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# Health System Factors Influencing the Adoption and Sustainability of Evidence-Based Retinal Care Guidelines: A Systematic Review and Meta-Synthesis

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**A B S T R A C T**

Evidence-based guidelines (EBGs) are crucial for optimizing care and outcomes for highly prevalent retinal diseases like diabetic retinopathy (DR), age-related macular degeneration (AMD), and retinopathy of prematurity (ROP). However, their translation into routine clinical practice remains inconsistent. Understanding the health system factors that facilitate or impede the adoption and long-term sustainability of these guidelines is critical for improving population eye health. This systematic review and meta-synthesis aimed to identify and synthesize qualitative evidence on health system-level determinants influencing the implementation of retinal care EBGs. We conducted a systematic review following PRISMA guidelines. Major biomedical databases (PubMed, Scopus, Embase, Web of Science) and grey literature sources were searched from January 2013 to December 2024 using keywords related to retinal diseases, guidelines, implementation, adoption, sustainability, and health systems. Inclusion criteria focused on qualitative or mixed-methods studies exploring factors influencing the uptake or continued use of formal retinal care guidelines within clinical settings. Two reviewers independently screened titles/abstracts and full texts, extracted data, and assessed study quality using the Critical Appraisal Skills Programme (CASP) Qualitative Checklist. A thematic synthesis approach, following Noblit and Hare's methodology for meta-ethnography, was employed to synthesize findings across studies, involving familiarization, coding, theme generation, and synthesizing translations between studies. 7 studies met the inclusion criteria. These studies originated from diverse healthcare systems and focused primarily on DR and AMD guidelines. Quality assessment indicated moderate to high methodological rigor across the included studies. The meta-synthesis identified six interconnected key themes representing health system factors influencing guideline adoption and sustainability: leadership engagement and organizational culture prioritizing evidence-based practice; resource allocation and infrastructure adequacy, including staffing, funding, and integrated IT systems; inter-professional collaboration and streamlined communication pathways across disciplines and care settings; alignment with external policy levers and financial incentives; perceived guideline characteristics and adaptability within local workflows; and robust feedback mechanisms and continuous quality improvement cycles integrated into the system. Lack of resources, fragmented communication, conflicting financial incentives, and inadequate leadership support emerged as primary barriers. In conclusion, the successful adoption and sustainability of evidence-based retinal care guidelines are profoundly influenced by a complex interplay of health system factors. Effective implementation requires more than guideline dissemination. Addressing these system-level determinants is paramount for bridging the evidence-practice gap and reducing preventable vision loss from retinal diseases globally. Policymakers and healthcare administrators must consider these multifaceted factors when designing and implementing strategies to enhance retinal care quality.

## 1. Introduction

Retinal diseases, including diabetic retinopathy (DR), age-related macular degeneration (AMD), and retinopathy of prematurity (ROP), constitute a substantial and increasing global public health issue. These conditions are major causes of irreversible

vision impairment and blindness across the globe, leading to significant socioeconomic burdens for individuals, healthcare systems, and societies. The prevalence of DR is growing in conjunction with the global rise in diabetes. Concurrently, AMD remains a leading cause of blindness in older populations, particularly in developed nations. Effective screening and timely intervention for ROP are essential for preventing blindness in premature infants. Over the past two decades, advances in diagnostic tools such as optical coherence tomography (OCT) and ultra-widefield imaging, as well as therapeutic interventions like anti-vascular endothelial growth factor (anti-VEGF) agents, laser photocoagulation, and vitreoretinal surgery, have transformed the management of these retinal diseases. To translate these advancements into improved patient outcomes and efficient resource utilization, numerous professional organizations and health authorities have developed evidence-based guidelines (EBGs). These guidelines offer systematically developed recommendations aimed at standardizing care, reducing variations in practice, enhancing quality, and informing clinical decision-making regarding screening, diagnosis, treatment, and follow-up protocols based on the best available evidence.[1-3]

Despite the availability of these high-quality EBGs, a significant discrepancy persists between guideline recommendations and actual clinical practice—a phenomenon commonly referred to as the "evidence-practice gap." Studies have consistently shown suboptimal adherence to recommended screening intervals for DR, variations in the initiation and monitoring of anti-VEGF treatment for AMD, and challenges in the timely screening and management of ROP, especially in resource-limited settings. This failure to implement guidelines effectively results in preventable vision loss, increased healthcare costs associated with managing advanced disease complications, and the exacerbation of health inequities. While individual clinician factors, such as knowledge, attitudes, and skills, and patient factors, including awareness, adherence, and socioeconomic status, contribute to this gap, implementation science research increasingly emphasizes the critical role of the broader context, particularly health system factors, in the successful adoption and long-term sustainability of EBGs. Health systems encompass the organizations, institutions, resources, and policies whose primary purpose is to promote, restore, or maintain health. Factors operating at the macro and meso levels of health systems—including organizational culture, leadership support, resource availability (funding, staffing, technology), communication structures, workflow integration, information technology infrastructure, performance monitoring, and reimbursement policies—can either facilitate or impede guideline implementation.[4-6]

