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FACTORS INFLUENCING THE PERFORMANCE OF HEALTH INFORMATION SYSTEMS IN URBAN HEALTHCARE FACILITIES IN CAMEROON: A THEORETICAL AND EMPIRICAL PERSPECTIVE

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ABSTRACT

The performance of health information systems (HIS) depends on multiple interconnected factors that determine their capacity to produce reliable, available, and effectively used data for decision-making. This article analyzes the factors influencing HIS performance in urban healthcare facilities in Cameroon using the PRISM (Performance of Routine Information System Management) framework. The analysis draws on a literature review conducted as part of a doctoral research study evaluating the effectiveness of HIS in improving healthcare service quality in Douala, Cameroon. Key factors are categorized into three domains: technical (hardware and equipment,

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software and tools, data collection tools, connectivity), organizational (leadership, governance, supervision, coordination, resource allocation), and behavioral (knowledge and skills, motivation, attitudes, confidence). Technical factors affecting HIS performance include insufficient computer equipment, poor internet connectivity, unreliable electricity supply, and inadequate equipment maintenance. Organizational challenges encompass weak leadership commitment, inadequate governance mechanisms, insufficient supervision, poor stakeholder coordination, and limited resource allocation. Behavioral factors include limited knowledge and skills among health workers, low motivation, negative attitudes toward data use, and lack of confidence in HIS. The article proposes a comprehensive framework for strengthening HIS performance through integrated interventions addressing technical, organizational, and behavioral dimensions. Successful HIS strengthening requires strong leadership, sustained political commitment, adequate resource allocation, capacity building, quality assurance mechanisms, supervision, stakeholder coordination, and a culture of data utilization.

Keywords: Health Information System, Performance, PRISM Framework, Technical Factors, Organizational Factors, Behavioral Factors, Cameroon, Healthcare Facilities

RÉSUMÉ

La performance des systèmes d'information de santé (SIS) dépend de multiples facteurs interconnectés qui déterminent leur capacité à produire des données fiables, disponibles et utilisées efficacement pour la prise de décision. Cet article analyse les facteurs influençant la performance des SIS dans les structures de santé urbaines au Cameroun en utilisant le cadre PRISM (Performance of Routine Information System Management). L'analyse s'appuie sur une revue de la littérature menée dans le cadre d'une étude doctorale évaluant l'efficacité des SIS dans l'amélioration de la qualité des services de santé à Douala, Cameroun. Les principaux facteurs sont catégorisés en trois domaines : techniques (équipements et matériel, logiciels et outils, outils de collecte de données, connectivité), organisationnels (leadership, gouvernance, supervision, coordination, allocation des ressources) et comportementaux (connaissances et compétences, motivation, attitudes, confiance). Les facteurs techniques affectant la performance des SIS comprennent l'insuffisance des équipements informatiques, la mauvaise connectivité internet, l'alimentation électrique peu fiable et la maintenance inadéquate des équipements. Les défis

organisationnels englobent un faible engagement du leadership, des mécanismes de gouvernance inadéquats, une supervision insuffisante, une mauvaise coordination des parties prenantes et une allocation limitée des ressources. Les facteurs comportementaux incluent des connaissances et compétences limitées des agents de santé, une faible motivation, des attitudes négatives envers l'utilisation des données et un manque de confiance dans le SIS. L'article propose un cadre complet pour renforcer la performance des SIS à travers des interventions intégrées abordant les dimensions techniques, organisationnelles et comportementales. Un renforcement réussi des SIS nécessite un leadership fort, un engagement politique soutenu, une allocation adéquate des ressources, un renforcement des capacités, des mécanismes d'assurance qualité, une supervision, une coordination des parties prenantes et une culture d'utilisation des données.

Mots-clés: Système d'Information de Santé, Performance, Cadre PRISM, Facteurs Techniques, Facteurs Organisationnels, Facteurs Comportementaux, Cameroun, Structures de Santé

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1. INTRODUCTION

1.1 The Importance of Health Information Systems

Health information systems (HIS) are essential components of effective health systems, providing the data needed for planning, monitoring, evaluation, and decision-making (WHO, 2010). A high-performing HIS produces reliable, timely, accessible, and actionable information that supports health system strengthening and improved health outcomes. However, the performance of HIS

depends on multiple interconnected factors that determine their capacity to produce and use health data effectively.

