

Assessing the impact of digital transformation on healthcare performance: A case study of healthcare establishments in the province of Midelt

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Abstract

In Morocco, digitalization now stands among the primary levers for modernizing the healthcare sector, and a national programme supports the digital overhaul of care delivery and of the establishments providing it. Whether such change translates into better performance remains an open empirical question. The present study puts that question to the test in the province of Midelt, a mountainous territory characterised by a dispersed population and by highly uneven access to services. A structured questionnaire was administered to 103 healthcare professionals who mobilise digital tools in their daily work, and perceived performance was measured through four dimensions drawn from the literature, namely efficiency, quality of care, accessibility and equity of services. Descriptive statistics, Pearson correlations and multiple linear regression were computed with IBM SPSS Statistics (v.26). The model explains 60.4% of the variance in perceived performance. Two predictors reach significance, service efficiency ($\beta = 0.371$, $p < 0.001$) and quality of care ($\beta = 0.342$, $p < 0.001$), which supports H1 and H2. Accessibility ($p = 0.273$) and equity ($p = 0.127$) remain below the significance threshold, an outcome traced to local constraints, starting with a telemedicine programme still confined to the pilot stage. The findings plead for patient-centred digital solutions, sustained investment in suitable tools and continuous strengthening of the digital skills of healthcare personnel.

Keywords: Digitalization; healthcare sector; quality of care; service efficiency; accessibility; equity of services

1. Introduction

Health occupies a central position on the international policy agenda, and the COVID-19 crisis reinforced that position. The pandemic revealed structural fragilities within healthcare systems, including those of the wealthiest nations, and it demonstrated that the capacity to absorb shocks now rests on resilience, innovation and organisational flexibility (Keesara et al., 2020). Among the most visible legacies of the crisis stands the accelerated recourse to digital technology in care delivery. Under intense pressure, hospitals and their personnel relied on telemedicine, connected health applications and monitoring systems to preserve continuity of care, sustain coordination and keep patients within reach of services (Whitelaw et al., 2020). Early systematic evidence confirms the breadth of this movement, since digital solutions were mobilised within a few months for diagnosis, prevention, surveillance and treatment across

very different health systems (Golinelli et al., 2020). Ting et al. (2020) add that digital technology thereby acquired the status of a strategic complement to conventional public health instruments rather than that of a mere support function.

Morocco has translated this orientation into its national planning. The Ministry of Digital Transition and Administration Reform (2024) promotes modernised public services and stronger interoperability under the Digital Morocco 2030 strategy. Within the health sector, this agenda converges with the New Development Model reforms and with the generalisation of social protection. The Ministry of Health and Social Protection has consequently engaged a series of projects, from the digitisation of administrative procedures and the reinforcement of information infrastructure to centralised electronic medical records and telemedicine. According to the Kingdom of Morocco (2025), the objective consists in providing all citizens with care that is simultaneously better and closer.

Three objectives federate these projects, namely fairer access for populations living at a distance from services, continuity and quality of care, and a more efficient organisation. Maita et al. (2024) regard digital technologies as the chief agents of such modernisation because they strengthen the robustness and the transparency of a system while overcoming physical barriers. The research field nevertheless converges on a prudent reading. On the basis of a systematic review, Kraus et al. (2021) show that the managerial benefits of digital transformation depend on organisational factors, workforce practices and socio-economic conditions far more than on the mere presence of technology. Interoperability difficulties persist, training lags behind, organisations resist change, rural infrastructure remains uneven and geography still conditions access to technology. The impact of digitalisation on the performance of healthcare organisations therefore deserves a careful empirical examination rather than an act of faith.

The province of Midelt offers a demanding observation ground, and its selection was deliberate. The territory sprawls across the High Atlas and its foothills, with a population that is anything but concentrated. Localities such as Imilchil, Anfgou or Gourrama sit at the end of mountain roads that snow regularly closes in winter, far from the provincial hospital, and consulting a specialist still implies a long and costly journey for many households. In such a setting, the digital tools operating in health centres, from national programme management software to the hospital information system, exceed the status of an administrative convenience since they can substitute, at least partially, for distance. Focusing on the establishments of the Provincial Health Delegation of Midelt therefore permits an assessment of what the daily use of these technologies brings, or fails to bring, to service organisation, access to care, quality of treatment and patient satisfaction.

The study consequently addresses the following question.

To what extent does digital transformation improve healthcare performance in Midelt's healthcare establishments?

Answering it requires tracing the contribution of digital tools to the main dimensions of establishment performance identified by the literature, namely efficiency, quality of care, accessibility and equity. A quantitative strategy was retained, through a standardised questionnaire administered to the health personnel working in the establishments of the province. Such an approach produces reliable data for the continuous improvement of health systems and permits a balanced weighing of the benefits and the limits of digital transformation in this particular context.

The conceptual framework developed from the literature distinguishes four key components of performance.

- Healthcare service efficiency designates the capacity to use resources in the best way in order to obtain the best health results.
- Quality of healthcare designates the degree to which care is delivered with the expected outcomes, according to best practices and with risk kept to a minimum.
- Access to health services designates the ability of individuals to obtain the care they need when they need it, free of financial, geographic, organizational or social restrictions.
- Equity of healthcare services designates the capacity of the system to provide quality care in an equitable manner, adjusted to the specific needs of each person and exempt from discrimination related to social, economic or geographic status.

The framework is put forward in support of the following hypotheses.

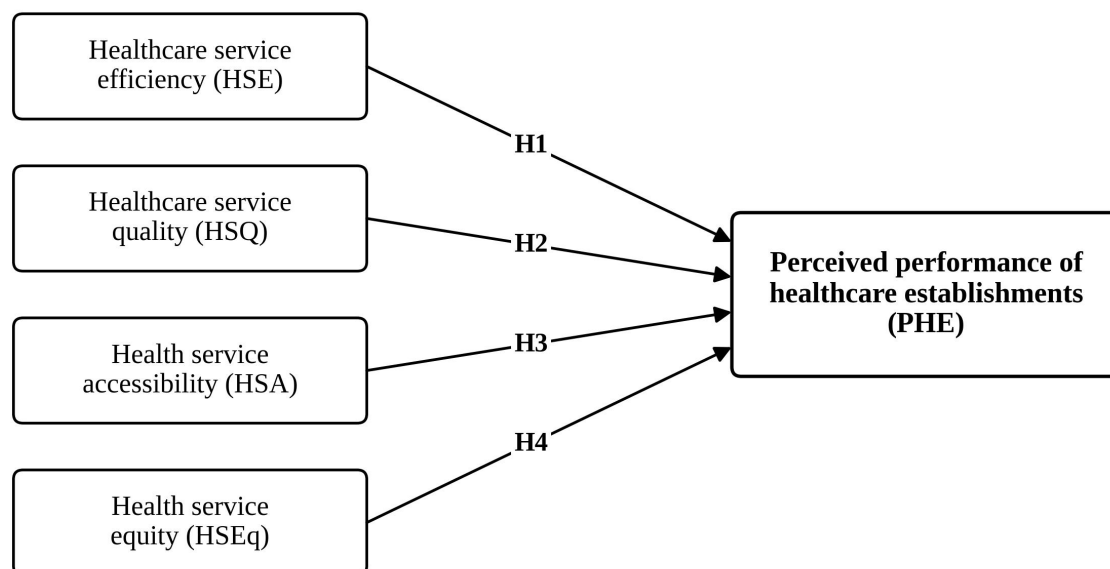
H1. By enabling a more optimum deployment of resources for the sake of maximal health outcomes, the digitalization of healthcare facilities has a positive effect on service efficiency.