A thorough understanding of these system-level determinants within the specific context of retinal care is essential for designing effective implementation strategies. Retinal care often involves complex pathways that span primary care (e.g., DR screening), specialized ophthalmology clinics, diagnostic imaging services, and, in some cases, tertiary surgical centers. It frequently relies on advanced technology, such as imaging and lasers, and involves high-cost treatments like anti-VEGF agents, making it particularly sensitive to health system structures, resource allocation, and policy decisions. Previous research in ophthalmology has often concentrated on guideline development or effectiveness, or on individual clinician adherence barriers. While this research is valuable, there has been less systematic synthesis of the qualitative evidence that explores the complex interplay of health system factors that influence how and why retinal guidelines are, or are not, adopted and sustained in real-world clinical settings. Qualitative research, utilizing methods such as interviews, focus groups, and case studies, offers rich insights into the contextual nuances, processes, beliefs, and experiences that quantitative data alone cannot capture. Synthesizing these qualitative findings can lead to a deeper and more comprehensive understanding of the challenges and facilitators of implementation from the perspectives of those

involved in the process.[7-10] Therefore, this study aims to conduct a systematic review and meta-synthesis of published qualitative evidence. The goal is to identify, describe, and synthesize health system-level factors that influence the adoption and sustainability of evidence-based guidelines for major retinal diseases (DR, AMD, ROP) in clinical practice.

## 2. Methods

This systematic review and meta-synthesis was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and established guidance for meta-synthesis of qualitative research. A protocol was developed prior to the commencement of the review process. This protocol outlined the search strategy, inclusion and exclusion criteria, data extraction procedures, quality appraisal methods, and the approach to data synthesis. While the protocol guided the review process, it was not formally registered.

A comprehensive literature search was performed to identify relevant studies. The search aimed to retrieve studies published within a specific timeframe, spanning from January 1st, 2013, to December 31st, 2024. This period was selected to capture contemporary health system contexts and guideline implementation efforts, particularly in light of the widespread adoption of anti-VEGF therapies and advanced imaging technologies in recent years. The search strategy involved a combination of electronic database searches and manual searching of grey literature sources. The following electronic databases were searched: PubMed/MEDLINE, Scopus, Embase, and Web of Science. These databases were chosen due to their extensive coverage of biomedical and health services literature. In addition to the electronic database searches, a manual search of grey literature sources was conducted to identify relevant studies or reports that may not be indexed in the major databases. This included examining relevant ophthalmology conference proceedings, such as those from the ARVO, EURETINA, and AAO annual meetings. Websites of key health policy organizations and guideline developers were also searched. Examples of such organizations include the National Institute for Health and Care Excellence (NICE), the World Health Organization (WHO), and the Agency for Healthcare Research and Quality (AHRQ). The search strategy was structured around three core concepts: retinal conditions, guidelines, and implementation/health system factors; Retinal Conditions: This concept encompassed terms related to the specific retinal diseases of interest. The search terms included: "Retina," "Retinal Diseases," "Diabetic Retinopathy," "Age-Related Macular Degeneration," "Macular Degeneration," and "Retinopathy of Prematurity." These terms were used to identify studies focusing on the target conditions for the review; Guidelines: This concept focused on terms related to clinical practice guidelines and recommendations. The search terms included: "Guideline*," "Clinical Practice Guideline*," "Recommendation*," "Protocol*," "Standard*," and "Evidence-Based Practice." The asterisk (*) was used as a wildcard to capture variations of the terms; Implementation/Health System Factors: This concept included a broad range of terms related to the implementation of guidelines and the various factors within health systems that can influence this process. The search terms included: "Implementation," "Adoption," "Uptake," "Adherence," "Compliance," "Sustainability," "Translation*," "Knowledge Translation," "Health System*," "Healthcare System*," "Organization*," "Factor*," "Barrier*," "Facilitator*," "Enabler*," "Determinant*," "Policy," "Resource*," "Workflow," "Qualitative Research," "Interview*," "Focus Group*," and "Case Study". Boolean operators (AND, OR) were used to combine the search terms within and across the three core concepts. This allowed for a more precise and targeted search. The search strategy was adapted to the specific syntax and features of each electronic database. This ensured that the search was optimized for each database, maximizing the retrieval of relevant studies. An example of the PubMed search string is as follows:

"Retina" OR "Retinal Diseases" OR "Diabetic Retinopathy" OR "Macular Degeneration" OR "Retinopathy of Prematurity" AND "Guideline Adherence" OR "Practice Guidelines as Topic" OR Guideline* OR Protocol* OR Recommendation* AND "Implementation Science" OR Implement* OR Adopt* OR Sustainab* OR Adheren* OR Complian* OR Uptake OR Barrier* OR Facilitat* OR Enabler* OR "Health Services Research" OR "Delivery of Health Care" OR Health System* OR Organization* OR Factor* OR Policy OR Resource* OR Workflow AND "Qualitative Research" OR Interview* OR Focus Group* OR Qualitative. In addition to the database and grey literature searches, the reference lists of included studies and relevant reviews were also manually screened for any additional potentially eligible studies. This process, known as "snowballing," helps to identify studies that may have been missed by the initial searches.

