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From Data to Empowerment: How the Integration of a Digital Health Surveillance System Supports Women's Engagement in Healthcare Sector in the Kurdistan Region of Iraq

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ABSTRACT

In Iraq, persistent inequalities between the sexes continue to limit women's access to education, employment, and decision-making roles, particularly within the health sector. In the northern region of Iraq, the Kurdistan Region (KRG) - a context characterized by institutional fragility, unreliable health data and strong demographic pressure - the digitization of health information systems represents a strategic opportunity to improve governance and promote women's empowerment. The present study examines the experience of the KRG-DHIS2, an epidemiological e-health system for data collection developed by the University of Rome Tor Vergata (Italy) in collaboration with the Ministry of Health of the Kurdistan Regional Government. It highlights the initiative's dual impact: strengthening epidemiological surveillance and enhancing women's roles as both producers and users of health data. Since 2016, the project has involved 98 health facilities, trained more than 900 operators–51% of whom are women–and supported female participation in advanced training programs, including doctoral studies and technical leadership activities. The results reinforce the evidence that integrating a digital system, coupled with investment in local capacities, can improve data quality, promote more equitable decision-making, and strengthen women's presence in health governance processes. The experience of the KRG illustrates that women's participation in managing health information systems can help position digital health as a catalyst for equity and sustainable development.

Keywords: Women Empowerment, Healthcare Sector, Iraq, Digital Health Surveillance

INTRODUCTION

Women play a pivotal role in society, serving as primary decision-makers regarding the health and well-being of their families, and are responsible for educating and raising the new generations. Empowering women is a cornerstone of sustainable development, driving both social and economic progress worldwide. In the Middle East, a region characterized by deep-rooted cultural traditions and complex socio-political structures, the path toward equality between men and women has been marked by both meaningful advances and enduring structural

barriers. Women continue to face significant challenges in terms of their representation in the labour market, particularly in the healthcare sector, both as professionals and patients. According to the "World Economic Forum's Global Gender Gap Index", the Middle East and North Africa (MENA) region was ranked the least progressive in terms of women's equality in 2020 (World Economic Forum, 2019).

The consequences of this imbalance are visible in multiple domains of women's lives, including their access to and utilization of healthcare services. In recent years, several Middle Eastern nations have implemented legal reforms and promoted women's participation in the labor market, achieving modest yet notable progress in advancing women's rights. Nonetheless, substantial obstacles remain. Women's participation in the workforce remains a significant barrier across the region. For instance, women in the MENA region earn approximately 22% less than men in comparable positions, according to the International Labour Organization.

Persistent social norms rooted in deeply entrenched patriarchal structures continue to constrain Arab women, reinforcing practices that hinder their development, such as early marriage, restricted access to formal education, and limited employment opportunities (Khamis, 2004). Furthermore, cultural stigmas surrounding women working in public-facing roles hinder their economic participation, particularly in more conservative contexts. In societies with high rates of illiteracy, women—especially those in rural and remote areas—experience disproportionately higher rates of illiteracy compared with men. At the opposite end of the spectrum, many highly educated women are marginalized from both the job market and the information economy (PRB, 2003). In the healthcare sector, a study conducted in Middle Eastern countries showed that women received fewer training and development opportunities than men (Tlaiss, 2013).

To make progress, MENA countries must prioritize women's education, specifically for the healthcare sector and expand female-oriented healthcare services. To achieve meaningful progress in the latter context, governmental and non-governmental institutions in Middle Eastern countries must produce and use specific health data that differentiates between the needs of women and men, to identify disparities in diagnosis, treatment, and healthcare access. Enhancing the scope and granularity of data related to sex bias will enable policymakers to develop evidence-based strategies and measurable objectives. It is equally important to improve women's health literacy and empower them with knowledge and awareness of their own health needs and rights. This kind of empowerment fosters individual agency and contributes to the development of a more equitable and comprehensive healthcare system. Furthermore, advancing women's participation and leadership in science, technology, engineering, and mathematics (STEM) fields is a fundamental step toward reducing gender inequality in health and research. By integrating sex-specific perspectives, female scientists can help ensure that health technologies and interventions address women's specific needs in a more effective way. In fact, women in executive leadership positions tend to improve the quality of interpersonal care more effectively than men, especially in high-pressure, complex organizational environments (Mohamadamin, 2025; Kalbarczyk, 2025).