H2. Quality is improved through digitalization as it fosters adherence to best practices and patient safety in order to secure the best possible results.

H3. Digital tools make it simpler for patients to access care by removing some of the financial, organizational and geographical obstacles that would otherwise stand in the way.

H4. Digitalization promotes equality in healthcare services by ensuring for all people an equitable access to sound treatment in line with their needs, irrespective of background or other circumstances.

Figure 1. Conceptual research model



Source: developed by the author

Two contributions follow from the study. For policymakers and managers of a resource-constrained province, it identifies which performance metrics respond to digitalization and which remain inert, a distinction of importance when budgets stay limited. For the Moroccan reform agenda, it delineates the conditions, training and patient-facing tools chief among them, under which technology delivers quality care to hard-to-reach populations instead of empty promises.

2. Literature review

A growing body of research examines how digitalization affects the performance of healthcare establishments, and many studies present digital technologies as levers for improving care in terms of efficiency, equity and quality (Kraus et al., 2021). This section reviews that evidence along the three lines of inquiry that inform the study, namely process efficiency, the quality of care, and matters of access and equity. It also keeps in view a question the literature keeps revisiting, which concerns the conditions under which the promised advantages actually materialise.

2.1. The impact of digitalization on the efficiency of healthcare establishments

Efficiency provides the clearest illustration of how digitization reorganizes care. It reduces costs, stretches resources and allows work to proceed with less friction. The use of electronic health records and digital billing to automate the administrative side of activity lightens the load, expedites processes and narrows the scope for human error. Agha (2014) observes that such a transition yields sizeable cost savings together with tidier financial and organizational accounts. Resource management constitutes a second mechanism. Fichman et al. (2011) demonstrate that an integrated Enterprise Resource Planning system corrects the old imbalance between over-stretched and under-used assets by allowing a more exact planning of material and human capacity. Lee et al. (2013) document the same phenomenon in practice, since real-time monitoring and digital means of communication improve the coordination of departments, patient pathways and waiting times. These tools also standardize clinical operations, secure them against error and relieve part of the administrative burden weighing on medical staff. Because digitized data is at hand and easily shared, duplication of paperwork and loss of information recede, which raises overall productivity (Grabenbauer et al., 2011).

These advantages nevertheless arrive under conditions. The gains drawn from digitalization depend on the organization's infrastructure and on its own digital maturity. Blumenthal and Tavenner (2010) report marked improvements in quality of care and performance where systems are well embedded, as in most industrialized nations, whereas contexts with fewer resources experience the benefits gradually, held back by structural limitations. Furukawa et al. (2010) point to a size effect as well, with larger hospitals extracting more value from the technology than smaller institutions constrained by labour or investment. Burton-Jones et al. (2020) generalise the argument through an institutional analysis and invite researchers to evaluate digital transformation in relation to the practices and the settings in which the tools operate. What these tools deliver is a function of where and how they are put to use, and in a province like Midelt that is precisely the crux of the matter.

2.2. Improving the quality of care through digitalization

Quality of care forms the second front, for which the mechanisms at work are amply documented. Error reduction remains paramount, and it is achieved in large part by the

combination of electronic health records with clinical decision support systems. Such a system acts as a real time companion to the practitioner, putting forward recommendations based on sound protocols and clinical data in order to contain prescription errors or drug interactions (Bates et al., 2003). The electronic records themselves render patient information more reliable and more available while curbing transcription mistakes and fostering cooperation among staff (Ammenwerth & Shaw, 2005). A second mechanism concerns care suited to the individual as opposed to the norm. With big data analytics now part of the processing of health information, therapies can be adjusted to the particular profile of a patient, which improves tolerance and efficacy (Raghupathi & Raghupathi, 2014).

Mobile applications and connected devices monitor patients on an ongoing basis, support the management of chronic conditions and prevent part of the complications and hospital stays that would otherwise occur, a dynamic consistent with the classical account of innovation diffusion (Rogers, 1983). Recent syntheses confirm that these patient-centric applications now redefine the experience of care itself and place the user at the heart of digitally transformed organisations (Stoumpos et al., 2023). Continuity forms the third element. Through patient portals and shared records, multiple professionals access the very same information, which removes redundant tests and closes gaps in the care plan (McDonald et al., 2014). In areas where health services are sparse, telemedicine provides a means for routine follow up and specialized attention while easing coordination between those involved (Dorsey & Topol, 2016). Safety, personalization and continuity therefore point in the same direction, provided the professionals hold the digital competencies required to operate the tools, a condition that recent reviews identify as decisive for translating technology into clinical quality (Longhini et al., 2022).

2.3. The impact of digitalization on access to healthcare and equity

The matter of access and equity proves less straightforward. Digital tools are remaking the delivery of healthcare and are presented as means to broaden access and erode long-standing inequities, yet the reality remains more complex. The literature indicates that the impact is uneven and contingent on the social context and on the infrastructure at hand (Brenner et al., 2016). Telemedicine offers a first illustration. For those in rural or underserved areas, an online consultation with a specialist spares an arduous journey and simplifies follow-up. Torre-Díez et al. (2015) document how this relieves the system of the costs and logistics of face-to-face visits while putting specialized care within reach of remote communities. Mobile health plays a comparable role for treatment adherence and patient monitoring in places where resources are thin. Digital platforms extend the movement, since they invite individuals to appropriate health knowledge and to become more proactive, and they carry public health education toward demographics that conventional awareness efforts miss (Lupton, 2013). On a systemic level, the analysis of health data permits a better allocation of resources to the highest-risk zones and to the most vulnerable groups.

The limitations deserve equal attention. In technologically sophisticated nations alike, the digital divide constitutes a formidable obstacle that undermines health policy where it should produce the strongest effect (Fang et al., 2018). During the pandemic, disparities in digital access among older and low-income patients directly restricted the reach of telemedicine (Roberts & Mehrotra, 2020). Qualitative evidence gathered among vulnerable groups shows that weak digital skills, language barriers and mistrust hamper the use of digital services and threaten to deepen exclusion precisely where needs are greatest (Kaihlanen et al., 2022). Scholars consequently plead for explicit equity frameworks and for design choices oriented toward inclusion, data security and cultural acceptability (Richardson et al., 2022; Shaw et al.,

2021). If digitalization is to deliver on its promise of equity, health systems must bridge these gaps and foster an inclusion that leaves nobody behind.