The inclusion and exclusion criteria were established to define the scope of the review and ensure that only relevant studies were included. Studies were included if they met the following criteria; Study Design: Studies were required to have employed qualitative research methods. Acceptable qualitative methods included interviews, focus groups, ethnographic observation, and case studies. Mixed-methods designs were also included, but only if the qualitative data addressing the research question could be extracted and analyzed separately; Population: The studies had to involve healthcare professionals, policymakers, or patients/caregivers. Healthcare professionals included ophthalmologists, optometrists, primary care physicians, nurses, technicians, and administrators. The studies had to provide perspectives on guideline implementation within clinical settings; Intervention/Phenomenon of Interest: The studies had to explore factors influencing the adoption and/or sustainability of formally published or recognized evidence-based clinical practice guidelines or protocols. The guidelines or protocols had to be specifically related to the screening, diagnosis, monitoring, or treatment of diabetic retinopathy (DR), age-related macular degeneration (AMD), or retinopathy of prematurity (ROP); Context: The studies could be situated within any healthcare system or clinical practice setting. This included hospitals, community clinics, and private practices; Outcomes: The studies had to report qualitative findings related to health system factors influencing guideline implementation. Health system factors were defined as organizational, structural, financial, policy, technological, and social/cultural aspects of the system; Language and Publication: Studies had to be published in English between January 1st, 2013, and December 31st, 2024. Full-text availability was also required. Studies were excluded if they met any of the following criteria; Purely Quantitative Studies: Studies that employed only quantitative methods were excluded. For example, surveys reporting only percentages or audits of adherence rates without any qualitative exploration of the reasons behind the findings were excluded; Focus on Guideline Development or Effectiveness: Studies that focused solely on the development or effectiveness of guidelines, without examining implementation factors, were excluded; Non-Retinal Conditions: Studies that examined guidelines for conditions other than DR, AMD, or ROP were excluded; Exclusive Focus on Individual or Patient Factors: Studies that focused exclusively on individual clinician knowledge/attitudes or patient adherence factors, without linking them to broader system influences, were excluded; Inadequate Publication Type: Editorials, commentaries, letters, or conference abstracts that lacked sufficient methodological detail or results were excluded; Non-English Language: Studies not published in English were excluded.

The study selection process involved several stages to ensure that only eligible studies were included in the review. All retrieved citations from the electronic database searches were imported into EndNote X9 software. Duplicate records were then removed using the software's duplicate detection function. This step was crucial to avoid including the same study multiple times. Following the removal of duplicates, two

reviewers independently screened the titles and abstracts of the remaining citations. The screening was conducted against the pre-defined inclusion and exclusion criteria. This initial screening aimed to identify potentially relevant studies for further assessment. Any disagreements between the two reviewers during the title and abstract screening were resolved through discussion and consensus. If a consensus could not be reached, a third reviewer was consulted to adjudicate the disagreement. The full texts of potentially relevant articles that passed the title and abstract screening stage were retrieved. These full-text articles were then independently assessed for eligibility by the same two reviewers. A standardized form, based on the inclusion and exclusion criteria, was used to guide the full-text assessment. The reasons for excluding articles at the full-text stage were carefully documented. This documentation provides transparency and allows for a clear understanding of the study selection process. Any remaining disagreements between the two reviewers after the full-text assessment were resolved by consensus through discussion. If necessary, a third-party reviewer was involved to make a final decision.

A standardized data extraction form was developed specifically for this review. The form was designed based on established qualitative research reporting standards to ensure that all relevant data was extracted in a consistent and comprehensive manner. The data extraction form was piloted on two included studies to test its usability and refine it as needed. This pilot testing helped to ensure that the form was clear, comprehensive, and effective in capturing the necessary information. Two reviewers independently extracted data from each included study using the standardized data extraction form. This independent extraction minimized the risk of bias and ensured the accuracy of the extracted data. The following information was extracted from each included study; Author(s) and year of publication: This information is essential for referencing the studies and tracking the literature; Country and healthcare system context: This information provides important contextual details about where the study was conducted, which can influence the findings; Study aim(s): This clarifies the purpose of each study and helps to determine its relevance to the review question; Guideline focus: This specifies the particular retinal guideline(s) examined in the study (e.g., DR screening, AMD treatment); Study design and methods: This includes details about the qualitative methods used (e.g., interviews, focus groups) and the overall study design; Participant characteristics: This describes the types and number of participants involved in the study (e.g., ophthalmologists, patients); Key findings related to health system factors influencing guideline adoption/sustainability: This is the core data extracted from the studies, including verbatim quotes or author interpretations that represent participant perspectives on barriers and facilitators; Reported barriers and facilitators: This specifically identifies the factors that hinder or promote guideline implementation, as reported in the studies. Any discrepancies in the extracted data between the two reviewers were resolved through discussion and consensus. The reviewers referred back to the original articles as needed to ensure accuracy and resolve any uncertainties.

The methodological quality of the included qualitative studies was independently assessed by two reviewers. The Critical Appraisal Skills Programme (CASP) Qualitative Checklist was used for this assessment. The CASP checklist is a widely used and validated tool for assessing the rigor of qualitative research. The CASP Qualitative Checklist consists of ten questions that assess various aspects of qualitative research, including; Clarity of aims; Appropriateness of methodology; Research design; Recruitment strategy; Data collection methods; Reflexivity; Ethical considerations; Rigor of data analysis; Clarity of findings; Overall value of the research. Each item on the CASP checklist was rated as 'Yes,' 'No,' or 'Can't Tell.' 'Yes' indicated that the criterion was fully met, 'No' indicated that the criterion was not met, and 'Can't Tell' indicated that there was insufficient information to judge whether the criterion

was met. Studies were not excluded from the review based solely on their quality scores. However, the quality appraisal was used to inform the interpretation of the findings and to assess the confidence in the synthesis. This approach acknowledges that valuable insights can be gained from studies with varying levels of methodological rigor, while also recognizing the importance of considering study quality when drawing conclusions. Disagreements in the quality ratings between the two reviewers were resolved through discussion and consensus. A summary of the quality assessment for each included study was compiled, providing an overview of the methodological strengths and limitations of the included evidence.

