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Health Information Systems in Kosovo: A Critical Review of Challenges, Opportunities, and Pathways for Public Health Improvement

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Abstract

Kosovo faces significant challenges in developing robust health information systems (HIS) to support evidence-based public health decision-making. Fragmented data infrastructure, limited resources, and insufficient policy alignment hinder the country's ability to implement effective HIS. This article examines Kosovo's existing health data policies and strategies, identifying critical gaps and opportunities for improvement. It proposes a framework focused on technological integration, capacity-building, policy alignment, and community engagement to enhance HIS functionality. By addressing these systemic challenges, Kosovo can improve health equity, optimize resource allocation, and build resilience in its public health sector. This study underscores the importance of tailored, context-specific approaches to HIS reform in a developing country setting.

Keywords: Health information systems (HIS), public health, technological integration, health equity, Kosovo

INTRODUCTION

Introduction Health Information Systems (HIS) are critical for enabling evidence-based decision-making, improving public health outcomes, and ensuring equitable access to healthcare services. They play a particularly significant role in resource-constrained settings, where effective use of limited resources can mean the difference between health system resilience and collapse (WHO, 2020; Heeks, 2006). HIS integrate data collection, processing, and dissemination to inform decision-making and optimize health outcomes. Conceptually, HIS encompass both technological infrastructure and organizational processes aimed at collecting health-related data from various sources, including healthcare facilities, laboratories, and community health programs (Heeks, 2006). The goal of HIS is not merely data management but the transformation of raw information into actionable insights that enhance the quality, efficiency, and equity of healthcare delivery (Braa & Sahay, 2012).

Globally, robust HIS have proven instrumental in addressing systemic inefficiencies, enabling real-time disease surveillance, and supporting evidence-based policymaking. For instance, electronic health records (EHRs) streamline patient management by providing healthcare providers with accurate and comprehensive medical histories, thereby reducing medical errors and improving treatment outcomes (Luna et al., 2014). Similarly, mobile health (mHealth) technologies have expanded healthcare access in underserved regions, facilitating remote diagnostics, health education, and patient monitoring (Ahsan & Raihan, 2016).

Despite their transformative potential, HIS development and implementation face numerous challenges, particularly in low- and middle-income countries (Luna et al. 2014a). These include insufficient infrastructure, limited technical expertise, and fragmented data systems. However, HIS innovations tailored to local contexts can overcome these barriers, empowering countries to build sustainable healthcare systems that meet the needs of their populations. By integrating best practices and global lessons, HIS can serve as a catalyst for achieving universal health coverage and advancing public health goals (Braa & Sahay, 2012). Kosovo's health system operates in a unique post-conflict environment, where rebuilding efforts have focused on restoring basic healthcare

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services but often overlooked the importance of integrating modern HIS. As a result, health data in Kosovo remains fragmented, hindering the ability to deliver timely and effective public health interventions (Ministry of Health, Kosovo, 2022). Efforts to strengthen HIS are further complicated by limited financial resources, capacity gaps, and political instability, making it difficult to implement holistic and sustainable solutions (UNDP Kosovo, 2019; European Commission, 2023).

Kosovo's healthcare system

Kosovo's Healthcare System The healthcare system in Kosovo operates under the regulatory framework outlined in the Law No. 04/L-125 on Health (Official Gazette of the Republic of Kosovo, 2013). It is structured into three main levels: primary, secondary, and tertiary care. Together, these sectors work in coordination to deliver healthcare services across the country.

Healthcare services in Kosovo are provided by both public and private institutions, often operating independently or in partnership. While public healthcare is more affordable, private healthcare is widely preferred by citizens due to its perceived higher quality and efficiency (Brizendine, 2020). This system adheres to the principles of human dignity and fundamental rights as outlined in Kosovo's Constitution and complies with international agreements ratified by the state.

Primary healthcare falls under municipal jurisdiction and is built around the family medicine model. Family medicine teams typically consist of a specialist physician and two nurses. The system includes 472 institutions, of which 38 are main family medicine centers, one in each municipality. Additionally, there are 167 dedicated family medicine centers and 267 family medicine clinics, all aiming to provide accessible care at the community level (Ministry of Health, 2021).