2.4. Synthesis and positioning of the study

Table 1 synthesises the mechanisms identified by the literature for each performance dimension together with their boundary conditions. Two lessons emerge from this synthesis. First, the evidence concentrates on high-income contexts and on large hospital structures, whereas rural and mountainous provinces of middle-income countries remain under-documented. Second, the literature treats adoption and performance as distinct phenomena, since the presence of a technology says little about the value it produces. The present study positions itself at this junction by testing, in a Moroccan province marked by strong geographic constraints, the perceived contribution of digitalization to four dimensions of establishment performance.

Table 1. Synthesis of the reviewed literature by performance dimension

Dimension	Main mechanisms identified	Key references	Boundary conditions
Efficiency	Automation of administrative tasks, resource planning, coordination of departments, reduction of duplication	Agha (2014); Fichman et al. (2011); Lee et al. (2013)	Digital maturity, organisational size, infrastructure (Blumenthal & Tavenner, 2010; Furukawa et al., 2010)
Quality of care	Clinical decision support, reliable records, personalised care, continuity of information	Bates et al. (2003); McDonald et al. (2014); Stoumpos et al. (2023)	Digital competencies of professionals (Longhini et al., 2022)
Access	Telemedicine, mobile health, health information platforms	Torre-Díez et al. (2015); Dorsey & Topol (2016)	Connectivity, geography, operational deployment (Jallal et al., 2023)
Equity	Outreach to vulnerable groups, transparency, targeted allocation of resources	Lupton (2013); Richardson et al. (2022)	Digital divide, skills, trust (Fang et al., 2018; Kaihlanen et al., 2022)

Source: compiled by the author from the reviewed literature

3. Methodology

3.1. Type of study

The study is quantitative, descriptive and analytical. Its purpose is simple to state, since it measures the relationship between digitization and the performance of healthcare establishments. The design permits the collection of quantitative data from healthcare professionals and traces the effect of digital technologies across four performance criteria, namely efficiency, quality, accessibility and equity of care.

3.2. Study setting

The research was conducted within the province of Midelt's healthcare establishments. The rationale has been set out above, since the province's socioeconomic make up and geography can constitute an impediment to care, which renders it a fitting environment in which to observe digitalization in action. The scope covers the public healthcare sector in its entirety. It

includes the provincial hospital as well as every urban and rural health centre, which offers a comprehensive picture of the impact of digital transformation on the way care is delivered and managed. In concrete terms, the frame of reference extends from the Midelt provincial hospital to the urban centres of the principal towns and on down to the rural dispensaries under the Provincial Health Delegation. It embraces the whole of the territory's public care pyramid, from the primary level of first line care to the point of referral at the provincial level.

3.3. Population and sampling

The target population comprises the healthcare professionals who actually use the digital tools and applications built into the health system for managing healthcare activities and services, that is practising physicians, nurses and administrative staff. The sampling strategy was exhaustive rather than probabilistic. With the support of the Provincial Health Delegation, every professional identified as a regular user of the digital applications in service was invited to take part, whatever the establishment or the professional category. Of the questionnaires returned, 103 were complete and usable, and they make up the final sample. The census-type approach made sense for two reasons. The population of active digital-tool users in the province is small, and a convenience sample drawn from a handful of facilities would have carried a selection bias the study preferred to avoid. For each of the five constructs of the model (PHE, HSE, HSQ, HSA, HSEq), an aggregate score was computed as the mean of the corresponding Likert items, once the internal consistency of each scale had been checked (Section 4.1).

3.4. Data collection tools

Table 2. Structure of the measurement instrument

Section of the questionnaire	Focus of measurement	Item format
Performance of healthcare establishments (PHE)	Overall perceived performance of the establishment	Five-point Likert
Efficiency of care delivery (HSE)	Resource allocation, error reduction, operating expenses, waiting times	Five-point Likert
Quality of care (HSQ)	Personalised care, diagnostic precision, patient management, care safety	Five-point Likert
Accessibility and equity of services (HSA, HSEq)	Reach toward remote or vulnerable groups, transparency, specific needs, reduction of inequities	Five-point Likert
Integration of digital solutions	Adoption, main tools used, training received, self-assessed mastery	Closed-ended
Sociodemographic characteristics	Gender, age group, professional category	Closed-ended

Source: developed by the author

Data were collected with a structured questionnaire administered electronically. The instrument counts thirty questions organised in six sections, whose structure appears in Table 2. Most items are closed-ended questions and five-point Likert scales, designed with the usual requirements of validity and reliability in mind. Before full distribution, a pre-test was run with ten professionals of the provincial hospital, chosen to reflect the three target categories, namely physicians, nurses and administrative staff. The pilot confirmed that the instrument

was understandable, relevant and consistent. It changed little, a few wording adjustments were made and the sociodemographic section moved to the end of the form so the questionnaire would open more lightly. Participants gave their informed consent before completing the final version.

3.5. Data collection and analysis

Collection ran over one month, in February 2025, once the ethical authorization obtained in January was in hand. The questionnaire went out online through Google Forms, relayed by the focal points of each establishment to the professionals of the province known to use digital tools in their work. Responses were entered into IBM SPSS Statistics (v.26) and analysed with descriptive statistics, Pearson correlations and multiple linear regression, and the same software produced the statistical outputs and the figures that illustrate the results section. Before running the regression, the reliability of the measurement scales was checked with Cronbach's alpha, sampling adequacy with the KMO index and the absence of problematic multicollinearity with tolerance and VIF values. The classical assumptions of the linear model held up as well, since the normal P-P plot of standardized residuals showed a distribution close to normality and the scatterplot of standardized residuals against predicted values displayed a pattern free of marked heteroscedasticity.

3.6. Ethical considerations

The research followed current ethical principles and received the authorization of the Delegation of the Ministry of Health and Social Protection of Midelt (Approval No. 41/07 January 2025). Participants were told what the study was for, how their data would be kept confidential, and that they could withdraw at any time, and their informed consent was obtained. Anonymity and data confidentiality were strictly protected.