Iraqi Demographic and Socio-Cultural Contests

Iraq is classified as an upper-middle-income country within the MENA region. Its demographic profile is complex yet relatively homogeneous. In 2022, the population was estimated to be 41,179,000 people (median age of 19.8 years) (UNESCO, 2022) with an Arab majority alongside a significant Kurdish minority, as well as several smaller ethnic and religious groups. According to the European Union Agency for Asylum (EUAA), Arabs constitute approximately 75–80% of Iraq's population, while Kurds account for 15–20%. The remaining 5% consists of minorities, including Turkmen, Shabak, Yazidis, Assyrians, Armenians, and Chaldeans. Islam is the state religion and encompasses about 95–98% of the total population. Of those, 64–69% are Shia and 29–34% are Sunni Muslims. Christians represent around 1–2% of the population, while Yazidis, Mandaeans, and other communities form smaller but long-established groups.

In terms of demographic composition, women account for 49.8% of Iraq's total population. Of those, 35.8% are under the age of 14; 4% are over 65, and women aged 20–45 represent around 35.8% of the total female population (WORLD BANK GROUP, 2024). Around 60.1% of women are aged 15–64, which is considered the working age. Within this group, labour market participation among women varies according to educational attainment. Among women with just a basic education, only 4.3% participate in the labour market. This figure rises to 10.5% and 62.6% for those with an intermediate or advanced qualification, respectively (WORLD BANK GROUP, 2025).

The country's demographic and religious composition profoundly influence the role and social status of women. This reflects broader patterns observed across the Arab world and the Middle East, where social norms, religious traditions, and institutional frameworks collectively shape gender-related dynamics and women's participation in the labour market. This national landscape reflects Iraq's predominantly Arab identity and governance, shaping its socio-political narrative and influencing the social norms that regulate public life (Minority Rights Group, 2023).

The Scenario of Women's Education, Labour and Empowerment in Iraq

Iraq is one of the Arab countries most severely affected by recurring wars and conflicts. After more than three decades of political instability and armed confrontation, the nation is currently undergoing a critical transition that has profoundly impacted both its population and the provision of public services. Over the years, these conditions have led to large-scale population displacements—particularly toward the Kurdistan Region of Iraq (KRI), which has served as a relatively safe refuge for displaced populations. According to data from the United Nations High Commissioner for Refugees (UNHCR), Iraq continues to host approximately one million internally displaced persons (IDPs). Additionally, around 177,300 refugees and asylum seekers, mostly Syrians but also from other nationalities, remain in the country. In 2024, an estimated 56,000 IDPs returned to their areas of origin and faced considerable challenges in reintegrating into communities still deprived of adequate infrastructure, security, and essential services (UNHCR, 2024).

The national recovery process is complex and is characterized by a fragile and dynamic demographic landscape that exerts substantial pressure on Iraqi society, particularly on an already strained health system. Understanding these contextual specificities is essential for accurately identifying the region's needs, vulnerabilities, and priorities for effective health and social interventions. These challenges are reflected in global indicators that monitor progress toward gender equality and social development.