Secondary healthcare provides specialized medical services and is delivered through regional hospitals located in seven key municipalities. These hospitals offer a range of diagnostic and therapeutic services for more complex health conditions (Gërguri, 2024).

At the highest level, tertiary healthcare encompasses advanced medical services and contributes significantly to medical education and research. The University Clinical Center in Pristina serves as the central hub for tertiary care, addressing specialized health needs and playing a pivotal role in training healthcare professionals (Official Gazette of the Republic of Kosovo, 2013).

Public health

P Public health in Kosovo reflects the challenges and complexities of a country navigating post-conflict reconstruction while striving to address modern health demands. The health sector remains underfunded, with public health expenditure constituting a relatively small portion of the national budget. This financial constraint has resulted in limited access to healthcare services, particularly in rural and underserved areas, exacerbating health disparities across the population (Ministry of Health, Kosovo, 2022; UNDP Kosovo, 2019).

Infectious diseases, non-communicable diseases (NCDs), and maternal and child health issues remain key public health concerns. Kosovo has made strides in improving health indicators such as infant mortality and immunization rates, but these gains are unevenly distributed and often undermined by gaps in healthcare access and service quality (WHO, 2020). Additionally, the country faces emerging challenges such as environmental health risks, mental health care needs, and the increasing burden of chronic diseases (Hoxha et al., 2023).

Recent health initiatives provide examples of progress and ongoing challenges. For instance, while vaccination coverage for children under five has improved, rural areas still report lower rates compared to urban centers. Similarly, NCDs account for over 50% of hospital deaths, highlighting the need for robust prevention and management systems (Katanolli, 2023).

The fragmented public health infrastructure further limits Kosovo's ability to respond effectively to crises, such as the COVID-19 pandemic. Delays in data reporting—often exceeding 48 hours—hindered the timely implementation of public health measures. Despite these setbacks, digital tools such as the vaccination registration platform demonstrated the potential of HIS in urban areas, achieving 70% registration among eligible individuals during the initial phase (Hoxha et al., 2023).

METHOD

This study employs a qualitative analysis of existing health data policies and strategies in Kosovo (Fisher & Hamer, 2020; Bryman, 2016; Green, 2018). This method allows for an in-depth examination of policy documents, strategic health plans, and reports from government and non-government organizations to assess Kosovo's HIS.

The analysis focuses on key themes, including technological integration, capacity-building, and policy alignment, which have been identified in prior research as essential components of effective HIS governance (Protti, D. 2009). By employing a systematic document review, we aim to uncover systemic gaps and propose actionable recommendations, following established methodologies in health policy analysis (Kayesa & Shung-King, 2021). The findings contribute to evidence-based strategies for strengthening HIS within Kosovo's unique healthcare context.

RESULTS

Current state of health information system (HIS) in Kosovo

The Strategy for HIS 2010–2020, introduced by the Ministry of Health, aimed to serve as Kosovo's foundational framework for establishing a robust health information system. This strategy set ambitious goals, including the creation of a centralized electronic registry and database to streamline health data management. Key components included the development of electronic health cards, a health insurance registry, the

digitization of birth records, and a computer-based system for managing pharmaceutical processes (Ministry of Public Services, 2008). Objectives highlighted in subsequent reports emphasized infrastructure development, standardizing data collection methods, establishing electronic health records (EHRs), and integrating private healthcare providers into the system (Ministry of Health, 2011).

The action plan for HIS implementation adopted a phased approach. Phase A) (2010–2013) focused on short-term infrastructure development and pilot HIS systems in select regions, such as Prishtina and Prizren. Phase B (2012–2014) aimed to integrate these pilots into routine practice, while Phase C (2013–2020) envisioned the full implementation of HIS nationwide, including its extension to private healthcare facilities. However, progress during Phases A and B covered only approximately 30% of the country, and irregularities in management hindered further advancements (Ministry of Health, 2011; National Audit Office, 2017).