4. Results

4.1. Reliability of the measurement scale

Table 3. Summary of the results of the factor analysis

Variable	KMO	Cronbach's alpha	Total explained variance (%)	Reliability level
The performance of healthcare establishments (PHE)	0.780	0.900	77.47	Excellent
Healthcare services efficiency (HSE)	0.758	0.762	58.79	Good
Healthcare service quality (HSQ)	0.817	0.873	72.58	Excellent
Health service accessibility (HSA)	0.798	0.896	76.36	Excellent
Health service equity (HSEq)	0.698	0.761	59.16	Good

Source: SPSS Output (v.26)

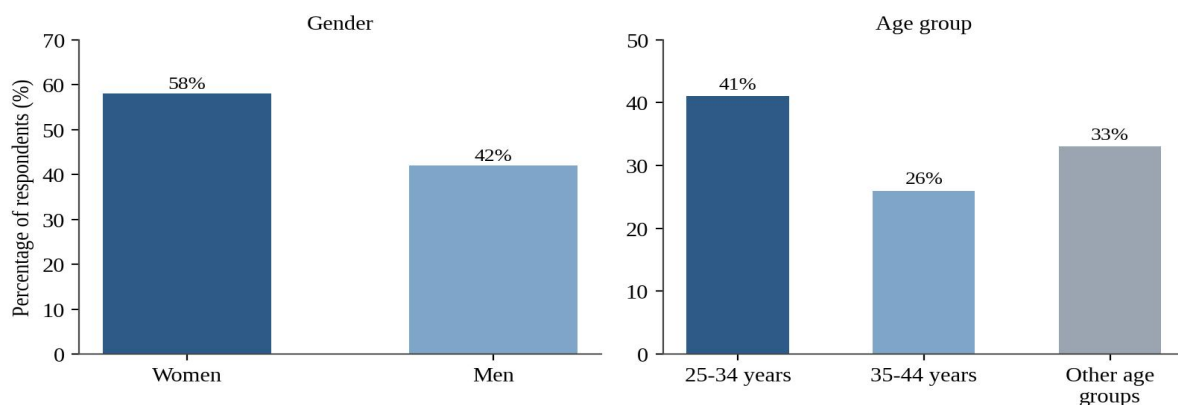
The internal reliability and the adequacy of the variables matching the dimensions of the conceptual model were assessed with Cronbach's alpha, the KMO index and the total explained variance. Table 3 sets out the results. The constructs hold up well. The KMO coefficients indicate that the sample suits factor analysis, Cronbach's alpha values between 0.761 and 0.900 point to good, and in three cases excellent, internal consistency, and the total explained variance confirms that the dimensions examined are the relevant ones.

4.2. Descriptive statistics

4.2.1. Sociodemographic characteristics

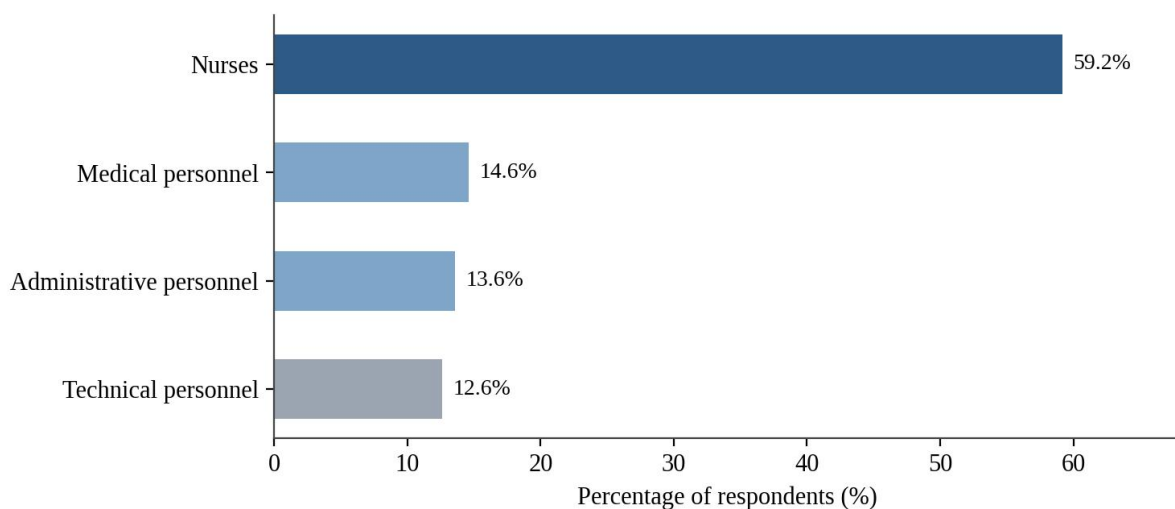
Women make up about 58% of the personnel in the establishments managed by the Provincial Health Delegation of Midelt. The staff is young, too, since 41% of respondents are between 25 and 34 years old and another 26% between 35 and 44. Figure 2 summarises these distributions. Nurses form the largest professional category (59.2%), which fits their central role in the delivery of care. Medical personnel follow at 14.6%, administrative personnel at 13.6% and technical personnel at 12.6%, as Figure 3 shows. A young, mostly female workforce emerges, with nurses at its core.

