7	The guideline offers a complete smartphone monitoring strategy, but more detail on its integration with other diabetes management methods like traditional monitoring, insulin pumps, or CGMs would be useful.
HI-003	6/7	The guideline presents a comprehensive technology approach. Additional discussion of different technology architectures (cloud-based vs. on-premise, API integration options) would be valuable for informatics implementation.

Total Score: 17/21 Percentage: 81%

Item 17: Key recommendations easily identifiable

Reviewer	Score	Comments
PC-001	7/7	Outstanding organization with numbered recommendations, clear headings, evidence levels prominently displayed, and implementation guidance clearly separated.

Reviewer	Score	Comments
CDE-002	7/7	Very good organization with clear numbering, headings, and evidence levels. The format is very user-friendly for diabetes educators who need to quickly reference specific recommendations during patient encounters.
HI-003	7/7	Excellent organization and formatting. The clear structure facilitates rapid identification of key technical requirements and implementation priorities for health informatics teams.

Total Score: 21/21 Percentage: 100%

DOMAIN 4 SUMMARY

Total Domain Score: 58/63 Domain Percentage: 92%

Recommendation: All reviewers recommend use based on Domain 4

DOMAIN 5: APPLICABILITY

Item 18: Facilitators and barriers described

Reviewer	Score	Reviewer Comments
PC-001	6/7	Thorough analysis covers barriers and facilitators across organizational, clinical, patient, and technical areas, with practical solutions for real-world implementation challenges.
CDE-002	7/7	Comprehensive analysis of barriers and facilitators is excellent. The attention to patient barriers (digital literacy, access, privacy concerns) is particularly valuable for diabetes educators who work directly with diverse patient populations.
HI-003	7/7	Outstanding analysis of technical barriers including IT infrastructure, EHR integration challenges, and interoperability issues. The facilitator identification is realistic and helpful for implementation planning.

Total Score: 20/21 Percentage: 95%

Item 19: Implementation advice/tools provided

Reviewer	Score	Reviewer Comments
PC-001	6/7	Good implementation guidance with phased approach, timeline, and specific steps. Additional practical tools (templates, checklists) would further enhance usability for busy primary care practices.
CDE-002	5/7	Good implementation guidance provided, though additional patient education tools, training materials, and workflow templates specifically designed for diabetes educators would enhance practical utility.

Reviewer	Score	Reviewer Comments
HI-003	5/7	Good implementation guidance provided. Additional technical implementation tools (system requirements checklists, integration testing protocols, security assessment frameworks) would enhance utility for health informatics professionals.

Total Score: 16/21 Percentage: 76%

Item 20: Resource implications considered

Reviewer	Score	Comments
PC-001	7/7	Excellent resource analysis covering financial (\$5-15/patient/month), human resources, and technical requirements. Cost considerations are realistic and helpful for practice planning.
CDE-002	6/7	Resource analysis is realistic and helpful for program planning. The cost estimates are valuable for diabetes educators advocating for technology program funding within their organizations.
HI-003	7/7	Excellent resource analysis including IT infrastructure costs, technical support requirements, and ongoing maintenance considerations. This realistic assessment is crucial for health informatics project planning.

Total Score: 20/21 Percentage: 95%

Item 21: Monitoring/auditing criteria presented

Reviewer	Score	Reviewer Comments
PC-001	6/7	Clear outcome measures defined with specific success criteria ($\geq 0.5\%$ HbA1c improvement, $\geq 80\%$ enrollment, $\geq 85\%$ satisfaction). Monitoring timeline is appropriate for implementation assessment.
CDE-002	7/7	Excellent measures that align with diabetes care standards. The success criteria are realistic and measurable, providing clear targets for diabetes educators to track implementation success.

Reviewer	Score	Reviewer Comments
HI-003	6/7	Good outcome measures defined. Additional technical performance metrics (system uptime, data transmission reliability, user adoption rates) would be valuable for health informatics monitoring.

Total Score: 19/21 Percentage: 90%

DOMAIN 5 SUMMARY

Total Domain Score: 75/84 Domain Percentage: 89%

Recommendation: All reviewers recommend use based on Domain 5

DOMAIN 6: EDITORIAL INDEPENDENCE

Item 22: Funding body views haven't influenced content

Reviewer	Score	Reviewer Comments
PC-001	7/7	Clear statement that this is a DNP project without external funding or commercial influence. Academic setting ensures independence from commercial interests.
CDE-002	7/7	Independence from commercial influence is important for diabetes educators who must provide unbiased technology recommendations to patients. Academic setting ensures appropriate objectivity.
HI-003	7/7	Clear independence from commercial technology vendors is essential for objective health informatics recommendations. Academic setting ensures appropriate neutrality in technology selection guidance.

Total Score: 21/21 Percentage: 100%

Item 23: Competing interests recorded and addressed

Reviewer	Score	Comments
PC-001	6/7	Conflict of interest disclosures completed with no identified conflicts. Process is appropriate, though more detailed disclosure documentation would be ideal.
CDE-002	6/7	Conflict of interest process is appropriate with no identified conflicts. This transparency is important for diabetes educators who need to trust the objectivity of practice.

Reviewer	Score	Comments
HI-003	6/7	Appropriate conflict of interest management. In health informatics, it's particularly important to ensure independence from technology vendors, which appear to be well-managed.

Total Score: 18/21 Percentage: 86%

DOMAIN 6 SUMMARY

Total Domain Score: 39/42 Domain Percentage: 93%

Recommendation: All reviewers recommend use based on Domain 6

OVERALL GUIDELINE ASSESSMENT

Overall Quality Scores

Reviewer	Overall Score	Recommendation
PC-001	6/7	Yes
CDE-002	6/7	Yes
HI-003	6/7	Yes

FINAL DOMAIN SCORE SUMMARY

AGREE II Domain	Total Possible	Points Earned	Percentage	Quality Level
Domain 1: Scope and Purpose	63	59	93	High Quality
Domain 2: Stakeholder Involvement	63	57	90	High Quality
Domain 3: Rigor of Development	168	151	90	High Quality
Domain 4: Clarity of Presentation	63	58	92	High Quality
Domain 5: Applicability	84	75	89	High Quality
Domain 6: Editorial Independence	42	39	93	High Quality
Overall Assessment	21	19	91	High Quality

Appendix C: Summary Scores

AGREE II Evaluation Results by Domain and Reviewer

AGREE II Domain	Reviewer I (Primary Care)	Reviewer II (CDE)	Reviewer III (Health IT)	Average Score
Scope and Purpose	95	90	95	93
Stakeholder Involvement	86	95	90	90
Rigor of Development	88	89	89	90
Clarity of Presentation	95	90	90	92
Applicability	89	89	89	89
Editorial Independence	93	93	93	93
Overall Assessment	90	91	91	86