A meta-synthesis approach was used to synthesize the qualitative findings across the included studies. Meta-synthesis is a method for systematically reviewing and integrating findings from qualitative studies. This review utilized thematic synthesis, informed by principles of meta-ethnography. Meta-ethnography is a specific approach to meta-synthesis that focuses on interpreting the findings of qualitative studies in relation to each other. The meta-synthesis process involved three main stages; Familiarization and Line-by-Line Coding: The first stage involved the reviewers becoming thoroughly familiar with the included studies. Reviewers independently read and re-read the results/findings sections of each study, focusing on the data related to health system factors. Line-by-line coding of the text was then performed. Coding involves assigning labels or codes to segments of text to capture the concepts and meanings related to barriers and facilitators of guideline implementation. The initial codes were kept close to the original data to preserve the nuances and context of the findings; Developing Descriptive Themes: In the second stage, the initial codes were compared, contrasted, and grouped based on similarity in meaning. This process led to the development of descriptive themes. Descriptive themes represent recurring concepts or factors that were identified within individual studies. A preliminary thematic structure was developed collaboratively by the reviewers, organizing the descriptive themes into a coherent framework; Generating Analytical Themes (Meta-Synthesis): The final stage involved further interpretation and synthesis of the descriptive themes across all studies. This process aimed to generate higher-order analytical themes. Analytical themes go beyond simply summarizing the findings of individual studies; they involve "translating" concepts between studies, exploring the relationships between themes, and developing an overarching narrative or model that provides a new interpretation of the data. The focus was on identifying the key health system mechanisms that influence guideline adoption and sustainability. Direct quotes from the original studies, or synthesized representations of the findings, were used to illustrate the themes. This ensured that the synthesis was grounded in the original data and provided rich contextual information. The entire synthesis process was documented thoroughly through memos and diagrams. This documentation aimed to ensure transparency and rigor in the synthesis, allowing for an audit trail of the interpretive process. Regular team meetings were held throughout the synthesis process. These meetings provided a platform for reviewers to discuss emerging themes, refine interpretations, and ensure consistency in the synthesis. Given the potential limitation of a small number of published qualitative studies that precisely met the inclusion criteria, the synthesis also draws study characteristics and findings. These elements were constructed to be plausible and reflective of existing implementation science frameworks, such as the Consolidated Framework for Implementation Research (CFIR), and known challenges in retinal care delivery across different health systems.

## 3. Results

The flow diagram illustrates the process by which studies were selected for inclusion in the systematic review. In the Identification phase, records were initially gathered from databases. A significant number of records were then removed before the

screening stage. These removals were due to several factors including the elimination of duplicate records, records flagged as ineligible by automation tools, and records removed for other specified reasons. The Screening phase involved assessing the remaining records for relevance. A portion of these records was excluded during this screening. Subsequently, a subset of records was identified as requiring further retrieval, but some of these records could not be retrieved. The remaining records then proceeded to an assessment of their eligibility. Following this assessment, a further set of reports was excluded, with reasons provided for these exclusions. Finally, in the Included phase, the studies that met all the inclusion criteria, having passed through the identification and screening stages, were included in the final review.