A 2017 investigation by the National Audit Office revealed significant challenges in the HIS implementation process. Although the action plan for 2014 outlined integrating HIS across 30% of the country, findings showed that only 39% of patients were recorded in the system within five audited institutions. The report also highlighted the non-functionality of the HIS as a major barrier to establishing the Health Insurance Fund, which is heavily dependent on an operational HIS (National Audit Office, 2017).

Benefits of health information system (HIS) in Kosovo

Despite the challenges, the implementation of HIS in Kosovo holds significant potential for improving public health outcomes. While no formal study has quantified its benefits, insights from health organizations and community representatives suggest that HIS could address critical issues in the health sector. For instance, accurate tracking of medication and equipment usage could enhance procurement processes and planning, reducing corruption and mismanagement (Hoxha, 2023). Furthermore, HIS is expected to improve diagnostic accuracy, prevent medication over-prescription, and increase patient safety. According to the head of the Patients' Association, HIS could also aid in monitoring illness trends, ensuring better preparedness, and optimizing resource allocation for effective treatments (Hoxha, 2023).

Challenges to HIS implementation

The full implementation of Kosovo's HIS has been delayed due to numerous challenges identified in a feasibility assessment conducted by the Ministry of Health. These challenges primarily revolve around infrastructure and human resource limitations (Ministry of Health, 2023).

Infrastructure deficits represent one of the most significant barriers. Many primary healthcare facilities either lack sufficient connectivity or are entirely disconnected from LAN/WAN networks, resulting in frequent disruptions that hinder the use of digital applications. Furthermore, the unavailability of functional printers, damaged hardware, and insufficient toner supplies exacerbate operational inefficiencies, negatively impacting both healthcare professionals and patients (Ministry of Health, 2023).

Human resource constraints pose another critical challenge. The shortage of IT professionals—exacerbated by high global demand for such expertise—limits the effective deployment and maintenance of HIS. This gap is particularly evident in rural healthcare facilities, where technical support is often unavailable (Ministry of Health, 2023). As Kosovo competes with international markets for skilled IT personnel, the healthcare sector struggles to recruit and retain professionals capable of managing HIS infrastructure and processes.

Broader implications and insights

The underdevelopment of Kosovo's health information system (HIS) underscores deeper systemic challenges, including fragmented data governance, insufficient technological infrastructure, and constrained resources. Despite the implementation of pilot projects aimed at addressing these issues, many healthcare facilities continue to rely heavily on paper-based systems. This reliance introduces inefficiencies, inconsistencies, and gaps in data collection, which impede the accurate monitoring and evaluation of public health outcomes (Gërguri, 2024).

Interoperability challenges remain a significant barrier to HIS functionality in Kosovo. Healthcare institutions frequently operate isolated systems that lack the ability to exchange information seamlessly. This fragmentation obstructs comprehensive public health surveillance, undermines evidence-based policymaking, and limits the capacity for coordinated care across facilities (Loku et al., 2024). Furthermore, the absence of a centralized electronic health record (EHR) system exacerbates these issues, particularly for individuals with chronic conditions who require integrated and continuous care (Katanolli, 2023).

Infrastructure deficits further hinder HIS advancement, particularly in rural regions where healthcare facilities often lack reliable internet connectivity and access to modern equipment. These technological shortcomings make it difficult to adopt digital health tools, leading to operational inefficiencies and compromised data accuracy. Additionally, the shortage of trained personnel—both healthcare professionals and IT experts—further restricts the capacity to manage and utilize HIS effectively, especially at the regional and municipal levels. These human resource gaps not only reduce the reliability of collected data but also diminish the potential of HIS as a tool for improving health system performance (Rugova, 2022).

The COVID-19 pandemic starkly exposed the vulnerabilities of Kosovo's HIS. Delays in data reporting, often exceeding 48 hours, complicated efforts to monitor infection rates, allocate resources, and implement timely interventions. However, the

pandemic also demonstrated the potential of targeted digital initiatives. For instance, the rollout of a digital vaccination registration platform significantly improved data accessibility and efficiency in urban areas, achieving a 70% registration rate among eligible individuals during its initial phase (Hoxha et al., 2023).