- The "Gender Inequality Index" (GII) quantifies disadvantages in three areas: reproductive health, empowerment, and labour market participation. The index ranges from 0, which indicates equality between men and women, to 1, which indicates maximum inequality. Iraq exhibits a persistently high GII value of 0.671, reflecting substantial sex-related disparities. According to the index, women holding at least secondary education represent 17.6% of the population compared with 35.7% among men - a gap of 18.1%. Labour force participation rates are particularly striking, with only 11.2% of women active in the workforce compared to 73.8% of men, revealing a 62.6% gap (UNDP, 2025). Iraq's national female labour force participation rate remains among the lowest in the world (TheGlobalEconomy.com, 2024).
- The "Gender Development Index" (GDI) measures inequalities in human development achievements across three dimensions: health (life expectancy), education (expected and mean years of schooling), and command over economic resources (estimated earned income). Iraq's GDI value of 0.687 underscores persistent inequities. Female expected years of schooling average 6.7 years, while mean years of schooling are 3.9 for women and 6.9 for men—a difference of three years. Economic disparities are even greater: gross national income per capita in 2021 was USD 1,053 for women compared to USD 12,306 for men, revealing an income gap of USD 11,253 (UNDP, 2025b).
- The "Global Gender Gap Index" evaluates disparities between men and women across four critical domains: health, education, economy, and politics. The unemployment rate among individuals with advanced education further illustrates this imbalance: 29.2% of the women labour force with advanced education are unemployed compared to 13.7% of men with advanced degrees (UN Women, 2025).
- The Sustainable Development Goals (SDG) Index ranks countries based on their performance between the worst (0) and the best or target (100) outcomes. Iraq ranks at the 113th position out of 167 countries. Among the most critical areas identified, "inclusive and equitable quality education" (SDG4) still presents major challenges, together with "gender equality" (SDG5), which remains stagnant or improving at less than 50% of the required rate. Additional challenges persist in "reducing inequalities within and among countries" (SDG10). Consequently, progress toward "good health and well-being" (SDG3) is moderate but insufficient to meet the target (SDR, 2025).

According to data from Iraq's Ministry of Planning, nine out of ten Iraqi women are excluded from the labour market (KRG, 2024). This extremely low level of economic participation is primarily attributed to social norms that define women's roles as domestic caregivers and limit their engagement in professional spaces. Recent data indicate that women's economic participation in Iraq remains among the lowest globally, with only about 10% active and approximately 7.6% employed (United Nations in Iraq, 2022).

The Iraqi Women Integrated Social and Health Survey, which was designed to evaluate the social and health circumstances of women in the Iraqi households, revealed that only 9.2% of women aged 15 and older are employed. An additional 21% of women reported being ready to work but unable to find employment, while 7% were willing to work under certain conditions. Of those not participating in the labor force, 37% cited household and childcare responsibilities as the reason for their inactivity, 22% cited a lack of desire to work, and about 12% reported devoting their time to education (IWISH2, 2022).

Of 153 countries surveyed globally, Iraq ranks 152nd in terms of women's participation in the economy. Even when women do work, Iraqi society continues to demonstrate a strong preference for teaching as an acceptable female profession.

Education in Iraq exhibits a significant imbalance between sexes. The literacy rate among women aged 25–64 years remains slightly below 60% (59.2%, compared to 85.9% for men), and among the elderly population (65+) literacy reaches only 6.7% for women versus 31.0% for men. Encouragingly, younger generations demonstrate more favorable results, with the gender gap in literacy rates narrowing (92.1% for females versus 94.9% for males) (UNDP, 2025). Currently, only 39.5% of women complete secondary education, compared to 56.5% of men (Begum, 2025). These disparities underscore the need for universities and health institutions to ensure equal access for women to academic and professional opportunities, including training, scholarships, conference participation, and leadership roles (Al-Ali, 2012).

In the healthcare sector, women are present as professionals, yet leadership roles remain underrepresented at the national level. Available studies suggest that women are more frequently employed in nursing or other traditional support roles and are underrepresented in managerial and decision-making positions (UNDP, 2022).

Additionally, women face both economic and structural barriers as patients: nearly 48% report a lack of money as the main reason for not seeking healthcare, while regular visits among vulnerable groups remain extremely low. Therefore, the availability of female-specific health services and facilities is limited, and even when such services exist, the country's overall shortage of healthcare infrastructures, combined with high female unemployment, renders medical care inaccessible to many women. These figures reinforce the evidence of high female unemployment, which severely limits women's access to healthcare services (REACH, 2019). These findings confirm that the professional and patient dimensions (women as healthcare providers and users, respectively) are central to understanding gender inequality in Iraq's health sector (Vilardo, 2018).

