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Delays in Medical Care: A Systematic Review of Determinants, Consequences and Interventions

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Abstract

Original Research Article

Background: Delays in medical care represent a significant public health challenge with substantial impacts on morbidity, mortality, and healthcare costs. These delays can occur at various stages of the care pathway, from symptom recognition by patients to treatment initiation. This systematic review aims to synthesize current evidence on the determinants, consequences, and interventions to reduce these delays through rigorous analysis of published studies. ***Materials and methods:*** A comprehensive search was conducted in PubMed, Embase, and Cochrane Library databases for studies published between January 2000 and December 2023. Search strategies combined MeSH terms and keywords: "delays in care," "access to care," "diagnosis," "treatment," and "interventions." Included studies were observational or interventional studies evaluating delayed care in adult patients with quantitative data on delays or consequences. Case studies, literature reviews, and in vitro studies were excluded. Methodological quality was assessed using the Newcastle-Ottawa Scale for observational studies and the Cochrane Risk of Bias Tool for interventional studies. Data extracted included study characteristics, delay determinants, consequences, and interventions. Meta-analyses were performed where appropriate using random-effects models. ***Results:*** Multiple factors influence delays in care. For instance, patients in rural areas experienced average delays 2.5 days longer for cardiac symptom consultation compared to urban residents. Patients with lower education levels were 1.8 times more likely to delay consultation for suspected cancer. Regarding consequences, meta-analysis revealed that each day of delay in stroke treatment increased death or disability risk by 5%. Interventions showed promise: patient education programs reduced cardiac symptom consultation delays by 30%, while telemedicine systems decreased specialist referral time for suspected cancer by 20%. ***Conclusion:*** Delayed medical care represents a complex problem requiring multi-level interventions. Future research should focus on evaluating intervention effectiveness across diverse settings and identifying underlying delay mechanisms.

Keywords: Delayed care, access to care, diagnosis, treatment, interventions.

INTRODUCTION

Delays in medical care, defined as any excessive time interval between symptom onset and treatment initiation, constitute a major public health issue in Africa with significant impacts on morbidity and mortality [1]. These delays can occur at various points throughout the care process: from patient recognition of symptoms, through diagnosis and treatment initiation, to accessing healthcare facilities. They are influenced by multiple interdependent factors, including patient-related determinants such as socioeconomic status, health literacy, and cultural beliefs [2]. For example, a study conducted in Nigeria revealed that patients living in rural areas with low education levels were more likely to delay seeking care for tuberculosis symptoms [3].

Healthcare professional factors include clinical skills, communication abilities, workload, and cognitive biases [4]. A South African study demonstrated that

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insufficient continuing education for healthcare providers regarding warning signs of non-communicable diseases contributed to diagnostic delays [5]. Health system factors encompass geographical and financial accessibility of services, waiting times, care coordination, and health policies [6]. A Kenyan study highlighted long distances to health centers and high consultation costs as major barriers to early breast cancer management [7].

This systematic review aims to provide a rigorous synthesis of knowledge on this topic, integrating evidence from African research to inform health policies and clinical practices aimed at reducing care delays and improving quality of care in Africa.

MATERIALS AND METHODS

Search Strategy

We conducted a systematic literature search following PRISMA guidelines in three major electronic databases: PubMed/MEDLINE, Embase, and Cochrane Library. The search covered studies published from January 1, 2000, to December 31, 2023. We developed comprehensive search strategies for each database in consultation with an experienced medical librarian.

Search Terms and Strategy

The search strategy combined the following concepts using appropriate Boolean operators:

- Concept 1: Delays in care (delay*, late, postpone*, wait*)
- Concept 2: Healthcare access (access*, barrier*, utilization, seek*)
- Concept 3 : Clinical processes (diagnostics *, treat*, care, intervention *)

The full search strategy for PubMed was:

((delay*[Title/Abstract] OR late [Title/Abstract] OR
postpone*[Title/Abstract] OR wait*[Title/Abstract])
AND (care [Title/Abstract] OR health*[Title/Abstract]
OR medical [Title/Abstract] OR clinical
[Title/Abstract])
AND (access*[Title/Abstract] OR
barrier*[Title/Abstract] OR utilization [Title/Abstract]
OR seek*[Title/Abstract] OR diagnosis*[Title/Abstract]
OR treat*[Title/Abstract]))
AND ("2000/01/01"[Date - Publication]:
"2023/12/31"[Date - Publication])

Similar strategies were adapted for Embase and Cochrane Library. Additionally, we manually searched reference lists of included studies and relevant review articles to identify additional eligible studies.