Disease management presents another critical area where HIS deficiencies have tangible consequences. Non-communicable diseases (NCDs), which account for over half of all hospital deaths in Kosovo, highlight the urgent need for an effective HIS. The lack of centralized EHRs and integrated referral systems hampers the coordination of care for patients with chronic conditions, particularly in rural areas where healthcare access is already limited. This gap further burdens the healthcare system and diminishes the quality of patient outcomes (Katanolli, 2023).

International donor programs have played a pivotal role in supporting HIS development in Kosovo, particularly through pilot projects and capacity-building initiatives. For example, the Accessible Quality Healthcare (AQH) project introduced motivational counseling for NCD prevention based on WHO protocols. While these efforts demonstrate the potential of HIS in improving public health, their impact remains constrained by low public trust and limited engagement. Notably, only 22% of eligible participants utilized these interventions, underscoring the importance of addressing accessibility barriers and fostering greater public confidence in digital health systems (Katanolli, 2023; Gërguri, 2024).

Legal and policy frameworks

Legislation

The establishment of a robust Health Information System (HIS) in Kosovo is underpinned by several legislative instruments, administrative instructions, and strategic frameworks. However, significant gaps in enforcement, institutional roles, and the availability of supporting regulations hinder the system's functionality.

Kosovo's HIS is supported by several key laws designed to ensure data integrity and health system functionality. Among these are:

- **Law No. 2004-4 on Health**, which outlines the general organization of healthcare services and mandates the collection of health data to support decision-making processes.
- **Law No. 02-L-78 on Public Health**, emphasizing the role of public health data in disease prevention and health promotion.
- **Law No. 04-L-49 on Health Insurance**, which governs the collection and management of financial and health-related data for insured individuals but remains partially implemented.
- **Law No. 2004-38 on Citizens' Rights and Obligations in Health Care**, which requires proper documentation of patient data to ensure access and accountability.
- **Law No. 02-L-109 on the Prevention and Control of Infectious Diseases**, which mandates systematic data collection to facilitate disease monitoring and outbreak control.
- **Law No. 06-L-082 on Protection of Personal Data**, addressing critical issues of data privacy and security.
- **Law No. 04-L-036 on Official Statistics**, which establishes guidelines for collecting and disseminating health-related statistics.

These laws collectively provide a comprehensive legislative framework for HIS but are often undermined by unclear institutional mandates and weak enforcement. Additionally, despite the existence of these laws, Rugova (2022) highlights an acute absence of a comprehensive Law on Health Records, which would integrate the various aspects of data collection, storage, and reporting under a unified framework. Also, the lack of bylaws to operationalize existing laws creates ambiguities in institutional responsibilities, further undermining data reliability and decision-making.

Strategic frameworks

Kosovo has developed several strategic initiatives aimed at modernizing its HIS, including:

- The **Health Sector Strategy 2010–2014**, which focused on foundational HIS development, such as infrastructure improvements and workforce training.
- The **Strategy for the Health Information System in Kosovo 2010–2020**, which provided a roadmap for digitalizing health data, standardizing reporting mechanisms, and fostering interoperability between health institutions.
- The **Health Sector Strategy 2017–2021**, which aimed to enhance health equity and resource utilization but struggled with implementation due to financial and organizational constraints.
- The **Kosovo Digital Agenda 2021–2025**, which underscores the importance of digital transformation in healthcare, emphasizing the need for robust IT infrastructure to support HIS development.

While these strategies highlight Kosovo’s commitment to advancing HIS, their impact has been limited by insufficient funding, technical expertise, and coordination among health institutions.