Politically, women hold 25% of parliamentary seats, while men hold 74.8% (MERI, 2025b). Female representation across governmental ministries remains uneven, as most Iraqi institutions continue to lack a balance in their male-to-female staffing ratios. The report "Gender Reality in Ministries and Institutions in Iraq", released by the Ministry of Planning, revealed significant disparities among ministries. Some institutions, such as the Central Bank and the Ministry of Education, show relatively high female representation—three women for every two men in the latter—while others, including the Ministry of Interior (less than 2%) and the Ministry of Oil (less than 10%), exhibited extremely low female participation (Ministry of planning, 2025; KRG, 2024). Within the Ministry of Health, women account for fewer than 40% of the workforce (MERI, 2025; Alhanabadi, 2025). Additionally, the proportion of female employees in decision-making positions is particularly low in these contexts. Fewer than 1% of women hold decision-making positions capable of influencing future workforce development (MERI, 2025b). This exclusion stems from a combination of structural, social, and psychological barriers (Ministry of planning, 2025b). Therefore, both healthcare institutions and policymakers must develop inclusive frameworks and national strategies to support women's progression into senior leadership roles.

The Scenario of the Kurdistan Region of Iraq: Women's Labour and Empowerment

The Kurdistan Region of Iraq (KRI) is a constitutionally recognized semi-autonomous region in northern Iraq, governed by the Kurdistan Regional Government (KRG), which is based in Erbil. According to the 2005 Iraqi Constitution, the KRG holds legislative, executive, and judicial authority, except in areas reserved for the federal government. The KRI is subdivided into four main governorates: Duhok, Sulaimaniya, Erbil, and Halabja. As of 2023, the region's population was estimated to be around 6.5 million, nearly equally divided between men (3.29 million) and women (3.26 million). Although there has been no recent national census to provide exact figures, official regional estimates suggest that Kurds form the majority, alongside Arab, Assyrian, Turkmen, Yazidi and Armenian minorities (KRG, 2025; The New Region, 2025). These minority groups should be taken into account, as they often represent the most vulnerable populations, who are disproportionately exposed to social and health inequalities, including disparities between males and females. For example, Christians have been among the minority communities most affected by traumatic events in Iraq. A recent study conducted on a sample of Christian couples seeking assistance in Erbil revealed marked sex disparities: 60% of men versus 33% of women had attained a bachelor's degree or higher level of education. The same study also showed significant differences in employment status: 24.1% of men and 70.4% of women were unemployed (Rofo, 2023).

KRI is hosting nearly 90% of all the refugees in Iraq. The most recent official data for 2024, revealed that in 2023 the Kurdistan Region hosted 900,467 displaced individuals, including 631,174 internally displaced persons (IDPs) and 269,293 refugees (251,475 from Syria, 7,796 from Turkey, 8,357 from Iran, 652 from Palestine, and 1,013 from other locations). Among the refugees and IDPs, 70% have integrated into communities outside of these facilities, while 30% (an estimated 110,000 Iraqi families) live across 33 camps within the main governorates: Erbil (41%), Duhok (40%), and Sulaimaniya (19%) (KRG, 2025). This population faces major challenges due to limited access to health and humanitarian services, including food, water, and shelter. These conditions become particularly critical during emergencies. For instance, during the COVID-19 pandemic, both internally IDPs and refugee—especially women—experienced deterioration of living conditions due to overlapping crises, which may have influenced women's attitudes toward fertility and attendance at pregnancy health (Alhanabadi, 2025).

The KRI differs from the rest of Iraq in several socio-cultural and political ways. This distinction has important implications for women's roles and empowerment. While Iraq as a whole remains predominantly Arab and is shaped by conservative norms rooted in patriarchal traditions, the KRI has evolved into a more diverse and socially flexible environment. Specifically, its semi-autonomous political framework enables local governance structures and legal reforms that, in certain cases, have advanced women's rights more than in federal Iraq. For instance, the 2008 KRI Law to Combat Domestic Violence and the 2011 amendment to the Personal Status Law introduced protections against sex-based violence and restrictions on polygamy—measures that remain largely absent or unenforced elsewhere in Iraq (medica mondiale, 2023).

Since the early 2000s, educational attainment among women in the KRI has steadily improved, with female enrollment rates at some public universities surpassing 50% (KRG, 2025b). Socially, Kurdish urban centers, such as Erbil and Sulaimaniya, tend to have higher levels of female participation in education, civil society, and professional life than those in southern or central Iraq.