Figure 2. Distribution of respondents by gender and age group



Source: developed by the author from SPSS (v.26) outputs

Figure 3. Distribution of respondents by professional category

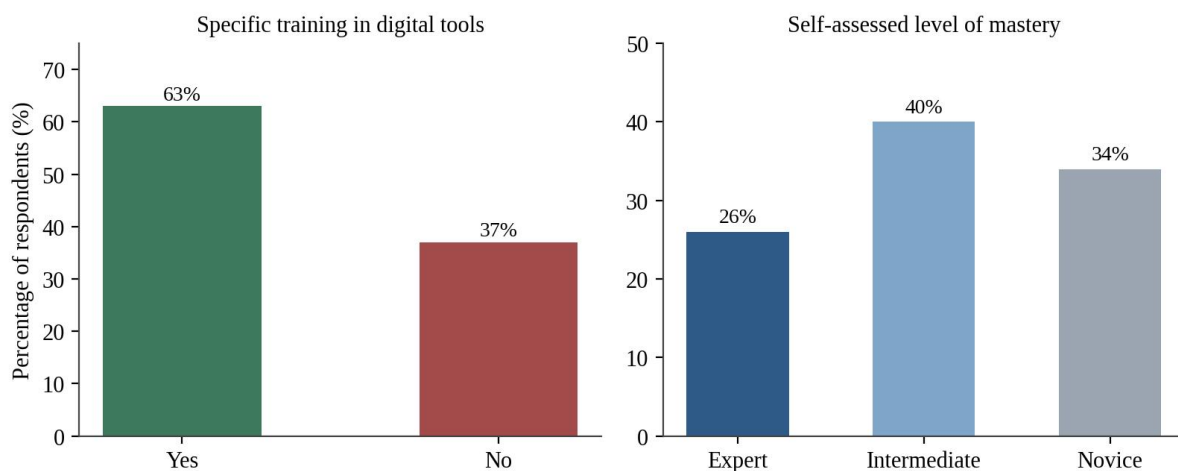


Source: developed by the author from SPSS (v.26) outputs

4.2.2. Adoption and utilization of digital solutions

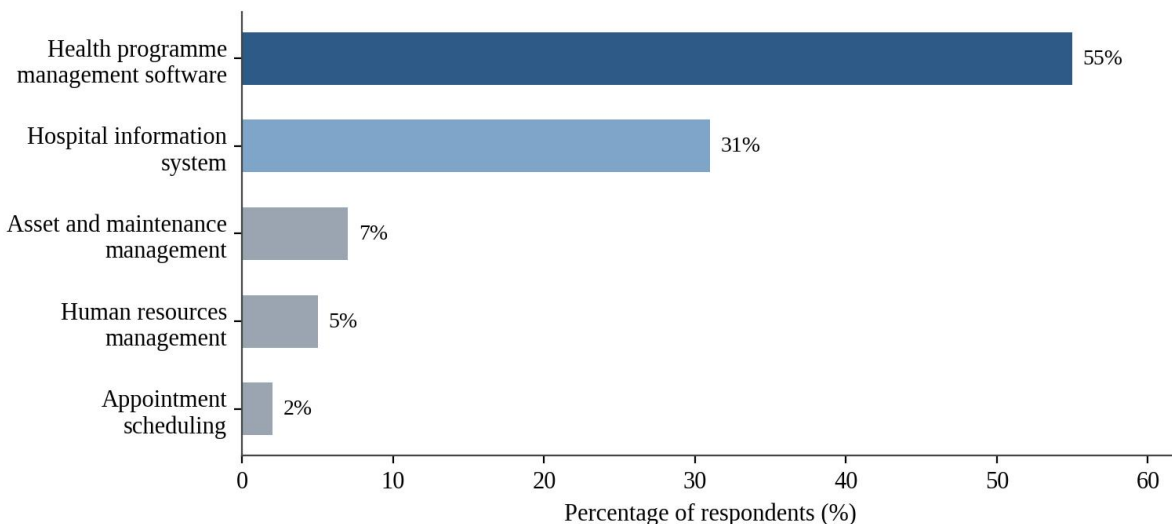
Digital transformation has come a long way in the province, since 98% of healthcare services have adopted digital solutions and only 2% have yet to integrate them. Training has trailed behind. While 63% of participants received specific training on these technologies, 37% went without, and that gap shows in the self-assessments, where 26% of users call themselves expert, 40% intermediate and 34% novice. Put differently, nearly three quarters of the personnel work below the expert level on tools they handle every day. Figure 4 illustrates this contrast.

Figure 4. Specific training in digital tools and self-assessed level of mastery



Source: developed by the author from SPSS (v.26) outputs

Figure 5. Main digital tools reported by respondents



Source: developed by the author from SPSS (v.26) outputs

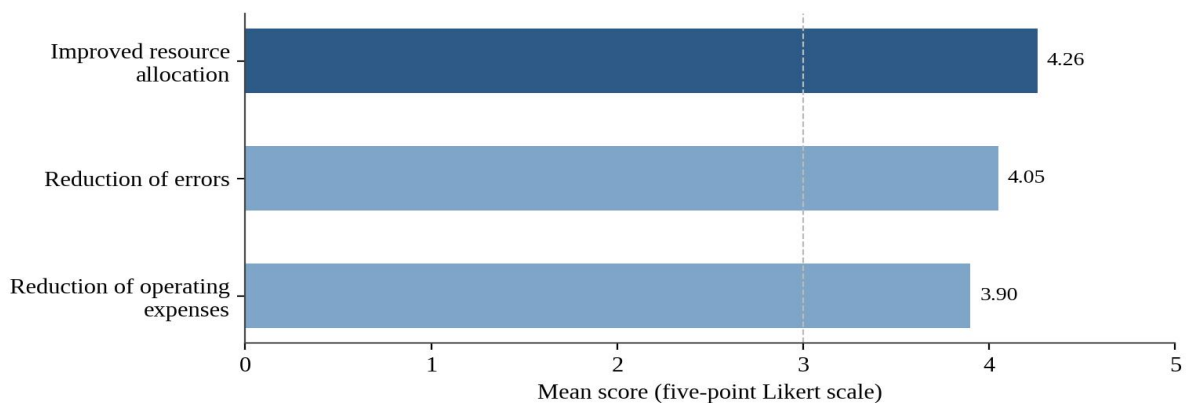
The tools themselves tell a story. Health programme management software is the most widespread (55%), followed by hospital information systems (31%), which says a lot about where priorities lie, namely operational running and service coordination. Everything else remains marginal, appointment scheduling at 2%, computer-assisted asset and maintenance

management at 7%, human resources management at 5%. Administrative and logistical operations still have a long way to go, as Figure 5 makes visible.

4.2.3. The role of digitalization in optimizing the efficiency of health services

Respondents broadly agree that digitalization has lifted the efficiency of healthcare. More than 75% say it improves resource allocation (mean score of 4.26), and close to 70% that it helps cut errors (mean score of 4.05). On operating expenses they are more careful, with a mean of 3.90, as if the financial benefits were felt yet still uncounted. Opinions scatter most on the reduction of patient waiting times, where views genuinely diverge. Figure 6 orders these perceptions.

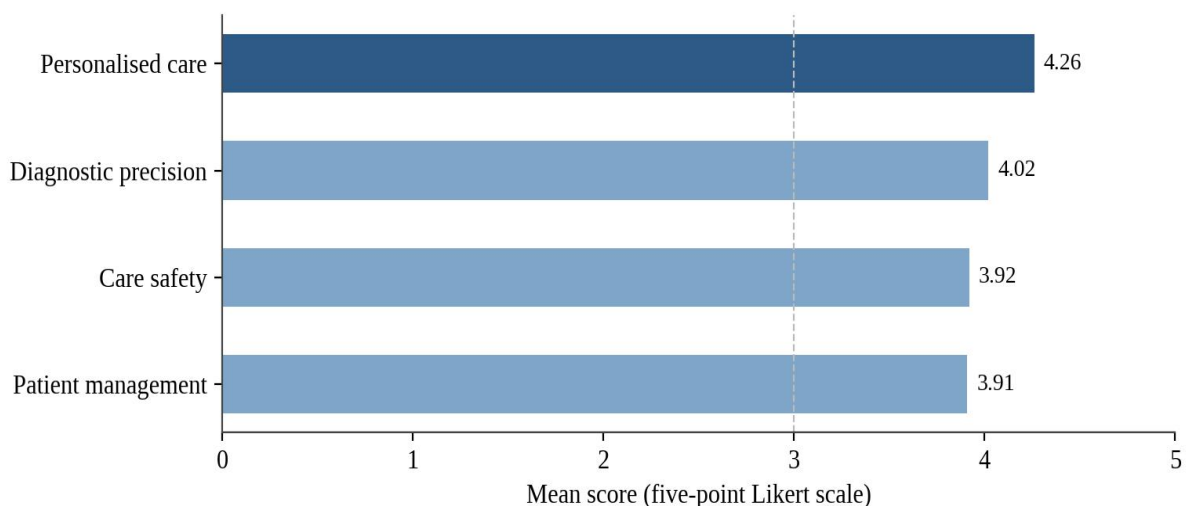
Figure 6. Perceived contribution of digitalization to service efficiency (mean scores)



Source: developed by the author from SPSS (v.26) outputs

4.2.4. Perceived influence of digitalization on the quality of healthcare services

Figure 7. Perceived influence of digitalization on quality of care (mean scores)