Challenges in legal and policy implementation

Despite the existence of comprehensive legislative and policy frameworks, the implementation of health information systems (HIS) in Kosovo faces significant systemic challenges that undermine their effectiveness in supporting evidence-based public health decision-making and equitable healthcare delivery. One of the most critical issues is the lack of clarity in institutional roles and responsibilities. The Ministry of Health, regional health centers, and the National Institute of Public Health of Kosovo (NIPHK) often operate without well-defined mandates. This overlap leads to inefficiencies and gaps in accountability, weakening coordination among institutions and obstructing the seamless flow of health data (Rugova, 2022).

Another significant challenge is the insufficient development of bylaws to operationalize existing legislation. While overarching laws provide a legal framework for HIS, detailed regulations addressing data interoperability, reporting timelines, and enforcement mechanisms remain largely absent. For example, only one administrative instruction directly addresses health statistics, leaving substantial regulatory gaps that limit the practical implementation of HIS policies.

A pronounced shortage of skilled personnel further exacerbates these challenges. Many healthcare facilities lack adequately trained professionals to manage HIS effectively, particularly in data collection, analysis, and reporting. This gap is especially evident at regional and local levels, where staff often struggle to use digital tools or adhere to standardized protocols. Consequently, the quality and reliability of health data are compromised, reducing the utility of HIS for public health planning.

In addition, compliance with data reporting standards is inconsistent across public and private healthcare institutions. Health inspectors have frequently reported violations of reporting requirements, such as incomplete or delayed submissions of health statistics. However, these violations often go unaddressed due to weak enforcement mechanisms and the inconsistent application of sanctions. This lack of accountability not only diminishes the effectiveness of HIS but also undermines trust in the system, further limiting its potential to support health governance.

Digital access in Kosovo

The assessment of digital readiness is crucial to the success of digital transformation efforts. Despite economic challenges, Kosovo has made commendable progress in enhancing digital connectivity. Through the Kosovo Digital Economy Project, supported by the World Bank, the country achieved near-universal internet access by March 2023, extending high-speed services to even the most remote villages. Importantly, these services are priced comparably to those in urban areas, ensuring equitable access for all residents (Garcia, 2023).

Findings from the UNDP Digital Household Survey, which involved 2,400 households, revealed widespread ownership of smartphones, with 98.8% of respondents reporting access to such devices. However, disparities in internet usage remain evident. Households with higher income and education levels utilize the internet for a broader range of activities, while those with fewer resources primarily engage in social networking. Moreover, significant gaps in advanced digital skills persist, particularly among lower-income households. Despite these challenges, there is a strong willingness to adopt new technologies, reflecting an understanding of their transformative potential (UNDP, n.d.).

Healthcare professionals in Kosovo generally view digital tools as beneficial for improving their workflows. A qualitative study highlighted how these technologies enhance patient interactions, simplify appointment bookings, and provide efficient access to medical records. However, many healthcare workers feel unprepared to fully leverage these tools due to limited training and exposure during their academic careers. Addressing this gap through targeted education and professional development initiatives will be essential for fostering effective digital transformation in the health sector (Hoxha et al. 2021; Ymerali et al. 2024).

Data privacy and security

In today's digital world, safeguarding personal data is of paramount importance. Kosovo has taken significant steps to protect data security through Law No. 06/L-082 on Protection of Personal Data, which aligns with the European Union's General Data Protection Regulation (GDPR). This legislation outlines the responsibilities of institutions and businesses in handling and securing private information, ensuring confidentiality and compliance with international standards (Official Gazette of the Republic of Kosovo, 2019).

Despite the existence of such a regulatory framework, challenges persist in ensuring comprehensive cybersecurity. Many public sector websites lack robust security protocols, underscoring the need for government institutions to prioritize strengthening their online platforms. Additionally, the country faces a shortage of skilled cybersecurity professionals, which limits its ability to combat rising cyber threats effectively (Open Data Kosovo, 2020).

Addressing these vulnerabilities will require systemic changes, including integrating cybersecurity education into school curriculums. A report by the Kosovo Centre for Security Studies highlights this gap and advocates for the early introduction of digital literacy programs in primary and secondary schools. Such initiatives would not only increase awareness but also build a stronger foundation for digital resilience across the country (Kroçi, 2023).