In 2021, female labour force participation in the KRI reached 16.5% - which is higher than in federal Iraq - compared to 73.5% for men, while the total employment rate was around 45% (Ministry of planning, 2023). Nevertheless, some challenges remain. The coexistence of progressive legislation and traditional norms creates a "dual reality" in which legal equality does not always translate into social or economic parity (WORLD BANK GROUP, 2022). Cultural expectations surrounding women's domestic responsibilities, family oversight of employment decisions, and social stigma surrounding women working in mixed-sex environments continue to limit their full participation (IOM IRAQ, 2019).

The development of women's professional careers within higher education institutions remains a significant challenge (Al-Assawi, 2011). Opportunities in academic and scholarship are often male-dominated, particularly with regard to access to overseas scholarships and research collaborations. This persistent inequality reflects institutional and sociocultural biases (Harb, 2008; Al-Dajani, 2010). Family resistance and social expectations further exacerbate these barriers, making it difficult for women to study or work abroad. Furthermore, female academics tend to be less involved in research and publication activities, focusing primarily on teaching roles. This phenomenon highlights the existence of structural and cultural constraints hindering women's research productivity and leadership in academia (Kaya, 2016; Jacqueline, 2014). Consequently, women's education and their access to academic opportunities in Iraqi Kurdistan are multidimensional issues influenced by both institutional policies and deep-rooted sociocultural norms (Hassan, 2021).

Health Sector in the KRI and Role of Women

Since gaining autonomy under United Nations auspices in 1991, the KRI has established its own health governance framework. Health services are delivered and financed through a mixed public–private model primarily managed by the KRG Ministry of Health, which oversees an extensive network of primary and secondary healthcare facilities funded through public revenues. The Ministry of Finance determines the annual health budget, and the Ministry of Planning is responsible for long-term health strategies. The public health sector in the KRI, overseen by the KRI Ministry of Health (MoH), provides care through two main levels: Public Hospitals (PHs) and Primary Health Care Centers (PHCCs). PHCCs are further categorized into two types. Main centers, located in urban and semi-urban areas, offer comprehensive range of services including primary medical and dental care, immunizations, maternal and child health services, child growth monitoring, oral rehydration therapy for diarrheal diseases, treatment of minor illnesses, and health education. Smaller PHCCs, located in rural areas, offer a more limited set of services. Despite their wide coverage, many PHCCs lack adequate infrastructure and equipment, including laboratories, diagnostic tools, and information technologies. Main PHCCs have at least one general practitioner on staff, supported by dentists, pharmacists, nurses, medical assistants, laboratory technicians, and administrative staff. In contrast, sub-centers are often staffed only by nurses and medical assistants and frequently lack a physician.

Women's health is a particular concern in KRI, because they make up nearly half of the total population. Although notable progress has been achieved in recent decades, women still face significant health challenges. Additional efforts are necessary to fulfil the Sustainable Development Goals' unfinished agenda. Therefore, understanding women's health needs is essential for developing effective interventions (Alsilefanee, 2022).

Health facilities face multiple challenges in data management, primarily due to their continued reliance on paper-based records, which increases the risk of essential information being lost or misplaced. Most available information is inferred from fragmented and outdated surveys, resulting in a scarcity of reliable health statistics and almost no epidemiological surveillance within the country. Consequently, health policies are often based on limited evidence, and the quality of healthcare remains insufficiently monitored and evaluated. Therefore, the World Health Organization (WHO) is supporting initiatives across the Eastern Mediterranean Region to develop national health information systems that improve the timeliness and completeness of health data registration. Integrating equity- and sex-focused approaches into digital health systems and surveillance initiatives would not