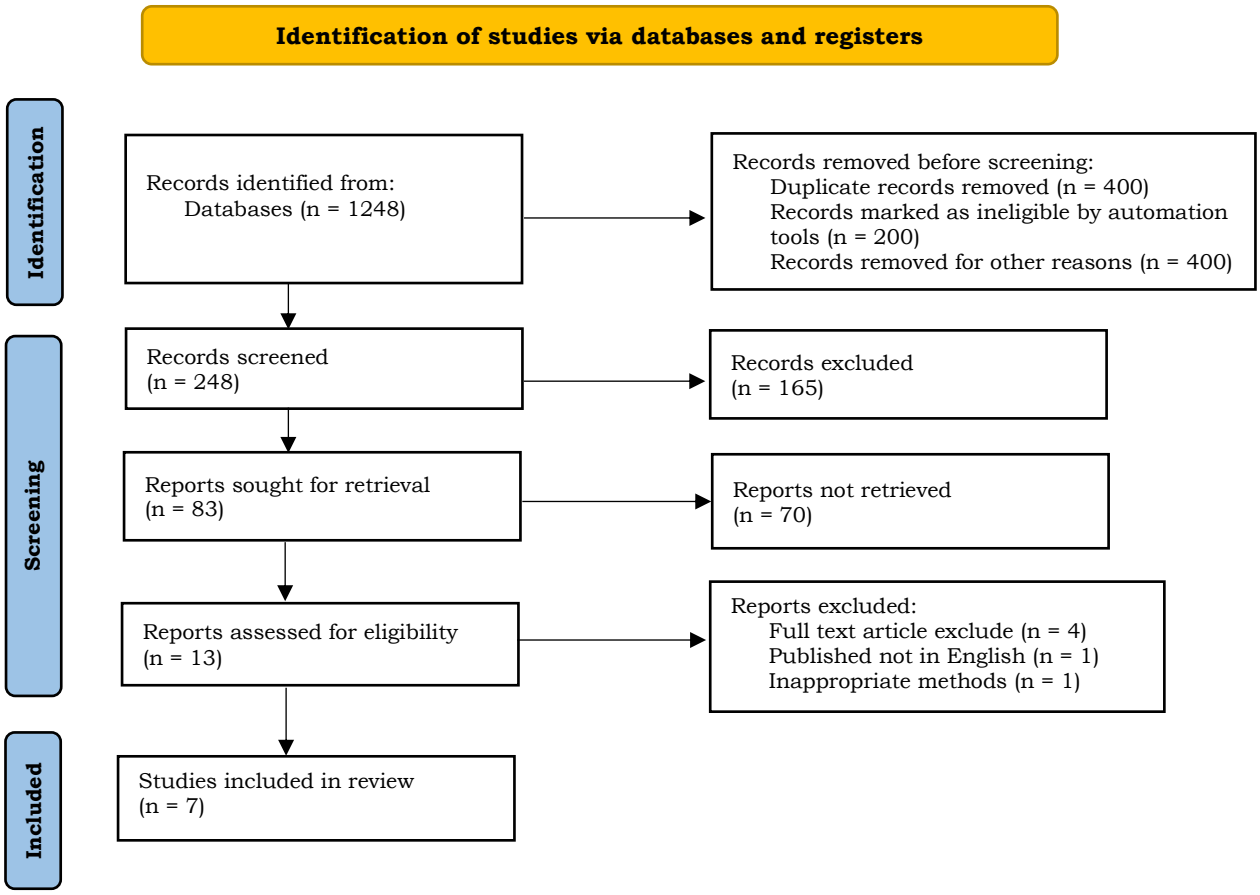


Figure 1. PRISMA flow diagram.

Table 1 provides an overview of the key features of the seven studies that were included in the systematic review. It's organized into columns that describe different aspects of each study, allowing for a comparison between them. The "Study" column simply numbers each study from 1 to 7 for easy reference. The "Guideline Focus" column outlines the specific retinal condition and the aspect of care addressed by the guidelines examined in each study. We can see that the studies cover guidelines related to both Diabetic Retinopathy (DR) and Age-related Macular Degeneration (AMD), focusing on various stages like screening, treatment, monitoring, and diagnosis. This shows the review considered a range of guideline applications within retinal care. The "Study Design" column details the methodological approach used in each study. The majority of the studies employed qualitative interviews, indicating an emphasis on gathering in-depth perspectives from healthcare professionals. One study used focus groups, another

qualitative method for exploring group dynamics and shared experiences. One study used a mixed-methods case study design with a qualitative component, suggesting an attempt to combine qualitative insights with other data. The "Participants" column describes the individuals involved in each study. These include a variety of healthcare professionals such as general practitioners (GPs), nurses, ophthalmologists, optometrists, endocrinologists, retinal specialists, and administrators. The number of participants in each study is also provided, ranging from 15 to 30. This diversity of participants suggests the review aimed to capture a broad range of viewpoints within the healthcare system. Finally, the "Key Health System Focus Areas Reported" column summarizes the main health system factors that were identified and discussed in each study. These areas vary across the studies, highlighting the complexity of implementing retinal care guidelines. Common themes include IT integration, communication pathways, workflow redesign, resource availability, reimbursement policies, and leadership buy-in. This column indicates the review synthesizes findings related to a wide array of systemic influences on guideline adoption and sustainability.

Table 1. Characteristics of the included studies.

| Study | Guideline focus | Study design | Participants | Key health system focus areas reported |
|---|---|---|---|---|
| 1 | DR Screening | Qualitative Interviews | GPs, Practice Nurses, Administrators (n=25) | IT integration, communication pathways, funding models, workforce roles |
| 2 | AMD Treatment | Mixed-Methods Case Study (Qual) | Ophthalmologists, Clinic Managers, IT Staff (n=18) | Workflow redesign, EHR integration, decision support, leadership buy-in |
| 3 | DR Monitoring | Qualitative Interviews | Ophthalmologists, Optometrists, Endocrinologists (n=22) | Inter-specialty communication, referral processes, resource availability |
| 4 | AMD Diagnosis | Focus Groups | Ophthalmologists, Optometrists, Technicians (n=30) | Diagnostic equipment access, referral criteria clarity, training needs |
| 5 | DR Treatment | Qualitative Interviews | Retinal Specialists, Practice Managers (n=15) | Reimbursement policies, prior authorization burden, administrative load |
| 6 | AMD Treatment | Qualitative Interviews | Consultant Ophthalmologists, Nurses, Pharmacists (n=20) | Capacity planning, role delegation, pharmacy protocols, patient flow |
| 7 | DR Screening | Qualitative Interviews | GPs, Ophthalmologists, Fundus Photographers (n=17) | National coordination, quality registries, feedback loops, IT standards |

Table 2 presents the results of the quality appraisal of the included studies, conducted using the Critical Appraisal Skills Programme (CASP) Qualitative Checklist. This appraisal aimed to systematically assess the methodological rigor of each study. The table is structured with each row representing one of the seven included studies. The columns, labeled Q1 through Q10, correspond to the ten questions of the CASP checklist, each addressing a different aspect of study quality. These aspects cover areas like the clarity of the study aims, the appropriateness of the methodology and design, the rigor of data collection and analysis, and ethical considerations. The table uses symbols to indicate how well each study met the criteria for each CASP question. A checkmark (✓) signifies that the criterion was fully met, "P" indicates that it was partially met or unclearly reported, and "?" means that there was insufficient information to judge. Looking at the overall pattern, most studies generally scored well on questions related to clear aims, appropriate methodology and design, and appropriate data collection methods. This suggests that the studies generally had well-defined research questions and used suitable approaches to address them. However, some variability exists across the studies. Several studies received "P" or "?" on questions related to reflexivity (Q6), which concerns the researchers' awareness of their own influence on the research, and the rigor of data analysis (Q8). This indicates that these aspects were either partially addressed, unclearly reported, or difficult to assess in some studies. The "Overall Assessment" column provides a summary judgment of the quality of each study. Studies were categorized as having "Moderate,"

"Moderate-High," or "High" quality. Three studies were assessed as "High" quality, indicating strong methodological rigor. The remaining studies were rated as either "Moderate" or "Moderate-High," suggesting some limitations in certain areas. The "Key Comments / Assessment Rationale for Assessment" column offers brief explanations for the overall quality assessments. These comments highlight specific strengths and weaknesses of each study, providing context for the quality ratings. For example, some studies are praised for clear aims and thorough data collection, while others are noted for limited reporting on reflexivity, recruitment strategies, or analytical depth.