Eligibility Criteria

We established the following inclusion and exclusion criteria:

Inclusion Criteria:

- Study design: Observational studies (cross-sectional, case-control, cohort) or interventional studies (randomized controlled trials, quasi-experimental designs)
- Population: Adult patients (≥18 years) experiencing or at risk of delays in healthcare
- Outcomes: Quantitative data on:
  - Time intervals between healthcare steps (symptom onset to consultation, consultation to diagnosis, diagnosis to treatment)
  - Consequences of delays (morbidity, mortality, quality of life)
  - Effectiveness of interventions to reduce delays
- Language: Studies published in English or French
- Publication type: Peer-reviewed journal articles

Exclusion Criteria:

- Case reports, case series, editorials, commentaries
- Literature reviews, systematic reviews, meta-analyses
- In vitro or animal studies
- Studies focusing exclusively on pediatric populations
- Studies without quantifiable data on delays or their consequences
- Conference abstracts without full-text publications

Study Selection Process

Two reviewers (M.T. and M.B.R.C.) independently screened titles and abstracts for relevance using Rayyan software. Full texts of potentially eligible studies were then retrieved and independently assessed against inclusion/exclusion criteria. Disagreements were resolved through discussion with a third reviewer (N.T.F.D.). We documented reasons for exclusion at the full-text screening stage.

Data Extraction

We developed a standardized data extraction form in Microsoft Excel based on the Cochrane Handbook for Systematic Reviews. Two reviewers (M.T. and O.I.L.) independently extracted the following data from each included study:

- Study characteristics: First author, publication year, country, study design, sample size, study duration
- Population characteristics: Age, gender, socioeconomic status, education level, comorbidities
- Delay measurements: Definitions used, measurement methods, time intervals reported
- Determinants of delay: Patient factors, healthcare professional factors, health system factors
- Consequences of delay: Morbidity measures, mortality rates, quality of life assessments, economic impacts
- Interventions (if applicable): Type, duration, implementation details, outcomes

Extracted data were cross-checked for accuracy, with discrepancies resolved through discussion.

Quality Assessment

We assessed the methodological quality of included studies using validated tools appropriate to study design:

- For observational studies: The Newcastle-Ottawa Scale (NOS), evaluating selection methods, comparability of groups, and outcome assessment
- For interventional studies: The Cochrane Risk of Bias Tool 2.0, assessing randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selective reporting

Two reviewers (N.T.F.D. and N.E.E.) independently assessed quality, with disagreements resolved through discussion. We did not exclude studies based on quality assessment but considered quality in the interpretation of findings.

Data Synthesis and Analysis

We conducted both narrative synthesis and, where possible, meta-analysis. For the narrative synthesis, we organized findings by:

- Types and definitions of delays
- Determinants (patient, healthcare professional, health system factors)
- Consequences (clinical outcomes, economic impacts)
- Interventions and their effectiveness

For quantitative synthesis (meta-analysis), we:

- Used random-effects models to account for anticipated heterogeneity
- Calculated pooled odds ratios (OR) with 95% confidence intervals for dichotomous outcomes
- Calculated mean differences (MD) with 95% confidence intervals for continuous outcomes
- Assessed statistical heterogeneity using I^2 statistics (I^2 >50% indicating substantial heterogeneity)
- Conducted sensitivity analyses excluding studies of low methodological quality
- Performed subgroup analyses by geographical region, disease type, and healthcare setting where data permitted

All statistical analyses were performed using Review Manager 5.4 software.

RESULTS

Study Selection

Our systematic search identified 3,742 potentially relevant records (PubMed: 1,628; Embase: 1,854; Cochrane: 260). After removing 487 duplicates, we screened 3,255 titles and abstracts, excluding 2,863 records that did not meet our inclusion criteria. We assessed 392 full-text articles for eligibility, ultimately including 124 studies in our review.

Characteristics of Included Studies

Table I summarizes the characteristics of included studies. The majority were observational studies (n=98, 79%), including cross-sectional (n=52), cohort (n=35), and case-control designs (n=11). Interventional studies (n=26, 21%) included randomized controlled trials (n=19) and quasi-experimental designs (n=7). Studies were conducted across diverse geographical regions, with 42 (34%) from Africa, 38 (31%) from Asia, 28 (23%) from Europe, 12 (10%) from North America, and 4 (3%) from South America.

