



## INTRODUCTION

Digital transformation in the healthcare sector has become a global priority in improving the efficiency of medical services and patient satisfaction. The World Health Organization (WHO) reports that more than 85% of hospitals in developed countries have successfully adopted integrated digital systems, including Electronic Medical Records (EMR), digital queuing systems, and technology-based patient management.<sup>1</sup> Countries such as Japan and South Korea have shown that the implementation of digital technology can cut patient waiting times by up to 50% and improve the accuracy of medical data recording.<sup>2</sup> This proves that digital systems can play an important role in improving the quality of health services and hospital operational efficiency.

The Ministry of Health of the Republic of Indonesia (2022) reports that only around 45% of hospitals in Indonesia have fully adopted digital systems in their healthcare services. Some of the main challenges in implementing this technology include limited technological infrastructure, lack of professionals in the field of information technology, and high investment costs. Research by Rahmawati (2022) revealed that the implementation of digital systems in patient data management in several hospitals in Indonesia has successfully reduced the risk of administrative errors by 25%, showing great potential in improving the effectiveness of health services.<sup>3</sup> Nevertheless, the implementation of digital systems in remote areas still faces various obstacles that need to be addressed immediately.

Kabelota Hospital in Central Sulawesi began implementing the Hospital Management Information System (SIM RS) in March 2024 as an

effort to improve the quality of administrative and medical services. The system covers various functions such as patient registration, medical record management, drug management, and administrative reporting.<sup>4,5</sup> However, the implementation of this system still faces a number of obstacles, such as limited technological infrastructure, lack of training for medical personnel, and resistance to change. An initial survey at RSUD Kabelota showed that more than 60% of outpatients expressed dissatisfaction with the efficiency of the service, especially in the process of registration and retrieval of medical results (Initial Study of RSUD Kabelota, 2024). In addition, the instability of the internet connection and the limited amount of hardware are the main obstacles in the system operation.

Patient perceptions of service quality are strongly influenced by ease of access to information, speed of service, and interaction with medical personnel.<sup>6</sup> According to the *Expectation-Confirmation Model* (ECM) by Bhattacharjee (2001), patient satisfaction depends on the extent to which their expectations match the service experience received. Optimal implementation of digital systems has the potential to increase transparency, reduce administrative errors, speed up the service process, and improve the accuracy of medical data.<sup>7</sup> However, a lack of readiness to implement digital systems can create a gap between patient expectations and the reality of the services provided.

Based on these problems, this study aims to analyze the effect of digital system integration on service quality and outpatient perceptions at Kabelota Hospital, Central Sulawesi. The results of this study are expected to provide strategic



recommendations for the hospital to increase the effectiveness of digital systems and increase patient satisfaction on an ongoing basis.

## MATERIALS AND METHODS

This research uses manual questionnaires for respondents who do not carry *Android mobile phones* and *Google forms* for respondents who carry *Android mobile phones* and have quotas that are shared links when collecting data. First, the validity of the questionnaire was tested, then continued with reliability and normality tests. Univariate analysis was used to describe the frequency and percentage of each variable, which showed the frequency and percentage of respondent characteristics variables "gender, age group, latest education, frequency of visits, reasons for visiting, certainty of patient data protection, payment systems running well and efficiently, digital system integration and service quality, patient perceptions." And bivariate analysis using an ordinal regression test (*Ordinal Logistic Regression*). To analyze the effect of digital system integration on service quality and patient perception.

## RESULTS

In this study, the results of univariate analysis were used to describe the frequency and percentage of each variable. These variables include gender, age group, latest education, frequency of visits, reasons for visiting, certainty of patient data protection, payment systems running well and efficiently, integration of digital systems and service quality, and patient perceptions.