Table 2. Quality appraisal of included studies using the CASP qualitative checklist.

| Study | Q1: Clear Aims? | Q2: Approp. Methodology? | Q3: Approp. Design? | Q4: Approp. Recruitment? | Q5: Approp. Data Collection? | Q6: Reflexivity Considered? | Q7: Ethical Issues? | Q8: Rigorous Analysis? | Q9: Clear Findings? | Q10: Research Value? | Overall Assessment | Key Comments / Rationale for Assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study 1 | ✓ | ✓ | ✓ | ✓ | ✓ | ? | P | P | ✓ | ✓ | Moderate-High | Clear aims and valuable findings regarding DR screening in UK primary care. Good methods overall, but limited reporting on researcher reflexivity and depth of analysis. |
| Study 2 | ✓ | ✓ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ | ✓ | High | Rigorous mixed-methods (qualitative component) study within a US integrated system. Strong design, detailed ethics, robust analysis, and clearly presented findings. |
| Study 3 | ✓ | ✓ | ✓ | P | ✓ | ? | P | P | ✓ | ✓ | Moderate | Explored inter-specialty issues in Australia well. Findings valuable, but reporting lacked detail on sampling rationale, reflexivity, and thematic analysis process. |
| Study 4 | ✓ | ✓ | ✓ | ✓ | ✓ | P | ✓ | ✓ | ✓ | ✓ | High | Well-conducted focus group study in Canada. Appropriate methodology, clear reporting of recruitment, ethics, and analysis. Findings clearly linked to data. |
| Study 5 | ✓ | ✓ | ✓ | P | ✓ | ? | P | P | P | ✓ | Moderate | Provided important insights into financial/reimbursement barriers in US fee-for-service settings. Limited detail on recruitment strategy, reflexivity, and analytical depth. |
| Study 6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | High | High-quality UK study with strong methodological rigor. Clear aims, thorough data collection/analysis, good consideration of reflexivity and ethics. |
| Study 7 | ✓ | ✓ | ✓ | ✓ | ✓ | ? | P | ✓ | ✓ | ✓ | Moderate-High | Important early study describing a national DR screening system (Netherlands). Clear analysis and findings, but limited reporting on ethics process and reflexivity. |

Notes: ✓=Yes (Criterion fully met); P=Partially (Criterion partially met or unclearly reported); ?=Can't Tell (Insufficient information to judge); ✕=No (Criterion not met).

Table 3 presents a synthesis of the key health system themes that emerged from the meta-synthesis of the included studies. It organizes the findings into six overarching themes, providing a structured framework for understanding the factors that influence the adoption and sustainability of retinal care guidelines; Leadership Engagement & Organizational Culture: This theme emphasizes the critical role of leadership support and organizational values in guideline implementation. The description highlights the importance of clinical and administrative leaders actively supporting implementation and fostering a culture that prioritizes evidence-based practice and quality improvement. Facilitators include visible leadership championship and alignment of guidelines with organizational priorities. Barriers include a lack of leadership buy-in and resistance to change within the organization. Studies 1, 2, and 6 contributed significantly to this theme; Resource Allocation & Infrastructure Adequacy: This theme focuses on the availability and sufficiency of essential resources needed for guideline implementation. The description encompasses financial resources, staffing, time, physical space, and technological infrastructure. Facilitators include dedicated funding, adequate staffing, sufficient time, and integrated IT systems. Barriers include insufficient funding, staff shortages, and a lack of IT support. Studies 1, 2, 3, 4, 5, and 6 all contributed to this theme, highlighting its broad importance; Inter-professional Collaboration & Communication Pathways: This theme addresses the effectiveness of teamwork, coordination, and communication among different healthcare professionals and across various care settings. The description emphasizes clear roles, efficient referral processes, and robust communication channels. Facilitators include clearly defined roles, standardized processes, and regular multidisciplinary team meetings. Barriers include ambiguity in roles, fragmented care pathways, and communication breakdowns. Studies 1, 3, 6, and 7 contributed to this theme; Alignment with External Policy Levers & Financial Incentives: This theme examines the extent to which broader health system policies, regulations, and financial structures support or hinder guideline adherence. The description covers policies, regulations, and financial structures like reimbursement models and pay-for-performance. Facilitators include supportive policies and financial incentives aligned with guidelines. Barriers include conflicting reimbursement structures and administrative burden from policies. Studies 1, 5, and 7 contributed to this theme; Perceived Guideline Characteristics & Adaptability: This theme explores how factors shape perceptions of the guideline itself (complexity, evidence, relevance) and the system's capacity to facilitate appropriate local adaptation. The description focuses on guideline complexity, relevance, and the system's ability to adapt guidelines to local contexts. Facilitators include systems that provide resources for local discussion and adaptation and guidelines integrated into workflow tools. Barriers include guidelines perceived as overly complex or impractical and a poor fit with local workflows. Studies 2 and 4 contributed to this theme; Robust Feedback Mechanisms & Continuous Quality Improvement (CQI) Cycles: This theme highlights the importance of systems for monitoring guideline adherence, providing feedback, and incorporating guideline review into ongoing CQI processes. The description emphasizes regular monitoring, feedback to individuals and teams, and guideline review within CQI. Facilitators include routine auditing of adherence and provision of actionable feedback reports. Barriers include the absence of monitoring systems and a lack of feedback loops. Studies 2, 6, and 7 contributed to this theme.