1.2 Understanding HIS Performance

HIS performance is not solely a technical issue but reflects the interaction of technical, organizational, and human factors. The PRISM (Performance of Routine Information System Management) framework provides a comprehensive approach for understanding and improving HIS performance by considering these three domains (Aqil, Lippeveld, & Hozumi, 2009).

1.3 The Cameroonian Context

In Cameroon, strengthening HIS has been a priority for health system development. The adoption of digital platforms, particularly DHIS2, has created opportunities for improved health data management. However, challenges persist in achieving optimal HIS performance, particularly in urban areas where healthcare facilities face high demand and complex health challenges.

2. THE PRISM FRAMEWORK

2.1 Overview

The PRISM framework was developed to provide a systematic approach for designing, strengthening, and evaluating routine health information systems. It considers three categories of factors that influence HIS performance:

1. **Technical factors:** Tools, software, equipment, and procedures used to produce data
2. **Organizational factors:** Governance, leadership, supervision, and data management mechanisms
3. **Behavioral factors:** Knowledge, skills, and motivation of system users

2.2 Technical Factors

Technical factors concern the "hardware" and "software" of HIS, including:

- **Hardware and Equipment:** Computers, servers, printers, and other physical infrastructure

- **Software and Tools:** HIS software (e.g., DHIS2), data collection tools, and analysis tools
- **Data Collection Tools:** Registers, forms, and electronic data collection tools
- **Data Management:** Data storage, processing, and analysis mechanisms
- **Connectivity:** Internet and network infrastructure for data transmission

2.3 Organizational Factors

Organizational factors concern the institutions and structures that support HIS functioning:

- **Leadership:** Vision, direction, and support from health authorities
- **Governance:** Policies, procedures, and accountability mechanisms
- **Supervision:** Monitoring, feedback, and support for HIS activities
- **Coordination:** Collaboration among stakeholders and integration of HIS activities
- **Resource Allocation:** Financial, human, and material resources for HIS

2.4 Behavioral Factors

Behavioral factors concern the individuals who use and interact with HIS:

- **Knowledge and Skills:** Understanding of HIS, data management, and information use
- **Motivation:** Willingness to use HIS effectively and consistently
- **Attitudes:** Perceptions of HIS usefulness, ease of use, and value
- **Confidence:** Trust in HIS and belief in ability to use it effectively

3. TECHNICAL FACTORS IN CAMEROON

3.1 Hardware and Equipment

Challenges:

- Insufficient number of computers in healthcare facilities
- Older equipment not supporting current software

- Frequent breakdowns due to lack of maintenance
- Inadequate provision of essential peripherals (printers, UPS)

Impact:

- Limited capacity for electronic data entry and analysis
- Reliance on manual reporting methods
- Loss of data due to equipment failure
- Delays in data transmission

Opportunities:

- Government and partner investments in computer equipment
- Possibility of using mobile devices for data collection
- Development of local capacity for equipment maintenance

3.2 Software and Tools

Challenges:

- Insufficient customization of DHIS2 to local needs
- Limited integration with other health information systems
- Software updates not fully implemented
- Lack of local capacity for software maintenance

Impact:

- Underutilization of DHIS2 functionalities
- Inefficient data management processes
- Limited interoperability with other systems
- Dependence on external technical support

Opportunities:

- Ongoing software improvements and updates
- Development of local technical capacity
- Possibility for system customization

3.3 Data Collection Tools

Challenges:

- Inadequate availability of registers and forms
- Inconsistent data collection practices
- Lack of standard data definitions
- Limited use of electronic data collection

Impact:

- Incomplete and inconsistent data
- Difficulties in data compilation and comparison
- Reduced data quality and reliability

Opportunities:

- Harmonization of data collection tools
- Adoption of electronic data collection
- Standardization of data definitions

3.4 Connectivity

Challenges:

- Poor internet connectivity in many facilities
- High costs of connectivity
- Unreliable electricity affecting connectivity
- Limited coverage of mobile networks in rural areas

Impact:

- Delayed data transmission
- Inability to access online systems
- Loss of data due to connectivity interruptions
- Reduced use of digital HIS

Opportunities:

- Expanding mobile network coverage
- Increasing availability of affordable connectivity
- Offline data collection options

4. ORGANIZATIONAL FACTORS IN CAMEROON

4.1 Leadership

Challenges:

- Weak leadership commitment to HIS
- HIS not integrated into health management processes
- Insufficient priority given to HIS in strategic planning
- Limited advocacy for HIS at higher levels

Impact:

- Inadequate resource allocation for HIS
- HIS not used for decision-making
- Low priority for HIS in health programs
- Limited sustainability of HIS initiatives

Opportunities:

- Growing recognition of HIS importance
- Development of national HIS policies
- Political support for digital health

4.2 Governance

Challenges:

- Insufficient HIS governance mechanisms
- Lack of clear policies and procedures
- Weak accountability for HIS performance
- Inadequate data governance (security, privacy, quality)

Impact:

- Inconsistent HIS management practices
- Poor data quality and reliability
- Limited data utilization
- Inefficient resource use

Opportunities:

- Development of HIS governance frameworks
- Strengthening data quality assurance
- Implementation of data protection measures

4.3 Supervision

Challenges:

- Insufficient supervision of HIS activities
- Lack of systematic feedback mechanisms
- Inadequate support for health workers

- Supervision not focused on HIS

Impact:

- Persistent data quality problems
- Limited learning and improvement
- Low motivation among health workers
- Poor adherence to data management procedures

Opportunities:

- Integration of HIS in supervision
- Development of supervision tools
- Use of data for supportive supervision

4.4 Coordination

Challenges:

- Weak coordination among stakeholders
- Fragmented HIS initiatives and efforts
- Duplication of activities
- Lack of information sharing

Impact:

- Inefficient resource use
- Inconsistent HIS approaches
- Missed opportunities for synergy
- Limited learning from experiences

Opportunities:

- Establishment of HIS coordination mechanisms

- Multi-stakeholder collaboration
- Harmonization of efforts

4.5 Resource Allocation

Challenges:

- Inadequate funding for HIS
- Limited allocation for HIS in health budgets
- Insufficient human resources for HIS
- Lack of sustainable financing mechanisms

Impact:

- Incomplete HIS implementation
- Inadequate equipment and tools
- Limited training and capacity building
- Unsustainability of HIS initiatives

Opportunities:

- Increased investment in digital health
- Development of sustainable financing models
- Integration of HIS in health budgets

5. BEHAVIORAL FACTORS IN CAMEROON

5.1 Knowledge and Skills

Challenges:

- Limited knowledge of HIS concepts and principles
- Inadequate skills for using digital HIS

- Insufficient training on data management
- Lack of understanding of data use

Impact:

- Poor data quality
- Incomplete data collection and reporting
- Underutilization of HIS data
- Limited value from HIS investments

Opportunities:

- Capacity building programs
- Training of trainers
- Integration of HIS in education curricula

5.2 Motivation

Challenges:

- Heavy workload limiting time for HIS
- Limited recognition for HIS activities
- Lack of incentives for good data management
- Negative perceptions of HIS as extra work

Impact:

- Low priority given to HIS
- Incomplete and low-quality data
- High staff turnover affecting HIS continuity

Opportunities:

- Recognition and rewards for good data management

- Integration of HIS in performance management
- Making HIS easier and more efficient

5.3 Attitudes

Challenges:

- Perception of HIS as not useful
- Preference for manual methods
- Resistance to change
- Lack of trust in data

Impact:

- Limited adoption of digital HIS
- Underutilization of data
- Inefficient data management processes

Opportunities:

- Demonstrating value and usefulness of HIS
- Involving users in HIS design
- Communication and change management

5.4 Confidence

Challenges:

- Fear of using technology
- Self-doubt about ability to use HIS
- Lack of support when problems occur
- Limited experience with digital systems

Impact:

- Avoidance of HIS use
- Reliance on others for support
- Underutilization of system capabilities

Opportunities:

- Training and practice
- Supportive supervision
- Building competence through use

6. INTEGRATED FRAMEWORK FOR HIS STRENGTHENING

6.1 Interconnectedness of Factors

The factors influencing HIS performance are interconnected. Technical factors affect organizational and behavioral factors, and vice versa. For example:

- Poor connectivity (technical) affects the motivation of health workers (behavioral) to use HIS
- Weak leadership (organizational) affects investment in equipment (technical) and training (behavioral)
- Limited skills (behavioral) affect data quality (technical) and governance (organizational)

6.2 Comprehensive Interventions

Strengthening HIS performance requires integrated interventions addressing all three domains:

Technical Interventions:

- Invest in computer equipment and infrastructure
- Ensure reliable connectivity and electricity
- Maintain and update software and tools
- Implement data quality assurance mechanisms

Organizational Interventions:

- Strengthen leadership and governance
- Establish supervision and feedback mechanisms
- Improve stakeholder coordination
- Allocate adequate resources

Behavioral Interventions:

- Provide training and capacity building
- Motivate and recognize HIS users
- Demonstrate value of data
- Build user confidence

6.3 Implementation Strategy

Phase 1: Assessment

- Conduct comprehensive HIS assessment using PRISM framework
- Identify strengths, weaknesses, opportunities, and threats
- Prioritize interventions

Phase 2: Planning

- Develop HIS strengthening strategy
- Define goals, objectives, and indicators
- Allocate resources
- Engage stakeholders

Phase 3: Implementation

- Implement prioritized interventions
- Monitor and evaluate progress

- Adapt based on learning
- Ensure sustainability

Phase 4: Evaluation

- Evaluate HIS performance
- Assess progress toward goals
- Identify lessons learned
- Update strategy

7. DISCUSSION

7.1 Application of PRISM in Cameroonian Context

The PRISM framework provides a useful lens for understanding HIS performance in Cameroonian healthcare facilities. The framework highlights the multiple factors affecting HIS and their interconnections. Applying PRISM in Cameroon can help identify priority areas for intervention and guide HIS strengthening efforts.

7.2 Technical-Organizational-Behavioral Interactions

The interaction between technical, organizational, and behavioral factors is particularly evident in Cameroonian healthcare settings. For example:

- Poor connectivity (technical) is not only a technical problem but also affects health worker motivation (behavioral) and governance (organizational)
- Limited training (behavioral) affects data quality (technical) and supervision (organizational)
- Weak leadership (organizational) affects resource allocation (technical) and capacity building (behavioral)

7.3 Implications for Policy and Practice

Understanding factors influencing HIS performance has important implications for policy and practice:

1. **Comprehensive Approach:** HIS strengthening must address technical, organizational, and behavioral dimensions simultaneously
2. **Context-Specific Interventions:** Interventions should be adapted to local context and needs
3. **Stakeholder Engagement:** All stakeholders must be involved in HIS strengthening
4. **Sustainability:** Interventions must ensure long-term sustainability
5. **Continuous Improvement:** HIS strengthening is an ongoing process

8. RECOMMENDATIONS

8.1 To Policy Makers

1. **Develop Comprehensive HIS Policy:** Develop and implement comprehensive HIS policy addressing technical, organizational, and behavioral dimensions
2. **Allocate Adequate Resources:** Ensure adequate allocation of resources for HIS implementation and sustainability
3. **Strengthen Leadership:** Strengthen leadership and governance for HIS at all levels
4. **Integrate HIS in Health System:** Integrate HIS in health system planning and management

8.2 To Health Managers

1. **Conduct Comprehensive Assessment:** Conduct regular HIS assessments using PRISM framework
2. **Implement Priority Interventions:** Implement priority interventions addressing identified gaps
3. **Monitor and Evaluate:** Monitor and evaluate HIS performance regularly

4. **Engage Stakeholders:** Engage all stakeholders in HIS strengthening

8.3 To Health Workers

1. **Use HIS Data:** Use HIS data for decision-making and planning
2. **Report Data Accurately:** Ensure accurate and timely data reporting
3. **Seek Training:** Seek training and capacity building opportunities
4. **Provide Feedback:** Provide feedback on HIS functioning and challenges

9. CONCLUSION

The performance of health information systems in Cameroonian healthcare facilities depends on multiple interconnected technical, organizational, and behavioral factors. The PRISM framework provides a comprehensive approach for understanding these factors and guiding HIS strengthening efforts.

Key technical factors include hardware and equipment, software and tools, data collection tools, and connectivity. Key organizational factors include leadership, governance, supervision, coordination, and resource allocation. Key behavioral factors include knowledge and skills, motivation, attitudes, and confidence.

Strengthening HIS performance requires integrated interventions addressing all three domains. This includes investments in infrastructure, capacity building, governance, supervision, and creating a culture of data utilization. With sustained commitment and comprehensive approaches, HIS can play a transformative role in strengthening health systems and improving health outcomes in Cameroon.

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