Source: developed by the author from SPSS (v.26) outputs

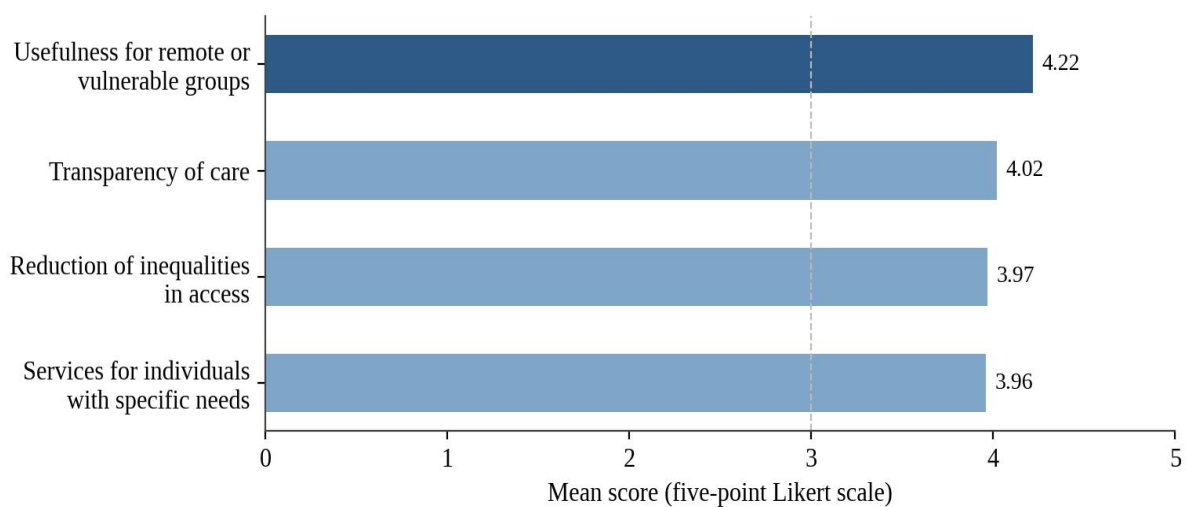
On quality of care, the judgment is favourable, with mean scores close to 4 on the scale used. Personalized therapy made possible by digital instruments stands out as the key benefit ($M = 4.26$), ahead of improved diagnostic precision ($M = 4.02$). Patient management ($M = 3.91$) and care safety ($M = 3.92$) draw more moderate marks. The standard deviations are moderate,

a reminder that respondents' experience of digitalized practice varies. Figure 7 presents these means.

4.2.5. Perceived impact of digitalization on access to and equity of health services

Perceptions of access and equity are favourable as well. Fully 84.4% of participants consider digitalization useful for remote or vulnerable groups (mean = 4.22), and 80.4% say it improves the transparency of care (mean = 4.02). More than 78% also value the services offered to individuals with specific needs ($M = 3.96$) and the reduction of inequities in access to care ($M = 3.97$). Again the standard deviations point to diverse viewpoints, yet the overall reading remains clear, since digitalization is seen as a promising avenue for equity and access. Figure 8 gathers these scores.

Figure 8. Perceived influence of digitalization on access and equity (mean scores)



Source: developed by the author from SPSS (v.26) outputs

Respondents therefore credit digitalization with a key role in efficiency, quality of care and equitable access, while holding back on cost reduction and waiting times. Whether these perceptions survive statistical testing is the question the next section answers.

4.3. Testing of research hypotheses

4.3.1. Collinearity test

Table 4. Collinearity diagnostics

Model	Dimension	Eigenvalue	Condition index	(Constant)	HSQ	HSE	HSA	HSEq
1	1	4.814	1.000	.00	.00	.00	.00	.00
	2	.080	7.746	.17	.09	.00	.13	.25
	3	.054	9.484	.07	.00	.11	.26	.65
	4	.033	12.029	.26	.05	.41	.55	.05
	5	.019	16.076	.50	.85	.48	.06	.04

Note. The last five columns report the proportions of variance. Source: SPSS Output (v.26)

The collinearity diagnostics (Table 4) show a moderate degree of correlation among the studied dimensions, namely quality, efficiency, accessibility and equity of health services. The degree stays moderate and remains far from a level that would compromise the validity of the model, so the variables can be used with confidence. Tolerance and Variance Inflation Factor figures (Table 5) confirm it. Tolerance runs from 0.388 to 0.636, VIF between 1.572 and 2.579, comfortably clear of the usual danger zones (tolerance under 0.1 or VIF above 10). Quality (HSQ), efficiency (HSE), accessibility (HSA) and equity (HSEq) are independent enough of one another to enter the model together.

Table 5. Collinearity statistics of the variables

Variables	Tolerance	VIF
HSQ	.636	1.572
HSE	.388	2.579
HSA	.468	2.135
HSEq	.617	1.622

Source: SPSS Output (v.26)

4.3.2. Correlation between the variables

The performance of healthcare establishments (PHE) correlates positively and significantly with every dimension examined (Table 6). Efficiency comes first (HSE, $r = 0.714$), then quality (HSQ, $r = 0.645$), accessibility (HSA, $r = 0.570$) and equity (HSEq, $r = 0.490$). This delivers preliminary support for the research hypotheses and a first hint of the ranking to come. Multiple linear regression can therefore be run on the four dimensions and the dependent variable with little risk of multicollinearity bias. Table 7 summarizes the model.

Table 6. Pearson correlation

	PHE	HSQ	HSE	HSA	HSEq
PHE	1.000	.645	.714	.570	.490
HSQ	.645	1.000	.602	.414	.302
HSE	.714	.602	1.000	.683	.545
HSA	.570	.414	.683	1.000	.586
HSEq	.490	.302	.545	.586	1.000

Note. One-tailed significance levels remain below 0.001 for all coefficients, except HSQ-HSEq ($p = 0.001$).

Source: SPSS Output (v.26)

Table 7. Summary of the evaluation of the dependent variable: performance of healthcare establishments

Model	R	R-squared	Adjusted R-squared	Standard Error of the Estimate
1	.777a	.604	.588	.88378

Source: SPSS Output (v.26)

The model stands up. Explanatory power is substantial ($R^2 = 60.4\%$) and residual dispersion fairly contained (standard error of the estimate = 0.884). Together, HSQ, HSE, HSA and HSEq account for a large share of the performance of healthcare establishments.

4.3.3. Analysis of variance (ANOVA) test

With the model's robustness established, its statistical significance was tested with an analysis of variance (Table 8).

Table 8. Analysis of variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	116.801	4	29.200	37.385	.000b
	Residual	76.544	98	.781		
	Total	193.345	102			

Source: SPSS Output (v.26)

The model is statistically significant ($F = 37.385$, $p < 0.001$). The regression captures the major share of variation (116.801) while the residual stays moderate (76.544), and the independent variables explain 60.4% of the variance in performance. The model, in other words, can be trusted.

4.3.4. Validation of the research hypotheses

Table 9 reports the regression coefficients and isolates what each predictor contributes on its own, namely healthcare service quality (HSQ), healthcare services efficiency (HSE), health service accessibility (HSA) and health service equity (HSEq).