Table I: Characteristics of Included Studies

Characteristic	Number of Studies (%)
Study Design	
Observational studies	98 (79%)
- Cross-sectional	52 (42%)
- Cohort	35 (28%)
- Case-control	11 (9%)
Interventional studies	26 (21%)
- Randomized controlled trials	19 (15%)
- Quasi-experimental	7 (6%)
Geographical Region	
Africa	42 (34%)
Asia	38 (31%)
Europe	28 (23%)
North America	12 (10%)
South America	4 (3%)
Disease Focus	
Cardiovascular diseases	32 (26%)
Cancer	29 (23%)
Infectious diseases	25 (20%)
Trauma/Emergency care	18 (15%)
Chronic non-communicable diseases	12 (10%)
Multiple diseases/General care	8 (6%)
Sample Size	
<100 participants	15 (12%)
100-500 participants	54 (44%)
501-1000 participants	32 (26%)

Characteristic	**Number of Studies (%)**
>1000 participants	23 (19%)
Publication Year	
2000-2005	12 (10%)
2006-2010	23 (19%)
2011-2015	36 (29%)
2016-2020	41 (33%)
2021-2023	12 (10%)

Quality Assessment

Quality assessment results are presented in Table II. Among observational studies, 29 (30%) were rated as high quality, 52 (53%) as moderate quality, and 17 (17%) as low quality according to the Newcastle-Ottawa Scale. For interventional studies, 8 (31%) had low risk of bias, 13 (50%) had some concerns, and 5 (19%) had high risk of bias according to the Cochrane Risk of Bias Tool.

Table II: Quality Assessment of Included Studies

Quality Assessment	**Number of Studies (%)**
Observational Studies (NOS)	98 (100%)
High quality (8-9 stars)	29 (30%)
Moderate quality (6-7 stars)	52 (53%)
Low quality (≤5 stars)	17 (17%)
Interventional Studies (Cochrane RoB)	26 (100%)
Low risk of bias	8 (31%)
Some concerns	13 (50%)
High risk of bias	5 (19%)

Determinants of Delays in Care

Our analysis identified multiple factors influencing delays in care, categorized into patient factors, healthcare professional factors, and health system factors. The key findings are summarized in Table III.

Table III: Determinants of Delays in Care

Determinant Category	**Key Findings**	**Effect Size (95% CI)**	**Number of Studies**
Patient Factors			
Age	Elderly patients (>65 years) had longer delays	MD : 2.3 days (1.5-3.1)	32
Gender	Women experienced longer delays than men	OR: 1.4 (1.2-1.6)	28
Socioeconomic status	Lower SES associated with greater delays	OR: 1.8 (1.5-2.1)	35
Education level	Lower education level predicted longer delays	OR: 1.6 (1.3-1.9)	30
Health literacy	Poor health literacy increased delay risk	OR: 2.1 (1.7-2.5)	22
Geographic location	Rural residence associated with longer delays	MD: 2.5 days (1.8-3.2)	26
Cultural beliefs	Traditional beliefs predicted delayed care-seeking	OR: 1.9 (1.5-2.3)	18
Comorbidities	Multiple comorbidities associated with diagnostic delays	OR: 1.4 (1.1-1.7)	24
Healthcare Professional Factors			
Clinical skills	Inadequate training associated with diagnostic delays	OR: 1.7 (1.3-2.1)	15
Communication	Poor patient-provider communication increased delays	OR: 1.5 (1.2-1.8)	13
Workload	High caseload associated with longer waits	MD: 1.8 days (1.2-2.4)	12
Cognitive biases	Presence of cognitive biases linked to misdiagnosis	OR: 1.3 (1.0-1.6)	8
Health System Factors			
Geographic accessibility	Distance >10km from facility increased delays	OR: 2.3 (1.9-2.7)	29
Financial accessibility	High out-of-pocket costs predicted delayed care	OR: 2.5 (2.1-2.9)	31
Waiting times	Each hour of waiting reduced follow-up adherence	OR: 1.1 (1.0-1.2)	20
Care coordination	Fragmented care associated with treatment delays	OR: 1.8 (1.5-2.1)	17
Health policies	Lack of universal coverage increased access barriers	OR: 2.0 (1.6-2.4)	14

Note: MD = Mean Difference; OR = Odds Ratio; CI = Confidence Interval; SES = Socioeconomic Status

Patient Factors

Age and gender significantly influenced care-seeking behavior, with elderly patients and women experiencing longer delays. Our meta-analysis showed that patients aged >65 years had delays that were 2.3 days longer (95% CI: 1.5-3.1) compared to younger patients. Women were 1.4 times more likely (95% CI: 1.2-1.6) to delay seeking care compared to men.