only improve the quality of health data but also ensure that women play a central role in shaping equitable and inclusive health policies. The Iraqi Ministry of Health (MoH) has recently sought to adopt e-health solutions to strengthen the national healthcare sector. However, little is currently known about the specific implementation plans or the progress achieved to date at the central government level. The Kurdistan Region's demographic diversity and investments in education have created favorable conditions for initiatives such as digital health for epidemiological surveillance, particularly those that integrate women into technical and leadership roles, which can directly enhance women's health in the region and, indirectly yet significantly, reinforce the broader process of women's empowerment and social participation. In fact, a recent study conducted in Erbil found that 27% of women held leadership positions in the healthcare sector, with most (72.3%) serving as unit heads in hospitals or primary healthcare centers. Since opportunities for leadership training were limited, it is likely that most women acquired their managerial skills through hands-on, experiential learning rather than formal education. Their duties often involved managing teams, coordinating services, supervising junior staff, and participating in administrative decision-making processes. A smaller proportion held higher-level roles as directors within health directorates or primary care centers. Overall, women are more frequently appointed to middle-management positions, which tend to be more attainable than senior executive posts, that require greater authority and involvement in strategic decision-making (UNDP, 2025).

A Practical Example of Women's Empowerment through the Implementation of a Digital Health Data Surveillance System

Since 2015, the University of Rome Tor Vergata (Italy) and the Kurdistan Regional Government's Ministry of Health (KRI MoH)—with the financial support from the Italian Agency for Development Cooperation (AICS)—have collaborated to implement an electronic health information system (KRG-HIS) in the region. Based on the open-source, Java-based District Health Information Software 2 (DHIS2) platform, the system allows users to enter data from peripheral health facilities directly into central servers via a standard web browser, even under conditions of low or intermittent internet connectivity. The KRG-DHIS2 was designed to improve public health data management by facilitating the collection, analysis, and storage of patients' medical records, which is a public health priority in the area (Emberti Gialloreti, 2020). Since 2016 to date, a total of 98 public health facilities (including 13 hospitals) have been incorporated into the system, distributed as follows: 48 in Duhok, 22 in Sulaimaniya, 21 in Erbil and 7 in Halabja. 18 of these facilities were situated in rural areas. Collectively, these centers have jointly recorded more than 2,260,000 health events since data collection began in 2016.

Since 2018, as part of the project, the University of Rome Tor Vergata has awarded eight PhD scholarships to Iraqi students and professionals with relevant backgrounds, seven in Public Health and Nursing Sciences and one in Computer Science, Control, and GeoInformation. Notably, six of the eight candidates (75%) were women. The PhD students received specialized training in public health disciplines, such us surveillance systems and international health data coding, as well as in the operating and managing the DHIS2 platform. One of their main tasks was to conduct evidence-based research to identifying data collection gaps and review relevant literature to address them. The students also analyzed the structure of health data collection systems in KRI to facilitate the integration of these datasets into the KRG-DHIS2, particularly for maternal and child health services. Since the beginning of their PhD programs and continuing after obtaining their doctoral degrees, these specialists have co-authored several scientific papers addressing major public health issues identified through field research in Iraq and best practices related to implementing the e-health system for data collection. In addition to their academic training, these specialists have received formal leadership training and became focal points for implementing and supporting the development of the KRG-DHIS2 in the region. Therefore, they play a crucial role in ensuring the future continuity and sustainability of the e-health system. They have been designated as focal points for both healthcare workers and local authorities regarding the KRG-DHIS2.

Throughout the project, the local personnel are continuously provided with advanced technical and professional training to ensure that the e-health system is sustainable and autonomous once managed by local authorities. In order to do so, a key component of this initiative is investing in local human resources by creating a "training-of-trainers" procedure to ensure that the PhD specialist can independently train local health facility staff members. Health personnel received ongoing training on the importance of collecting reliable and accurate data. Local staff were closely supervised through field visits and online monitoring during daily data entry to promptly identify and correct errors. When field visits were not possible, communication was maintained via phone calls and online groups to enable rapid feedback and problem-solving. Networking among supervisors and focal points at each health facility helped identify data entry challenges, including missing data, insufficient staff, limited equipment, lack of training, or difficulties in data analysis. Since the project began, a total of 965 professionals have been trained. Of these, 13% were PHs employees, while around 3% were workers from the MoH or regional Directorate of Health officials, and the rest were PHCCs workers. Of the trained personnel, 51% were women. Among these women 31% were medical doctors, 23% were statisticians, 17% were administrative employees, 9%

were managers, 8% were nurses or pharmacists, 5% were reception or planning staff, and 4% were IT department members. Seventy-three percent of these women worked in PHCCs, with around 16% working in rural facilities. Additionally, 17% worked in administrative offices such as the regional health directorates (around 20% of whom worked in the ministry offices), and the others worked in PHs.