**Table 1. Frequency Distribution of Respondent Characteristics at Kabelota Hospital**

Characteristics	n	%
<b>Gender</b>		
Male	42	34
Female	83	66
<b>Age Group</b>		
18-22 years	12	10
23-27 years	18	14
28-32 years	15	12
33-37 years	17	13
38-42 years	9	7
43-47 years	21	17
48-52 years	20	16
53-58 years	13	10
<b>Last Education</b>		
Primary school/equivalent	1	1
SMP/equivalent	21	17
High school/equivalent	77	61
Diploma	7	6
Bachelor's degree	19	15
<b>Frequency of Visit</b>		
First Time	33	27
1-3 Times	48	38
4-6 Times	13	10
>6 Times	31	25
<b>Reason for Visiting</b>		
Routine Control	33	26
Treatment of Specific Illness	14	11
Health Consultation	76	61
Other	2	2
<b>Certainty of Patient Data Protection</b>		
Strongly Disagree	1	1
Disagree	1	1
Neutral	37	30
Agree	86	68
<b>The Payment System Runs Well and Efficiently</b>		
Strongly Disagree	1	1
Disagree	3	2
Neutral	41	33
Agree	79	63
Strongly Agree	1	1
<b>Digital System Integration</b>		
Deficient (Score <60)	36	28
Fair (Score 60-79)	15	12
Good (Score 80-100)	74	60
<b>Service Quality</b>		
Poor (Score <60)	23	18
Fair (Score 60-79)	98	78
Good (Score 80-100)	4	4
<b>Patient Perception</b>		
Poor (Score <60)	23	18
Fair (Score 60-79)	72	58



Characteristics	n	%
Good (Score 80-100)	30	24
<b>Total</b>	<b>125</b>	<b>100</b>

Source: Primary Data, 2025

Based on the results of the study, of the total respondents, the majority were women (66%) compared to men (34%). The largest age groups were in the range of 23-27 years (14%) and 33-37 years (13%). In terms of education, most respondents had a senior high school education (61%), followed by junior high school (17%) and university degree (15%).

The frequency of visits showed that 38% of respondents had visited 1-3 times, while 27% were first-time visitors. The main reason patients came to the hospital was for health consultation (61%), followed by routine control (26%). In terms of certainty of patient data protection, most respondents agreed (68%), while only 1% disagreed. The payment system was rated as good and efficient by the majority of respondents (63%), although 1% strongly disagreed. Digital system integration was rated as good by 60% of respondents, while 28% considered it lacking. The quality of service was mostly rated as fair (78%), with only 4% rating it as good. Patients' perception of the service also tended to be moderate (58%), with 24% rating it as good and 18% rating it as poor.

Overall, these results show that although most aspects of service and digital systems have been running quite well, there is still room for improvement, especially in digital system integration and service quality, to meet patient expectations better.

**Table 2. Results of Ordinal Regression Test of Digital System Integration Variables on Service Quality**

Service Quality	Digital System Integration
<b>Model Fitting Information</b>	<b>-2 Log Likelihood</b>
Intercept Only	51.513
Final Model	12.902
Chi-square	38.611
df	2
Sig.	0.000
<b>Goodness-of-Fit</b>	<b>Chi-Square</b>
Pearson	0.152
Deviance	0.287
<b>Pseudo R-Square</b>	
Cox and Snell	0.266
Nagelkerke	0.376
McFadden	0.252
<b>Parameter Estimates</b>	<b>Estimate</b>
<b>Threshold</b>	
[Service Quality = 1]	-3.653
[Service Quality = 2]	2.896
<b>Location</b>	
[Digital System Integration = 1]	-3.656
[Digital System Integration = 2]	-2.294
[Digital System Integration = 3]	0a
<b>Link Function</b>	<b>Login</b>

Source: Primary Data, 2025

Based on the *Model Fitting Information* results, the *-2 Log Likelihood* value for the *Intercept Only model* is 51.513, while for the *Final Model* is 12.902, with *Chi-Square* = 38.611 and p-value = 0.000. This indicates that the ordinal regression model used is negatively significant, as it has a large improvement over the intercept-only model.

Furthermore, the *Goodness-of-Fit* results show that Pearson's *Chi-Square* value = 0.152 and *Deviance* = 0.287, which are both greater than 0.05. This indicates that the model fits the analyzed data, so the assumptions of the ordinal regression model are met.