Socioeconomic factors played a substantial role, with lower socioeconomic status associated with 1.8 times greater odds of delayed care (95% CI: 1.5-2.1). Similarly, patients with lower education levels were 1.6 times more likely to delay seeking medical attention (95% CI: 1.3-1.9).

Health literacy emerged as a particularly strong predictor, with poor health literacy associated with 2.1 times higher odds of delayed care (95% CI: 1.7-2.5). Geographic location was also important, as patients in rural areas experienced delays averaging 2.5 days longer than urban residents (95% CI: 1.8-3.2).

Cultural beliefs significantly influenced care-seeking behavior, with traditional beliefs associated with 1.9 times higher odds of delay (95% CI: 1.5-2.3). The presence of comorbidities increased diagnostic complexity, with multiple comorbidities associated with 1.4 times greater odds of delayed diagnosis (95% CI: 1.1-1.7).

Healthcare Professional Factors

Healthcare professionals' clinical skills significantly impacted timely diagnosis, with inadequate training associated with 1.7 times higher odds of diagnostic delays (95% CI: 1.3-2.1). Poor communication between providers and patients increased delays by 50% (OR: 1.5, 95% CI: 1.2-1.8).

High workload among healthcare professionals contributed to longer waiting times, with high caseloads associated with delays averaging 1.8 days (95% CI: 1.2-2.4). Cognitive biases among clinicians were linked to a 30% increase in misdiagnosis risk (OR: 1.3, 95% CI: 1.0-1.6).

Health System Factors

Geographic accessibility represented a major barrier, with distances greater than 10km from healthcare facilities associated with 2.3 times higher odds of delayed care (95% CI: 1.9-2.7). Financial accessibility similarly impacted care-seeking, as high out-of-pocket costs were associated with 2.5 times greater odds of delay (95% CI: 2.1-2.9).

Prolonged waiting times reduced follow-up adherence, with each additional hour of waiting associated with a 10% increase in non-adherence (OR: 1.1, 95% CI: 1.0-1.2). Fragmented care coordination resulted in 1.8 times higher odds of treatment delays (95% CI: 1.5-2.1), while lack of universal health coverage increased access barriers by 100% (OR: 2.0, 95% CI: 1.6-2.4).

Consequences of Delays

The analysis revealed significant consequences of delayed care across multiple domains, summarized in Table IV.

Table IV: Consequences of Delays in Care

Outcome Category	Key Findings	Effect Size (95% CI)	Number of Studies
Mortality			
Cardiovascular disease	Each hour of delay in myocardial infarction treatment increased mortality	HR: 1.08 (1.05-1.11) per hour	15
Stroke	Each day of delay in stroke treatment increased mortality risk	HR: 1.05 (1.03-1.07) per day	12
Cancer	Three-month delay in cancer treatment associated with increased mortality	HR: 1.06-1.13 (varies by cancer type)	18
Trauma	Each hour of delay in trauma care increased mortality	OR: 1.07 (1.04-1.10) per hour	9
Sepsis	Each hour of delay in antibiotic administration increased mortality	OR: 1.09 (1.06-1.12) per hour	7
Morbidity			
Complications	Delays >24h associated with increased complication rates	OR: 1.85 (1.53-2.17)	21
Disability	Delayed rehabilitation associated with poorer functional outcomes	SMD: 0.42 (0.31-0.53)	16
Disease progression	Delays associated with more advanced disease at diagnosis	OR: 2.14 (1.76-2.52)	24
Hospital length of stay	Each day of delay increased hospital stay	MD: 1.3 days (0.9-1.7)	19
Economic Impact			
Healthcare costs	Delays associated with increased treatment costs	Cost ratio: 1.31 (1.18-1.44)	13
Productivity loss	Delayed treatment associated with longer work absence	MD: 12.4 days (9.6-15.2)	8
Quality of Life			
General quality of life	Delays associated with lower quality of life scores	SMD: -0.38 (-0.45 to -0.31)	14
Psychological impact	Delayed diagnosis associated with increased anxiety and depression	OR: 1.72 (1.43-2.01)	11

Note: HR = Hazard Ratio; OR = Odds Ratio; MD = Mean Difference; SMD = Standardized Mean Difference; CI = Confidence Interval

Mortality

Delays in care significantly increased mortality across multiple conditions. For cardiovascular disease, each hour of delay in myocardial infarction treatment was associated with an 8% increase in mortality risk (HR: 1.08, 95% CI: 1.05-1.11). Similarly, each day of delay in stroke treatment increased mortality risk by 5% (HR: 1.05, 95% CI: 1.03-1.07).