Throughout the project, a participatory approach was maintained with continuous dialogue and consultation with KRI health authorities. Performance gaps and implementation proposals were jointly reviewed in order to develop shared strategies. Weekly reports summarized activity checks and feedback from local staff. The MoH provided official authorization for the enrolment of new health centers, meetings with facility supervisors, data retrieval, local training activities, and the sharing of findings within the PhD research framework. PhD specialists adapted implementation strategies to the specific needs of each health facility. Additionally, a dedicated communication line (including phone calls, messaging tools, and online meetings) was established between the local team member and Italian experts—four from the University of Rome Tor Vergata and four from a technical informatics consultancy—to support real-time troubleshooting. The international staff provided ongoing technical assistance, and women accounted for half of the team in both these institutions.

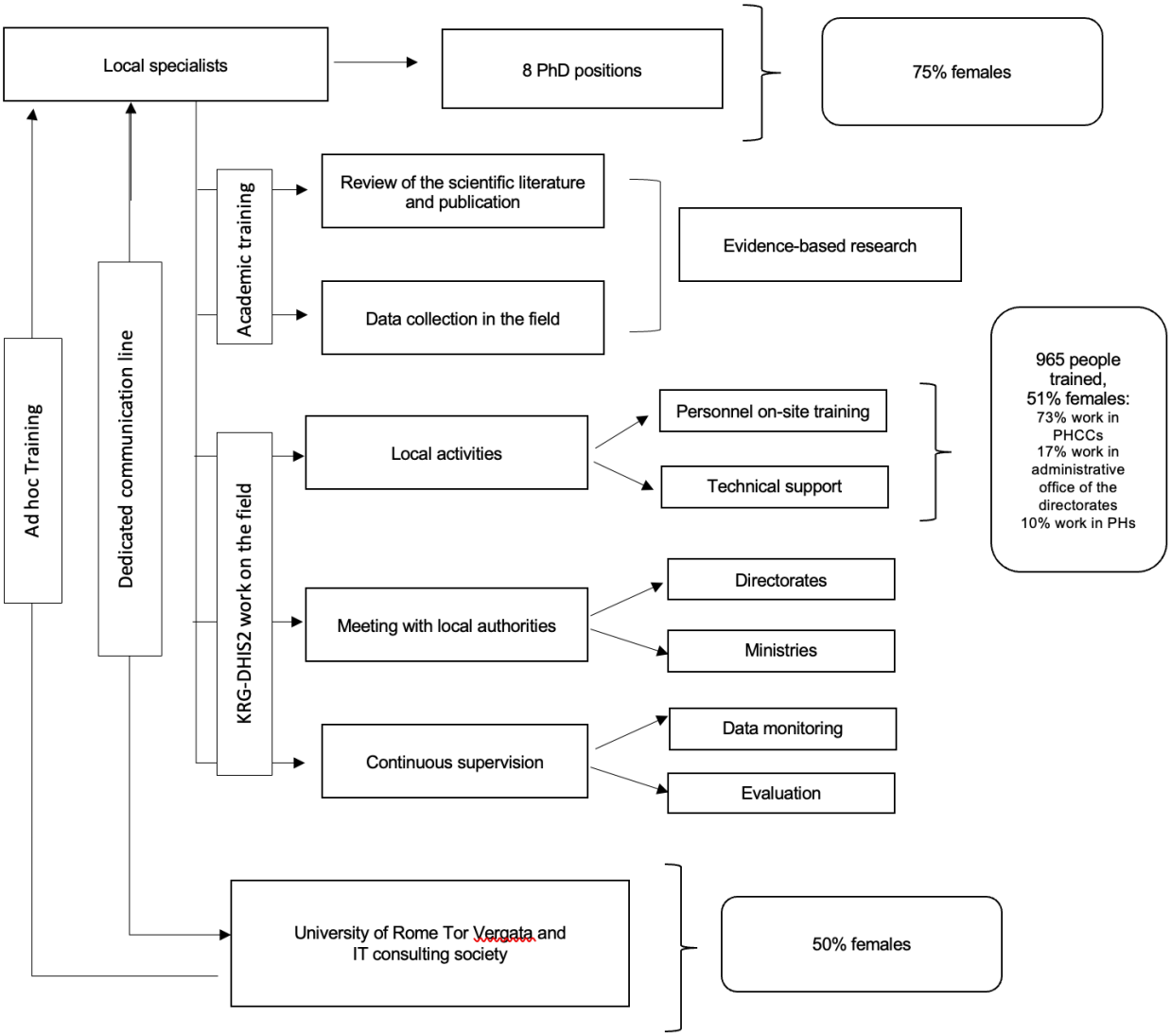

Figure 1. Flowchart of the methodological and implementation steps

CONCLUSION

Despite notable progress in recent years, women in Iraq still face significant obstacles to fully participating in education and labour market, especially in the healthcare sector. Deeply rooted social norms, structural inequalities, and limited access to leadership and training opportunities hinder their professional advancement and ability to contribute to national development. The persistent underrepresentation of women in decision-making positions and the scarcity of sex-disaggregated health data further impede progress toward a more equitable and effective

healthcare system. In this context, several strategic actions are needed to promote women's empowerment and participation, particularly through the opportunities created by the digital health transformation.

Implementing the KRG-DHIS2 is a decisive step toward strengthening health governance in the Kurdistan Region of Iraq. It links the principles of Universal Health Coverage (UHC) and Global Health Security (GHS) within the broader framework of the right to health. By transforming raw data into actionable intelligence, the system contributes to more equitable health planning, informed policy-making, and evidence-based strategies to reduce inequalities, including those related to sex differences (Azeez, 2022). Importantly, the system plays a pivotal role in generating reliable data on women's access to healthcare services and their specific health needs—an essential prerequisite for achieving the Sustainable Development Goals (SDGs) of the 2030 Agenda.