In the *Pseudo R-Square* section, the Nagelkerke  $R^2$  value = 0.376, which means that this model is



able to explain about 37.6% of the data variability in 56 negative Service Quality, while the rest is influenced by other 56 gates outside the model.

The Parameter Estimates results show that all Digital System Integration categories have significant regression coefficients. The threshold value for Service Quality = 1 is -3.653, while for Service Quality = 2 is 2.896, which indicates the separation point between categories in the ordinal regression model.

**Table 3. Ordinal Regression Test Results of Digital System Integration Variables on Patient Perceptions**

Patient Perception	Digital System Integration
<b>Model Fitting Information</b>	
<b>-2 Log Likelihood</b>	
Intercept Only	77.977
Final Model	16.305
Chi-square	61.672
df	2
Sig.	0.000
<b>Goodness-of-Fit</b>	
<b>Chi-Square</b>	
Pearson	0.613
Deviance	0.881
<b>Pseudo R-Square</b>	
Cox and Snell	0.389
Nagelkerke	0.455
McFadden	0.254
<b>Parameter Estimates</b>	
<b>Threshold</b>	
[Patient Perception = 1]	-4.212
[Patient Perception = 2]	0.437
<b>Location</b>	
[Digital System Integration = 1]	-4.339
[Digital System Integration = 2]	-2.689
[Digital System Integration = 3]	0a
<b>Link Function</b>	
<b>Login</b>	

Source: Primary Data, 2025

In the Location section, the regression coefficient for Digital System Integration = 1 is -3.656, and for Digital System Integration = 2 is -2.294. These 56 negative values indicate that the lower the Digital System Integration category, the

less likely it is to get a higher Service Quality category. Conversely, the Digital System Integration = 3 category is used as a reference (value 0a) in the model.

From the results of this ordinal regression analysis, Digital System Integration has a significant effect on Service Quality. The negative coefficient value indicates that an increase in Digital System Integration increases the likelihood of getting better Service Quality.

Based on the Model Fitting Information results, the -2 Log Likelihood value for the Intercept Only model is 77.977, while for the Final Model is 16.305, with Chi-Square = 61.672 and p-value = 0.000. This indicates that the ordinal regression model used is statistically significant, as it has a large improvement over the intercept-only model.

Furthermore, the Goodness-of-Fit results show that Pearson's Chi-Square value = 0.613 and *Deviance* = 0.881, which are both greater than 0.05. This indicates that the model fits the data analyzed, so the assumptions of the ordinal regression model are met.

In the Pseudo R-Square section, the Nagelkerke R<sup>2</sup> value = 0.455, which means that this model is able to explain about 45.5% of the data variability in the Patient Perception variable, while the rest is influenced by other factors outside the model. The Parameter Estimates results show that all categories of Digital System Integration (ISD) variables have significant regression coefficients. The threshold value for Patient Perception = 1 is -4.212, while for Patient Perception = 2, it is 0.437, which indicates the separation point between categories in the ordinal regression model.

In the Location section, the regression coefficient for Digital System Integration = 1 is -



4.339, and for Digital System Integration = 2 is -2.689. These negative values indicate that the lower the Digital System Integration category, the less likely it is to get a higher Patient Perception category. Conversely, the Digital System Integration = 3 category was used as a reference (value 0a) in the model.

From the results of this ordinal regression analysis, it can be concluded that Digital System Integration has a significant effect on Patient Perception. The negative coefficient value indicates that an increase in Digital System Integration increases the likelihood of getting a better Patient Perception.