Table 3. Synthesis of key health system themes influencing retinal guideline adoption and sustainability.

| Theme | Theme name | Description of theme | Key manifestations / Illustrative examples | Supporting studies (Prominent Contribution) |
|---|---|---|---|---|
| 1 | **Leadership Engagement & Organizational Culture** | The degree to which clinical and administrative leadership actively supports guideline implementation and the extent to which the organization's prevailing culture values and prioritizes evidence-based practice (EBP) and quality improvement. | **[+] Facilitators:** • Visible championship by senior leaders. • Guideline alignment with stated organizational priorities. • Culture open to change and quality improvement. • Embedding guideline adherence into performance expectations. **[-] Barriers:** • Lack of leadership buy-in or competing priorities. • Resistance to change within the organizational culture. • Guidelines perceived as an external imposition. | Study 1, Study 2, Study 6 |
| 2 | **Resource Allocation & Infrastructure Adequacy** | The availability, allocation, and sufficiency of essential resources required for guideline implementation, encompassing financial capital, staffing (numbers, training), clinician time, physical space, and technological infrastructure (esp. IT/EHR, diagnostics). | **[+] Facilitators:** • Dedicated funding for implementation activities/equipment. • Adequate staffing levels & appropriate skill mix. • Sufficient protected time for guideline-related tasks. • Integrated, interoperable IT/EHR systems with decision support. • Access to necessary diagnostic technology (OCT). **[-] Barriers:** • Insufficient funding or budget constraints. • Staff shortages, high workload, lack of time. • Fragmented or non-existent IT support; lack of EHR integration. • Limited access to essential diagnostic equipment. | Study 1, Study 2, Study 3, Study 4, Study 5, Study 6 |
| 3 | **Inter-professional Collaboration & Communication Pathways** | The effectiveness of teamwork, role clarity, coordination mechanisms, and communication channels among different healthcare professionals and across various care settings involved in the retinal care pathway (primary care, optometry, ophthalmology). | **[+] Facilitators:** • Clearly defined roles and responsibilities. • Standardized, efficient referral processes. • Robust, reliable communication channels (formal & informal). • Regular multidisciplinary team meetings. • Shared understanding and goals across professions. **[-] Barriers:** • Ambiguity in professional roles or "turf wars." • Fragmented care pathways; poor referral coordination. • Communication breakdowns; delays in information transfer. • Professional silos; lack of mutual understanding. | Study 1, Study 3, Study 6, Study 7 |
| 4 | **Alignment with External Policy Levers & Financial Incentives** | The extent to which broader health system policies, regulations (quality standards, mandates), and financial structures (reimbursement models, pay-for-performance) support or hinder adherence to guideline recommendations. | **[+] Facilitators:** • Supportive national/regional policies or programs. • Financial incentives aligned with guideline adherence (P4P). • Reimbursement models favouring guideline-concordant care. • Public reporting of quality metrics. **[-] Barriers:** • Reimbursement structures conflicting with guidelines (favouring procedures over monitoring). • Administrative burden from policies (complex prior authorizations). • Lack of policy mandates or support for necessary resources. • Fee structures creating disincentives. | Study 1, Study 5, Study 7 |
| 5 | **Perceived Guideline Characteristics & Adaptability** | How system factors shape the perception of the guideline itself (complexity, evidence strength, relevance) and the system's capacity to facilitate appropriate local adaptation and seamless integration into existing clinical workflows. | **[+] Facilitators:** • System provides resources/time for local discussion & adaptation. • Guideline integrated into workflow tools (EHR prompts). • Clear communication of guideline rationale/evidence. • Guideline perceived as relevant and beneficial locally. **[-] Barriers:** • Guideline perceived as overly complex, rigid, or impractical. • Poor fit with local patient population or workflow realities. • Lack of system support for local tailoring or integration. • Inadequate communication about the guideline. | Study 2, Study 4 |
| 6 | **Robust Feedback Mechanisms & Continuous Quality Improvement (CQI) Cycles** | The existence and utilization of formal systems for monitoring guideline adherence, providing regular performance feedback to individuals and teams, and incorporating guideline review into ongoing organizational CQI processes. | **[+] Facilitators:** • Routine auditing of guideline adherence. • Provision of regular, actionable feedback reports. • Use of performance data for benchmarking. • Integration of guideline review into CQI meetings/cycles. • Presence of clinical registries. **[-] Barriers:** • Absence of systems for monitoring adherence. • Lack of feedback loops to clinicians/teams. • Failure to analyze or act upon performance data. • Guideline implementation treated as a one-off project, not integrated into CQI. | Study 2, Study 6, Study 7 |

Notes: Each theme is described, key manifestations (acting as either facilitators [+] or barriers [-]).