A key outcome of this initiative has been the active inclusion and empowerment of women at every stage of the project. Women have participated not only as beneficiaries of improved health services, but also as key contributors to the development, management, and monitoring of the KRG-DHIS2. Many now hold senior positions within the system's governance and data supervision structures, demonstrating their strong competence in health information management and strategic decision-making. Their involvement has been essential in developing a women-responsive approach to public health information, ensuring that women's health indicators are accurately represented and consistently monitored.

The empowerment of women achieved through this initiative extends beyond health service delivery. It encompasses equitable access to education at all levels, greater participation in the labour market and decision-making processes, enhanced economic independence, and full social recognition as equal contributors to national development. Collaborating with the University of Rome Tor Vergata has further advanced women's academic and professional opportunities. Several female health professionals have pursued doctoral studies and contributed to the scientific literature through peer-reviewed publications. These achievements underscore the project's broader societal impact, where access to education, research, and leadership roles translates into stronger representation and agency for women in the health sector. It is essential to foster a robust research culture that actively encourages women's participation in scientific projects, data analysis, and publication. Continued investment in mentorship, international collaboration, and lifelong learning will further strengthen women's leadership and visibility in health and digital innovation.

The KRG-DHIS2 thus serves two purposes. First, it is a technical instrument that improves public health data management. Second, it is a social catalyst that fosters equity, professional growth, and institutional resilience. Continued investment in female leadership and the promotion of a data-driven public health culture will be crucial to ensuring the system's sustainability and potential expansion to other regions. Ultimately, the Kurdistan Region of Iraq's experience demonstrates that when women are empowered as data producers, analysts, and decision-makers, digital health systems evolve from surveillance tools into transformation engines. The KRG-DHIS2 contributes to the fulfilment of the 2030 Agenda's central promise—to leave no one behind—by transforming the health information landscape (Gialloreti, 2020). This study offers a valuable contribution to the limited body of literature on women's engagement in healthcare within Iraq's unique sociocultural and institutional context. The findings highlight how the integration of digital health surveillance systems can not only strengthen health data management but also foster women's participation, leadership, and empowerment. In the evolving health landscape of Iraq, empowering women through digital health is a critical step toward equitable governance and improved population health outcomes.

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