**Table 4. Ordinal Regression Test Results of Service Quality Variables on Patient Perceptions**

Patient Perception	Service Quality
<b>Model Fitting Information</b>	<b>-2 Log Likelihood</b>
Intercept Only	62.766
Final Model	14.348
Chi-square	48.418
df	2
Sig.	0.000
<b>Goodness-of-Fit</b>	<b>Chi-Square</b>
Pearson	0.346
Deviance	0.652
<b>Pseudo R-Square</b>	
Cox and Snell	0.321
Nagelkerke	0.375
McFadden	0.199
<b>Parameter Estimates</b>	<b>Estimate</b>
<b>Threshold</b>	
[Patient Perception = 1]	-4.699
[Patient Perception = 2]	-1.111
<b>Location</b>	
[Service Quality = 1]	-5.543
[Service Quality = 2]	-2.089
[Service Quality = 3]	0a
<b>Link Function</b>	<b>Login</b>

Source: Primary Data, 2025

Based on the Model Fitting Information results, the -2 Log Likelihood value for the Intercept Only model is 62.766, while for the Final Model is

14.348, with Chi-Square = 48.418 and  $p$ -value = 0.000. This indicates that the ordinal regression model used is statistically significant, as it has a large improvement over the intercept-only model. Furthermore, the *Goodness-of-Fit* results show that *Pearson's Chi-Square* value = 0.346 and *Deviance* = 0.652, which are both greater than 0.05. This indicates that the model fits the analyzed data, so the assumptions of the ordinal regression model are met.

In the Pseudo R-Square section, the Nagelkerke  $R^2$  value = 0.375, which means that this model is able to explain about 37.5% of the data variability in the Patient Perception variable, while the rest is influenced by other factors outside the model.

The Parameter Estimates results show that all categories of Service Quality variables have significant regression coefficients. The threshold value for Patient Perception = 1 is -4.699, while for Patient Perception = 2, it is -1.111, which indicates the separation point between categories in the ordinal regression model.

In the Location section, the regression coefficient for Service Quality = 1 is -5.543, and for Service Quality = 2 is -2.089. These negative values indicate that the lower the Service Quality, the less likely it is to get a higher Patient Perception. Instead, the Service Quality = 3 category is used as the reference (value 0a) in the model.

From the results of this ordinal regression analysis, it can be concluded that Service Quality has a significant effect on Patient Perception. The negative coefficient value indicates that an increase in Service Quality increases the likelihood of getting a better Patient Perception.



## DISCUSSION

Based on Table 2, the results show that digital system integration has a significant influence on service quality at Kabelota General Hospital. The ordinal regression model used shows a great improvement in the fit of the model to the data, which means that the relationship between the variables in this study is quite strong. By the results of previous studies, a well-integrated digital system can improve service efficiency and accuracy of medical records.<sup>9,10</sup>

One of the factors affecting the effectiveness of digital systems is the readiness of medical personnel to use them. Lack of training can slow down data access and input, thus impacting the efficiency of healthcare services. A study by Chang & Lee (2022) also showed that medical personnel who are less skilled in technology are more prone to data input errors, which can ultimately hamper healthcare services.<sup>2</sup> This is also in line with a study by Hassan & Rahman (2024), who found that medical personnel's resistance to digital systems is a barrier to their effective use.<sup>11</sup>

In addition to human resources, digital infrastructure also plays an important role in the successful implementation of digital systems in hospitals. Delays in data access and system disruptions can prolong patient waiting times and hinder quick and appropriate medical decision-making.<sup>12</sup> Lack of adequate storage or processing capacity can lead to data mismatches between service units, making it difficult to coordinate patient care.<sup>13</sup> Chow & Lim (2023) also highlight that while hospital digitalization can improve efficiency, system unpreparedness can complicate the transition and hinder service effectiveness.<sup>14</sup>

Resistance to new technology is also a

challenge in optimizing digital systems in hospitals. Some medical personnel are still more comfortable with conventional methods, which can lead to inconsistencies in recording patient data and hinder the digitalization transition.<sup>7</sup> If this resistance is not managed properly, then the implementation of digital systems will not achieve optimal results, and the expected benefits in improving the efficiency and quality of health services will not be fully realized.<sup>12</sup> Singh & Verma's (2021) research also indicates that lack of training and technical errors in the implementation of digital systems can be factors that hinder the adoption of health technology, especially in developing countries.<sup>15</sup>

The results of this study support the Technology Acceptance Model (TAM) Theory, which states that perceived benefits and ease of use strongly influence technology adoption. If medical personnel feel that digital systems make their work easier, then technology adoption will be more effective and have a positive impact on service quality. Research by Patel et al. (2021) and Chang & Lee (2022) support these findings by showing that good implementation of digital systems can increase service efficiency by up to 30% and significantly reduce administrative errors.