Cancer outcomes were particularly sensitive to delays, with three-month treatment delays associated with increased mortality across cancer types (HRs ranging from 1.06 to 1.13). In trauma care, each hour of delay increased mortality odds by 7% (OR: 1.07, 95% CI: 1.04-1.10), while in sepsis, each hour of delay in antibiotic administration increased mortality odds by 9% (OR: 1.09, 95% CI: 1.06-1.12).

Morbidity

Delays exceeding 24 hours were associated with 85% higher odds of complications (OR: 1.85, 95% CI: 1.53-2.17). Delayed rehabilitation was associated with poorer functional outcomes (SMD: 0.42, 95% CI: 0.31-0.53), while delays in diagnosis were associated with 2.14 times higher odds of advanced disease at diagnosis (95% CI: 1.76-2.52).

Hospital length of stay increased by an average of 1.3 days (95% CI: 0.9-1.7) for patients experiencing delayed care.

Economic Impact

Delayed care was associated with 31% higher treatment costs (Cost ratio: 1.31, 95% CI: 1.18-1.44) and longer work absences averaging 12.4 additional days (95% CI: 9.6-15.2).

Quality of Life

Delays were associated with significantly lower quality of life scores (SMD: -0.38, 95% CI: -0.45 to -0.31) and 72% higher odds of anxiety and depression (OR: 1.72, 95% CI: 1.43-2.01).

Interventions to Reduce Delays

The review identified various interventions aimed at reducing delays in care, with their effectiveness summarized in Table 5.

Table V: Interventions to Reduce Delays in Care

Intervention Category	Key Components	Effectiveness	Number of Studies
Patient Education			
Symptom awareness programs	Education on disease warning signs	Reduced patient delay by 30% (20-40%)	12
Decision aids	Tools to guide care-seeking decisions	Reduced consultation delay by 25% (15-35%)	8
Community outreach	Culturally-tailored health messaging	Reduced care-seeking delay by 35% (25-45%)	10
Healthcare Professional Interventions			
Clinical decision support	Diagnostic algorithms and reminders	Reduced diagnostic delay by 28% (20-36%)	9
Communication training	Patient-centered communication skills	Reduced referral delay by 22% (15-29%)	7
Continuing education	Regular updates on clinical guidelines	Reduced misdiagnosis by 18% (12-24%)	11
Health System Interventions			
Telemedicine	Remote consultations and triage	Reduced specialist access time by 20% (12-28%)	15
Fast-track pathways	Expedited routes for specific conditions	Reduced time to treatment by 40% (30-50%)	13
One-stop clinics	Multiple services in single visit	Reduced diagnostic time by 35% (25-45%)	8
Task shifting	Delegation to trained non-specialists	Reduced waiting time by 15% (8-22%)	6
Extended hours	Expanded service availability times	Reduced appointment delay by 25% (18-32%)	5
Multi-level Interventions			
Integrated approaches	Combined patient, provider, system components	Reduced overall delay by 45% (35-55%)	14

Patient-focused Interventions

Patient education programs focusing on symptom awareness reduced delays in seeking care by approximately 30% (range: 20-40%). Decision aids designed to guide care-seeking behavior decreased consultation delays by 25% (range: 15-35%). Community outreach programs using culturally-tailored health messaging were particularly effective, reducing care-seeking delays by 35% (range: 25-45%).

Healthcare Professional Interventions

Clinical decision support tools reduced diagnostic delays by 28% (range: 20-36%). Communication training focusing on patient-centered skills decreased referral delays by 22% (range: 15-29%). Continuing education programs updating providers on clinical guidelines reduced misdiagnosis rates by 18% (range: 12-24%).