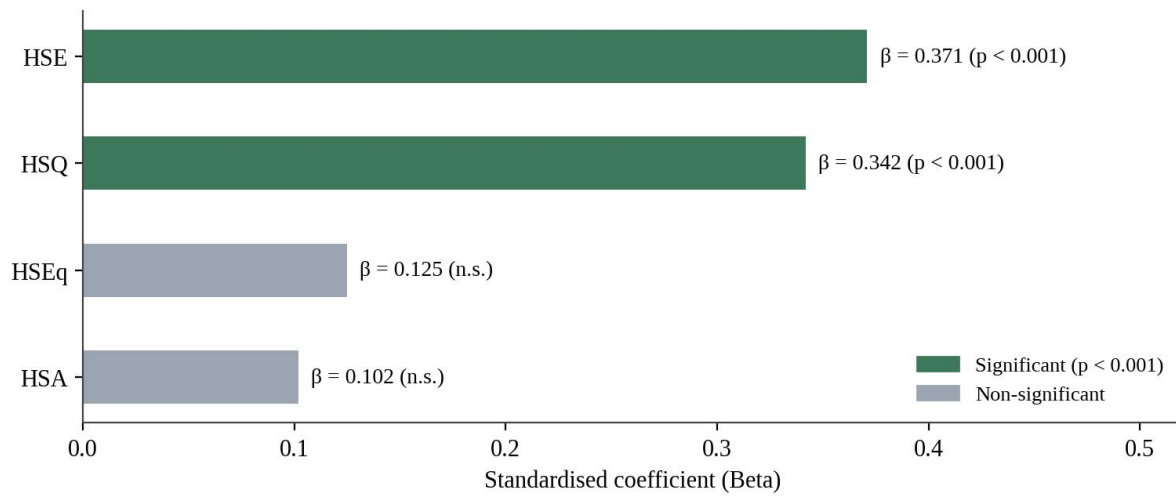
Table 9. Regression coefficients of the explanatory dimensions of the performance of healthcare establishments

Variable	B	Standard Error	Beta	t	P-value
Constant	.028	.415		.068	.946
Healthcare service quality (HSQ)	.401	.093	.342	4.286	.000
Healthcare services efficiency (HSE)	.390	.108	.371	3.630	.000
Health service accessibility (HSA)	.096	.087	.102	1.102	.273
Health service equity (HSEq)	.116	.076	.125	1.539	.127

Source: SPSS Output (v.26)

Two predictors matter. Quality ($\beta = 0.342$, $p < 0.001$) and efficiency ($\beta = 0.371$, $p < 0.001$) weigh significantly on the performance of healthcare establishments, whereas accessibility ($p = 0.273$) and equity ($p = 0.127$) remain below the significance threshold. Within this model, performance runs on quality and efficiency, while accessibility and equity barely register. Figure 9 visualises this hierarchy of standardised coefficients.

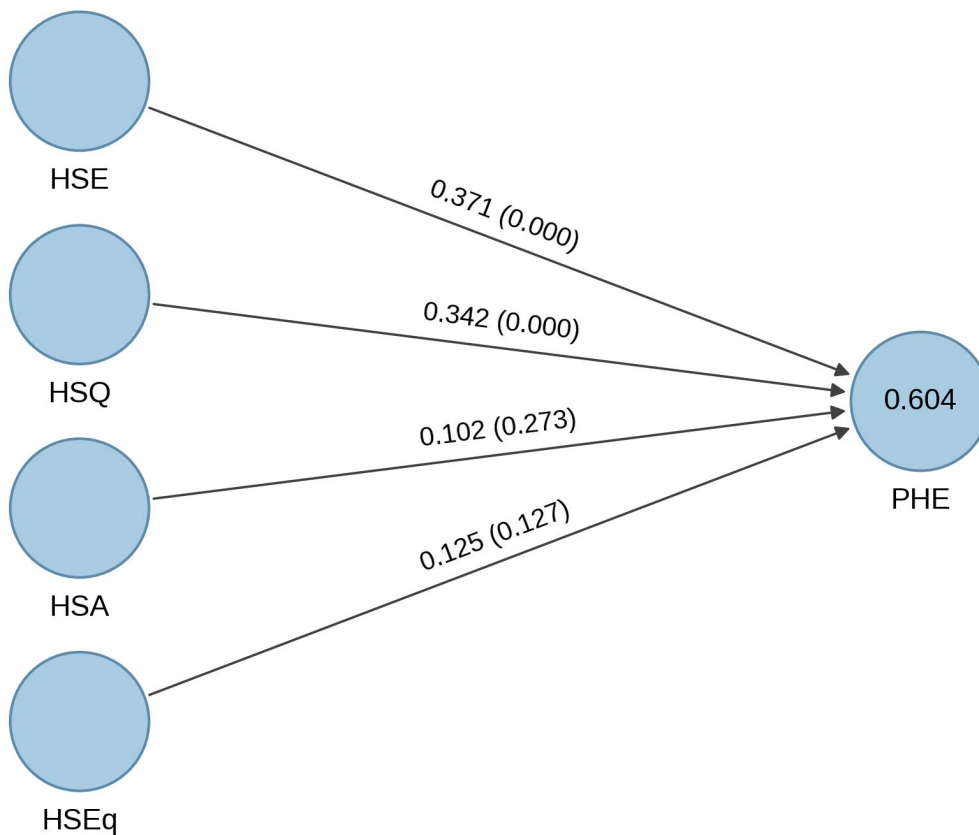
Figure 9. Standardised regression coefficients of the four predictors



Source: developed by the author from SPSS (v.26) outputs

Table 10 pulls the hypothesis tests together. Two hypotheses stand, two fall. Efficiency and quality are confirmed, since digitization enhances both dimensions. Accessibility and equity fall short, which indicates that, in the context studied, digitalization has yet to deliver significant improvements there. Figure 10 superimposes these results on the conceptual model.

Figure 10. Empirically tested research model



Source: developed by the authors

Table 10. Summary of confirmed and rejected hypotheses

Research Hypotheses	Status
H1: By enabling a more optimum deployment of resources for the sake of maximal health outcomes, the digitalization of healthcare facilities has a positive effect on service efficiency.	Accepted
H2: Quality is improved through digitalization as it fosters adherence to best practices and patient safety in order to secure the best possible results.	Accepted
H3: Digital tools make it simpler for patients to access care by removing some of the financial, organizational and geographical obstacles that would otherwise stand in the way.	Rejected
H4: Digitalization promotes equality in healthcare services by ensuring for all people an equitable access to sound treatment in line with their needs, irrespective of background or other circumstances.	Rejected

Source: compiled by the author

5. Discussion

The results show that digitalization has been taken up by virtually every healthcare establishment in the province, with an adoption rate of 98%. These tools have left the experimental stage and now belong to the very fabric of how services are organized. Such a level of penetration matches the World Health Organization's view of digital technology as an essential driver of system quality and efficiency (WHO, 2021), and it echoes the acceleration observed worldwide since the pandemic (Golinelli et al., 2020). Adoption should nevertheless remain distinct from performance. The data in Section 4.2.2 make it clear that the value of digitalization derives less from the presence of infrastructure than from the users' skill in employing it, a distinction that institutional analyses of digital transformation place at the centre of any serious evaluation (Burton-Jones et al., 2020). This reading agrees with Cresswell and Sheikh (2012), who describe the well-documented chasm between owning a technology and mastering it. Only a quarter of the respondents consider themselves experts, 40% stand at an intermediate stage and 34% remain novices, so user proficiency and acceptance emerge as the determining factors.