The study by Gonzalez et al. (2023) also showed that the implementation of an optimal digital system can reduce patient waiting time by 40% and increase diagnosis accuracy by 20%. Meanwhile, research by Setiawan et al. (2024) confirms that hospitals that successfully adopt digital systems well experience increased operational efficiency and coordination of medical personnel.<sup>7</sup> On the other hand, Liu & Zhang's (2023) study found that the success of



digitalization is highly dependent on smooth technology integration and continuous training for medical personnel.<sup>16</sup>

Based on Table 3, the results of this study show that digital system integration has a significant influence on patient perception. The ordinal regression model used proved to be statistically significant, with a large increase over the intercept-only model, indicating that the variables in this study have a strong relationship. In addition, the Goodness-of-Fit results show that the model fits the data analyzed, making it reliable in interpreting the relationship between digital system integration and patient perception.

The Nagelkerke  $R^2$  value of 0.455 indicates that this model is able to explain about 45.5% of the variability in the patient perception variable, while the rest is influenced by other factors outside the model. This finding is in line with the research of Patel et al. (2021), which states that the use of an integrated digital system increases patient satisfaction by 30% and reduces medical errors by 15%. Patel et al. also emphasized that suboptimal implementation can cause delays in data access and communication barriers between medical personnel and patients.<sup>9</sup>

In addition, Chang & Lee's (2022) research also supports the results of this study, where they found that electronic medical record systems increased healthcare efficiency by 25% and improved patient perceptions of service quality. However, they also noted that limited technical support and lack of training may hinder the benefits of such digital systems.<sup>2</sup>

Gonzalez et al. (2023), in their study of hospitals in the United States, showed that the adoption of good digital technology can reduce

patient waiting time by 40% and increase the accuracy of diagnosis by 20%. This shows that an efficient digital system not only speeds up service delivery but also increases patient confidence in the health services provided.

Setiawan et al. (2024) found that the implementation of a good digital system improves the coordination of medical personnel, reduces administrative errors, and improves hospital operational efficiency with a significance level of  $p < 0.001$ . These results suggest that in addition to impacting the speed and accuracy of services, integrated digital systems also contribute to the overall patient experience.

However, some factors that may affect the effectiveness of digital systems in improving patient perceptions are infrastructure limitations, lack of medical personnel training, and resistance to new technologies. Kim & Kang (2021) reported that slow or frequently interrupted systems can cause delays in service delivery, which impacts patient satisfaction.<sup>17</sup> Errors in electronic records and limited data storage capacity can also hinder medical personnel's access to patient history, reducing the effectiveness of healthcare services.<sup>13</sup> This is also reinforced by Nguyen & Tran's study (2024), which found that telemedicine as part of healthcare digitization needs to be improved in terms of accessibility and training for medical personnel for maximum results.<sup>18</sup>

Based on the results of this study and previous studies, improving the quality of hospital services, both in terms of timeliness, communication, and digital system efficiency, has a major impact on patient perceptions. Therefore, efforts to improve service quality and digital system integration need to be continuously developed to improve patient



satisfaction and overall healthcare effectiveness.

Based on Table 4, the results of ordinal regression analysis show that service quality has a significant influence on patient perceptions. The -2 Log Likelihood value, which decreased significantly from the Intercept Only model to the final model, as well as the significant Chi-Square value ( $p < 0.05$ ), indicated that the model used in this study was able to describe the relationship between variables well. In addition, the *Goodness-of-Fit* results show that the model used fits the data analyzed, so the assumptions of ordinal regression are met. With a Nagelkerke  $R^2$  value of 0.375, the model is able to explain about 37.5% of the variability in patient perceptions, while the rest is influenced by other factors not included in the model.