Health System Interventions

Telemedicine approaches reduced specialist access time by 20% (range: 12-28%). Fast-track pathways for specific conditions decreased time to treatment by 40% (range: 30-50%). One-stop clinics offering multiple services in a single visit reduced diagnostic time by 35% (range: 25-45%).

Task shifting to trained non-specialists decreased waiting times by 15% (range: 8-22%), while extended service hours reduced appointment delays by 25% (range: 18-32%).

Multi-level Interventions

Integrated approaches combining patient, provider, and system components showed the greatest effectiveness, reducing overall delays by 45% (range: 35-55%).

DISCUSSION

This systematic review has highlighted the multifactorial complexity of delays in medical care and their detrimental impact on patient health. These delays, defined as any excessive time interval between symptom onset and treatment initiation, are influenced by numerous interdependent factors.

Patient-related Determinants

Our findings demonstrate that socioeconomic factors significantly influence care-seeking behavior. Patients with lower socioeconomic status face multiple barriers to timely care, including financial constraints, transportation difficulties, and competing priorities [8]. Health literacy emerged as a particularly strong predictor of delays, with inadequate understanding of symptoms and appropriate responses leading to postponed care-seeking [9]. This aligns with findings from Nigeria, where patients with lower education levels were more likely to delay seeking care for tuberculosis symptoms [10].

Cultural beliefs and perceptions about illness also play crucial roles in care-seeking decisions. Traditional beliefs about disease causation and appropriate remedies can lead patients to first seek traditional healers before accessing conventional medical care [11]. This finding was particularly prominent in rural African settings, where traditional medicine remains an important component of healthcare systems.

Geographic location creates substantial barriers, with rural patients experiencing significantly longer delays compared to urban residents. This disparity reflects both distance-related challenges and the uneven distribution of healthcare resources favoring urban centers [12]. A study from Kenya highlighted those long distances to health facilities represented major barriers to early breast cancer treatment [13].

Healthcare Professional Factors

Our analysis revealed that healthcare professionals' clinical skills and training significantly impact diagnostic timeliness. Inadequate recognition of warning signs for serious conditions contributes to missed or delayed diagnoses [14]. A South African study demonstrated that insufficient continuing education for healthcare providers regarding warning signs of non-communicable diseases contributed to diagnostic delays [15].

Communication between providers and patients emerged as another critical factor. Poor communication can lead to incomplete symptom reporting, misunderstanding of instructions, and reduced trust in healthcare recommendations [16]. This highlights the importance of culturally sensitive and patient-centered communication approaches.

Provider workload significantly affects care quality and timeliness. Overburdened healthcare systems with high patient-to-provider ratios inevitably lead to longer waiting times and potentially rushed consultations that increase the risk of diagnostic errors [17].

Cognitive biases among clinicians, including anchoring bias (focusing too quickly on one diagnosis) and availability bias (overemphasizing recently encountered conditions), contribute to diagnostic delays. Addressing these biases through structured decision-making processes represents an important improvement opportunity [18].

Health System Factors

Healthcare accessibility fundamentally determines timely care. Geographic barriers particularly affect rural populations, while financial barriers disproportionately impact those without adequate health insurance or in systems with high out-of-pocket costs [19]. Our findings show that distances greater than 10km from healthcare facilities and high out-of-pocket costs were strongly associated with delayed care.

System-level coordination issues contribute significantly to delays between diagnosis and treatment initiation. Fragmented care requiring multiple referrals between providers and facilities creates opportunities for breakdowns in communication and care continuity [20]. Health policies, particularly those related to healthcare financing and resource allocation, create structural conditions that either facilitate or hinder timely access to care [21].

Consequences of Delays

Our findings demonstrate that delays in care have profound consequences across multiple domains. The relationship between treatment delays and mortality is particularly concerning, with clear dose-response relationships observed across conditions including cardiovascular disease, stroke, cancer, trauma, and sepsis [22]. For example, our meta-analysis showed that each hour of delay in myocardial infarction treatment was associated with an 8% increase in mortality risk.

Delays significantly impact morbidity outcomes, leading to increased complications, disease progression, and poorer functional outcomes [23]. The financial consequences extend beyond direct healthcare costs to include productivity losses from extended work absences and potentially permanent disability [24].

Quality of life impacts were substantial, with delayed care associated with poorer physical functioning, increased psychological distress, and reduced overall well-being [25]. These findings emphasize that the human cost of delayed care extends far beyond clinical outcomes to affect all dimensions of patients' lives.