Much of this variation can be put down to training. While 63% of those surveyed credit their competence to specialized instruction, which Lamia et al. (2025) see as vital for cutting errors and streamlining work, the other 37% lack that background and form a kind of structural impediment to transformation. Systematic reviews reach converging conclusions, since the digital competence of professionals conditions patient safety and the actual usage of the systems in place (Konttila et al., 2019), and validated frameworks now exist to assess and develop these competencies (Longhini et al., 2022). Inan (2025) has shown for Morocco that, without proper programmes and ongoing support, the integrity of clinical and administrative data can suffer. Geography also plays its part, as the Midelt case makes plain. The province is a large mountainous area with health facilities far apart from one another. Organising provincial training means pulling staff from rural centres and making do with smaller teams elsewhere, so the urban and hospital personnel are the ones who get trained first. Those in outlying posts, who stand to gain most from the reach of these tools, end up the least prepared. The literature on implementation places the responsibility for correcting such asymmetries on

healthcare leadership, whose role in supporting frontline users proves decisive (Laukka et al., 2020).

Application usage bears this out. There is a heavy concentration on software for national health programme management (55%) and hospital information systems (31%), a focus on clinical activity and indicators that Zahidi et al. (2025) link to better decision-making. By contrast, appointment or human resources tools see little use, often because they remain the preserve of managers. This narrowness does little to address entrenched inefficiencies. Telemedicine deserves a separate observation. In places like Anfgou, Imilchil and Gourrama the equipment is there, yet the local initiative has stalled at the pilot phase. Jallal et al. (2023) present this situation as typical of the organisational and staffing deficits that block any lasting deployment. For a region where medical professionals are unevenly spread, it amounts to a missed opportunity. Deprived of the stable connectivity, maintenance and formal referral channels needed to make it a routine part of practice, the rooms and devices in these locations sit idle and residents are left to make the journey for consultations the technology could provide.

On the question of professional opinion, there is recognition of real gains in efficiency. Most respondents would agree with WHO (2016) and Agarwal et al. (2010) that error rates are down and resources better allocated. Cost reductions are felt more slowly as they require a shift in practice. As for care quality, while diagnostic precision is viewed favourably, respondents are more circumspect about patient safety, perhaps wary of the day-to-day friction of new tools (Akhtar et al., 2022). They see digitalization as a way to improve equity and transparency for disadvantaged communities, yet the picture remains mixed, since disparities in equipment and skill levels mean that what is perceived and what is observed diverge at times. The hypothesis tests provide an analytical framework to put these observations in context. The data support H1 in that digitalization has a positive impact on the efficiency of healthcare services. As Mrabet and Benfadel (2024) point out, information and communication technology in healthcare settings removes redundancies, better coordinates specialists and makes for more effective use of resources. This is evident in Midelt where, with 98% of services having taken on digital tools and staff properly trained, one sees a more orderly management of processes, especially with the deployment of intermediate or advanced systems. In the end, what the technology yields is a function of user competence.

H2 is also upheld, since the proposition that digitalization enhances the quality of care is borne out. By standardizing clinical protocols and cutting down on the errors of manual administration, digital technologies serve patient safety. One can see this in the way hospital information systems and the national health programme applications in Midelt ensure accuracy and adherence to best practice (Zahidi et al., 2025). Recent international syntheses reach the same conclusion when they associate digitally supported, patient-centric processes with better clinical outcomes, provided competent operators stand at the helm (Stoumpos et al., 2023).

There is little empirical backing for H3, however, and it must be rejected. The figures show that digitalization has done little to overcome the geographic and economic hurdles patients face. Field work in Midelt is instructive, since the province holds the infrastructure while telemedicine operates only partially or below its potential. Deployment has stalled before the routine stage, so the local population draws few consistent benefits. The situation differs from the unequal usage Yao et al. (2022) describe, which widens access gaps among users. In Midelt the problem runs deeper because the digital tools have been focused on the system's internal workings rather than on the patient.

The same holds true for H4, which is rejected on the evidence. Movement toward parity of access between urban and rural areas remains scant. This outcome converges with the international literature on digital health equity, which shows that vulnerable groups derive benefits from digital services only when skills, trust and adapted design are addressed together (Kaihlainen et al., 2022). Deprived of digital solutions that are truly inclusive and oriented to the patient, the system leaves any equity effect beyond measurement. All told, the results suggest that digitalization operates as an effective lever for efficiency and quality while its reach in matters of accessibility and equity stays limited. It is therefore apparent that existing systems need to be supplemented with patient-centred instruments, be it functional telemedicine or aid for vulnerable groups. To become an inclusive tool for universal access, digitalization will have to shed its largely administrative nature. That calls for a thoroughgoing strategy of transformation, with the right training and technologies to meet the actual needs of patients.

6. Conclusions

This study set out to assess the effect of digitalization on the performance of healthcare facilities in the province of Midelt, examined through four service dimensions, namely equity, accessibility, quality and efficiency. The findings present a contrasted picture. On the one hand, H1 and H2 are supported, since digitalization emerges as a strategic asset for improving performance in process management, decision-making and the overall quality and efficiency of services. On the other hand, the anticipated gains in equity and accessibility remain absent from the empirical evidence, which leads to the rejection of H3 and H4. Although the technology is in place, its utility depends closely on the training and expertise of the staff who operate it. Patient-facing solutions remain at an early stage of development, which constrains the contribution of digitalization to access to care. Several recommendations follow from these results. Priority should be given to patient-centred solutions and to sustained support for professionals in their appropriation of new technologies, through the continuous technical assistance and training that these establishments require.

It also appears necessary to reactivate the existing pilot projects, in particular the telemedicine sites that are already installed and awaiting operational deployment. Strengthening these patient-oriented digital services constitutes the condition for their integration into routine practice, and equity frameworks developed by recent research offer a useful compass for designing them (Richardson et al., 2022). This study presents certain limitations that call for prudence in the interpretation of its results. The sample was restricted to the province of Midelt and data collection depended on the availability of professionals, which limits the generalizability of the findings. Moreover, a quantitative approach captures only part of user perceptions and of the barriers to adoption, and a qualitative analysis would be required to explore these dimensions in greater depth. Future research could track over time the influence of digitalization on service efficiency and patient satisfaction, and identify the determinants of the most effective use of these tools in a healthcare environment.

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