This finding reinforces the results of previous studies that highlight the importance of service quality in shaping patient perceptions of health services. Gonzalez et al. (2023) found that improving healthcare standards increased patient satisfaction by 35% ( $p < 0.01$ ), especially in the aspects of service timeliness and communication between medical personnel and patients. Similarly, Chang & Lee (2022) reported that hospitals with more responsive service systems experienced a 27% increase in patient satisfaction ( $p = 0.004$ ), suggesting that well-integrated systems have a positive impact on patient experience.

Kim & Kang (2021) stated that patients who receive friendly, efficient, and accurate services tend to have a more positive perception of health services. Their study found that 80% of patients ( $p < 0.05$ ) were more satisfied with health facilities that emphasized effective communication and involvement of medical personnel. Meanwhile,

research by Setiawan et al. (2024) focusing on hospitals in Indonesia found that hospitals with better service standards experienced a 40% increase in positive patient perceptions ( $p = 0.003$ ), which is in line with the findings of this study.

In addition to service quality factors, the effectiveness of queuing and administrative systems also plays a role in improving patient perceptions. Wang et al. (2020) reported that patients' positive perceptions of health services increased by 25% ( $p < 0.01$ ) when queuing and administration systems were more efficient(12). Oktaviola et al. (2022) also found that the use of digital-based service systems can reduce patient complaint rates by 30% ( $p = 0.002$ ), proving that digital integration can contribute significantly to improving patient perceptions of healthcare services.<sup>19</sup>

Nonetheless, some studies show results that are not in line with these findings. For example, Hassan & Rahman (2024) in their study found that resistance to hospital digitalization remains a significant challenge, with 42% of medical personnel reporting difficulties in adapting to the new system. This can lead to patient dissatisfaction due to longer and less efficient service processes.<sup>11</sup> In addition, Singh & Verma (2021) revealed that the challenges in implementing electronic medical records in developing countries are still enormous, especially related to infrastructure readiness and minimal training of medical personnel.<sup>15</sup>

Chow & Lim (2023), in their research, stated that hospital digitalization has both positive and negative impacts.<sup>14</sup> Although digital systems can speed up administrative processes, lack of infrastructure reliability often leads to technical glitches that hamper services. Tanaka & Saito



(2020) also reported that while the use of artificial intelligence (AI) in hospital digital systems can improve efficiency, suboptimal implementation slows down the workflow of medical personnel due to technical glitches and lack of interoperability between different systems.

In addition, a study by Rodriguez & Bennett (2022) showed that the implementation of *digital care pathways* could improve patient satisfaction but requires good coordination between various healthcare units to run optimally.<sup>20</sup> Nguyen & Tran (2024) also found that although telemedicine has a digital strategy can improve access to healthcare services, the technology gap between large hospitals and remote areas is still an obstacle to its equitable implementation.<sup>18</sup>

Based on the results of this study and previous studies, improving the quality of hospital services, both in terms of timeliness, communication, and efficiency of digital systems, has a major impact on patient perceptions. However, the successful implementation of digital systems is strongly influenced by infrastructure readiness, training of medical personnel, and acceptance of technology by health workers. Therefore, efforts to improve service quality and digital system integration need to be continuously developed to improve patient satisfaction and the overall effectiveness of health services.

## CONCLUSIONS AND SUGGESTIONS

Based on the results of the research that has been conducted, the integration of digital systems has a significant influence on service quality and patient perceptions at Kabelota Hospital, Central Sulawesi Province. Improved service quality supported by effective digital systems can improve

patient experience in obtaining health services. In addition, better service quality is also proven to contribute to positive patient perceptions of the hospital. Therefore, optimal implementation of digital systems is an important factor in improving patient satisfaction and overall efficiency of health services.

As a recommendation, hospitals need to ensure the effectiveness of digital system integration with strategic measures such as developing better technology, training medical personnel on the use of digital systems, improving digital infrastructure, and continuous evaluation to ensure the system can function optimally. In addition, further research is recommended to use longitudinal methods with larger samples and approaches that combine subjective and objective data to gain a more comprehensive understanding of the impact of digital system integration in health services.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article.



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