Effective Interventions

Our review identified promising interventions at patient, provider, and system levels. Patient education focusing on symptom recognition and appropriate care-seeking behavior demonstrated significant effectiveness in reducing delays [26]. Healthcare professional interventions, particularly clinical decision support tools and communication training, showed substantial promise for improving diagnostic timeliness [27].

System-level interventions including telemedicine, fast-track pathways, and one-stop clinics demonstrated considerable effectiveness in reducing specific delay components [28]. However, the most impressive results came from multi-level interventions addressing multiple delay determinants simultaneously, suggesting the need for comprehensive approaches rather than isolated interventions [29].

Limitations and Research Gaps

This review has several limitations. First, the heterogeneity in how studies defined and measured delays complicated direct comparisons. Second, most included studies were observational, limiting causal inferences about determinants and intervention effectiveness. Third, publication bias may have affected our findings, as studies showing significant impacts of delays or intervention effectiveness are more likely to be published.

Important research gaps remain. Few studies examined the cost-effectiveness of interventions to reduce delays, which is critical information for resource-constrained settings. Additionally, most intervention studies had relatively short follow-up periods, limiting our understanding of long-term sustainability. There is also limited research on how intersecting social determinants (such as gender, race, and socioeconomic status) interact to influence delays in different contexts.

Future research should prioritize rigorous evaluation of multi-level interventions using strong methodological designs, including randomized controlled trials where feasible. Studies examining the mechanisms through which delays occur and how these mechanisms vary across different healthcare contexts are needed. Implementation science approaches could help identify strategies for adapting effective interventions to diverse settings.

CONCLUSION

This systematic review demonstrates that delays in medical care represent a complex challenge influenced by patient, provider, and health system factors. These delays have significant consequences for mortality, morbidity, economic outcomes, and quality of life across a range of medical conditions. Our findings suggest that addressing delays requires comprehensive approaches targeting multiple levels of the healthcare system simultaneously.

Patient-level interventions should focus on enhancing health literacy, addressing cultural beliefs, and removing socioeconomic barriers to timely care-seeking. Provider-level strategies should emphasize continuing education, communication skills, and decision support tools. System-level approaches should prioritize improving geographic and financial accessibility, streamlining care pathways, and enhancing coordination across different healthcare sectors.

Given the substantial impacts of delayed care on health outcomes and healthcare costs, policymakers should prioritize initiatives to improve timely access to diagnosis and treatment. Particular attention should be paid to vulnerable populations who face disproportionate barriers to timely care, including rural residents, individuals with lower socioeconomic status, and those with limited health literacy.

Contributions

This systematic review (124 studies) provides the first comprehensive quantitative synthesis of healthcare delay determinants, consequences, and interventions globally.

Key innovations:

- Quantifies the human and economic costs of delayed care across conditions
- Demonstrates effectiveness of multi-level interventions
- Identifies evidence-based strategies for health systems strengthening

Alignment with review scope

Bridges the gap between research evidence and practical solutions for improving timely access to medical care globally, with particular relevance for resource-limited settings.

Future directions

Cost-effectiveness analyses, implementation science approaches, and examination of intersecting social determinants influencing healthcare delays.

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Ethical Approval

This systematic review did not require formal ethical approval as it did not involve direct human participants.

Consent for Publication: Not applicable.

Availability of Data and Materials

All data generated or analyzed during this study are included in this published article and its supplementary information. The complete list of reviewed articles and data extraction tables are available upon reasonable request from the corresponding author. Search strategies and inclusion/exclusion criteria are detailed in the methodology section.

Competing Interests

The authors declare no financial or non-financial conflicts of interest related to this study.

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Author Contributions

NKOLO TOLO Francis Daniel: Designed the systematic review protocol, defined the inclusion and exclusion criteria, and developed the search strategy.

MOSSUS Tatiana and MEVA'A BIOUELE Roger Christian: Conducted the bibliographic search in the selected databases, selected the studies based on predefined criteria, and extracted relevant data from included studies.

MOSSUS Tatiana and ONGTOKONO Ingrid Lovana: Assessed the methodological quality of included studies using appropriate tools and drafted the manuscript.

NSEME ETOUCKEY Eric: Critically reviewed the systematic review protocol, validated the search strategy, and revised the manuscript to ensure scientific rigor and clarity of presentation.

All authors: Participated in discussion and interpretation of results, and approved the final version of the manuscript for publications.

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