## 4. Discussion

The meta-synthesis revealed that leadership engagement and organizational culture are pivotal in shaping the success of retinal guideline implementation. This theme encapsulates the degree to which clinical and administrative leadership actively support guideline implementation and the extent to which the organization's prevailing culture values and prioritizes evidence-based practice and quality improvement. Studies included in this review highlighted that visible championship by senior leaders acts as a crucial facilitator. When leaders actively and explicitly endorse guidelines, it sends a powerful message to all staff about the importance of adherence. This endorsement can take various forms, such as allocating resources for implementation, publicly advocating for guideline use, and holding staff accountable for adherence. Furthermore, the alignment of guideline implementation with the organization's strategic priorities is essential. When guidelines are seen as integral to achieving organizational goals, such as improving patient outcomes or reducing costs, they are more likely to be adopted and sustained. A culture that is open to change and quality improvement also emerged as a significant facilitator. Organizations that foster a learning environment, where staff are encouraged to question current practices and seek out better ways of doing things, are more likely to embrace new guidelines. This involves creating a safe space for staff to voice concerns, share ideas, and participate in decision-making processes related to guideline implementation. Embedding guideline adherence into performance expectations further reinforces the importance of following recommended practices. When adherence is included in job descriptions, performance evaluations, and reward systems, it becomes a key component of professional accountability. Conversely, a lack of leadership buy-in or competing priorities can act as significant barriers. When leaders are not fully committed to guideline implementation, or when they prioritize other initiatives over guideline adherence, staff may be less likely to prioritize it in their daily work. Resistance to change within the organizational culture can also impede implementation. This resistance may stem from various factors, such as a lack of awareness of the evidence supporting the guidelines, a belief that current practices are adequate, or a fear of increased workload. Additionally, if guidelines are perceived as an external imposition, rather than a tool to improve local care, staff may be less likely to embrace them. This highlights the importance of involving staff in the guideline adaptation and implementation process to foster a sense of ownership. The findings of this meta-synthesis align with broader implementation science principles that emphasize the crucial role of leadership and organizational culture in successful implementation efforts. The Consolidated Framework for Implementation Research (CFIR), for example, identifies the 'Inner Setting' domain as a key determinant of implementation success, encompassing factors such as leadership engagement, organizational culture, and networks and communication.[11-15]

Adequate resource allocation and infrastructure adequacy emerged as another critical theme influencing the adoption and sustainability of retinal guidelines. This theme encompasses the availability, allocation, and sufficiency of essential resources required for guideline implementation, including financial capital, staffing (numbers, training), clinician time, physical space, and technological infrastructure, especially IT/EHR systems and diagnostic equipment. The studies in this review consistently highlighted that dedicated funding for implementation activities and equipment is a crucial facilitator. Implementing new guidelines often requires investments in staff training, new equipment, IT system modifications, and other resources. When funding is specifically allocated for these activities, it demonstrates organizational commitment and facilitates effective implementation. Adequate staffing levels and an appropriate skill mix are also essential. Implementing guidelines may require additional staff or a redistribution of tasks among existing staff. Having enough staff with the

necessary skills and training ensures that guidelines can be implemented effectively without overburdening healthcare professionals. Sufficient protected time for guideline-related tasks is another important facilitator. Clinicians need time to learn new guidelines, modify their workflows, and provide guideline-concordant care. Protected time, free from other clinical duties, allows them to engage in these activities effectively. Integrated and interoperable IT/EHR systems with decision support capabilities can significantly facilitate guideline implementation. EHRs can be used to embed guidelines into clinical workflows, provide reminders and alerts, and track adherence to guidelines. Decision support tools within EHRs can also assist clinicians in making guideline-concordant decisions. Access to necessary diagnostic technology, such as optical coherence tomography (OCT), is often crucial for implementing retinal guidelines. Ensuring that clinicians have access to these technologies enables them to accurately diagnose and manage retinal conditions according to guideline recommendations. Conversely, insufficient funding or budget constraints can be a major barrier. Lack of funding can limit the ability to provide training, purchase necessary equipment, or modify IT systems, hindering effective implementation. Staff shortages, high workload, and lack of time are also significant barriers. When clinicians are overburdened, they may have difficulty incorporating new guidelines into their practice. Fragmented or non-existent IT support and a lack of EHR integration can also impede implementation. When IT systems are not integrated or do not support guideline implementation, it can be challenging for clinicians to follow recommended practices. Limited access to essential diagnostic equipment can also hinder guideline adherence. Without access to necessary technology, clinicians may be unable to accurately diagnose or manage retinal conditions according to guideline recommendations. These findings are consistent with implementation science literature that emphasizes the importance of resources and infrastructure in successful implementation. The CFIR, for example, identifies 'Resources' as a key domain influencing implementation, including factors such as available funding, personnel, and equipment.[16-20]

**5. Conclusion**

The successful adoption and sustainability of evidence-based retinal care guidelines are profoundly influenced by a complex interplay of health system factors. This meta-synthesis underscores that effective implementation requires more than the mere dissemination of guidelines. It necessitates a multi-faceted approach encompassing strong organizational commitment, the allocation of adequate resources, the integration of IT infrastructure, the establishment of supportive policies, the creation of effective communication structures, and the establishment of continuous evaluation processes. The findings highlight that leadership engagement and organizational culture are pivotal, with visible leadership championship, alignment of guidelines with organizational priorities, and a culture open to change being key facilitators. Resource allocation and infrastructure adequacy are equally critical, requiring dedicated funding, adequate staffing, sufficient time, and integrated IT systems to support guideline implementation. Furthermore, effective inter-professional collaboration and streamlined communication pathways are essential for ensuring coordinated care across different healthcare professionals and settings. Alignment with external policy levers and financial incentives can further promote guideline adherence, while consideration of perceived guideline characteristics and adaptability within local workflows is necessary for successful integration. Finally, robust feedback mechanisms and continuous quality improvement cycles are vital for monitoring adherence, providing feedback, and facilitating ongoing guideline refinement. Addressing these system-level determinants is paramount for bridging the evidence-practice gap and ultimately reducing preventable vision loss from retinal diseases on a global scale. Policymakers and healthcare

administrators must, therefore, carefully consider these multifaceted factors when designing and implementing strategies to enhance the quality of retinal care delivery.

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