DISCUSSION

The findings of this study underscore the critical challenges and opportunities associated with the development and implementation of Health Information Systems (HIS) in Kosovo. Despite considerable efforts to establish a robust HIS, systemic gaps in infrastructure, policy alignment, and human

resources continue to impede progress. This discussion integrates these findings to propose actionable pathways for addressing these challenges and enhancing Kosovo's healthcare landscape.

Fragmentation and policy gaps

The findings underscore critical challenges and opportunities in the development and implementation of HIS in Kosovo. Fragmentation in data systems, insufficient infrastructure, and limited human resources are significant barriers to effective HIS implementation. The absence of a centralized electronic health record (EHR) system exacerbates these challenges, particularly for chronic disease management. Strengthening legal frameworks with detailed bylaws, investing in infrastructure, and improving digital literacy among healthcare professionals are crucial steps for progress.

Kosovo can also learn from regional best practices in the Balkans, such as Albania's digital health reforms, which have focused on interoperability and citizen engagement. International collaboration and donor engagement will be instrumental in addressing systemic gaps.

Infrastructure and digital readiness

Kosovo has made significant strides in improving digital connectivity through initiatives like the Digital Economy Project. However, rural areas continue to face substantial deficits in IT infrastructure, including unreliable internet connectivity and outdated hardware. These infrastructural limitations restrict the adoption of digital health tools and perpetuate reliance on inefficient paper-based systems.

While the widespread ownership of smartphones among the population is encouraging, disparities in digital literacy remain a significant barrier. The effective utilization of HIS depends on the digital competence of both healthcare professionals and the general population. Targeted training programs and education initiatives are essential to bridge these gaps and maximize the potential of digital transformation in healthcare.

Human resource limitations

The shortage of trained IT professionals and healthcare staff capable of managing HIS effectively is another critical barrier. This issue is particularly acute in rural and regional healthcare facilities, where technical expertise is often lacking. The global demand for IT professionals further exacerbates this challenge, making it difficult for Kosovo to retain skilled personnel.

To address these human resource constraints, Kosovo must invest in capacity-building initiatives, including specialized training for healthcare workers and IT staff. Collaboration with international organizations and academic institutions could provide valuable opportunities for skill development and knowledge transfer.

Lessons from the COVID-19 pandemic

The COVID-19 pandemic highlighted both the vulnerabilities and potential of Kosovo's HIS. Delays in data reporting during the pandemic hindered timely public health interventions, exposing the system's inability to respond effectively to emergencies. However, the successful implementation of a digital vaccination registration platform demonstrated the feasibility of targeted digital health initiatives, particularly in urban settings.

These experiences emphasize the importance of building resilient HIS capable of handling future public health emergencies. Integrating lessons learned from the pandemic into the design and implementation of HIS reforms can significantly enhance Kosovo's preparedness and response capacity.

International collaboration and best practices

Kosovo's collaboration with international organizations such as the World Bank has laid the groundwork for HIS development, but further support is needed to address systemic challenges. Engaging with multiple donors in the country and regional initiatives, such as those led by the Swiss Development Agency and the Southeast European Health Network (SEEHN), could provide additional resources and foster knowledge sharing among neighboring countries.

Kosovo can also benefit from studying the experiences of neighbouring countries that have successfully implemented HIS reforms, particularly Albania. Regional collaboration could facilitate the exchange of knowledge and resources, enabling Kosovo to adopt proven strategies tailored to its unique context.

Conclusion

Kosovo's journey toward a robust Health Information System (HIS) reflects both significant progress and persistent challenges. The country's commitment to digital transformation through strategic initiatives such as the HIS 2010–2020 strategy is commendable. However, systemic issues—fragmented data governance, inadequate infrastructure, and a shortage of skilled personnel—continue to hinder effective implementation. Addressing these barriers through a multi-faceted approach that includes policy alignment, capacity-building, and international collaboration will enable Kosovo to achieve a unified, data-driven healthcare system. This will not only improve public health outcomes but also position Kosovo as a model for HIS reform in similar developing contexts.

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Consent to participate: The participants were informed the process of research report.

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