

Digital transformation of health licensing services: a qualitative study of service processes, human resource capacity, and system reliability in indonesia

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ABSTRACT

Introduction: Digital transformation has improved the accessibility, transparency, and efficiency of public licensing services. However, health licensing remains dependent on effective procedures, competent personnel, and reliable digital systems. This study explored health licensing services at the Makassar City Investment and One-Stop Integrated Services Agency, focusing on service processes, human resources, and technology.

Methods: A descriptive qualitative study was conducted in July 2026. Five informants were selected purposively, comprising one key informant, three primary informants, and one supporting informant. Data were collected through in-depth interviews, non-participant observation, and documentation. The data were organized, reduced, categorized, and interpreted using content analysis, with source, method, and data triangulation applied to strengthen credibility.

Results: Licensing procedures generally followed established SOPs, although incomplete documents and limited applicant understanding sometimes caused delays. Personnel demonstrated adequate procedural and communication skills, but workloads increased during peak demand. Digital systems supported service delivery, although slow performance, maintenance, and server downtime occasionally disrupted operations.

Conclusion: Health licensing services were generally well implemented, but service quality could be strengthened through clearer applicant information, continuous workforce development, workload management, and improved reliability of digital infrastructure. These improvements may support more accessible, efficient, and resilient public licensing services.

Keywords: digital technology; health services administration; human resources; licensure; public services.

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Highlight:

- Health licensing services generally followed established SOPs.
- Staff demonstrated adequate competence and communication skills.
- Digital systems supported efficient service delivery.
- Applicant understanding and technical disruptions remained key challenges.
- Stronger information, workforce support, and system reliability are needed.

INTRODUCTION

Health licensing is a critical component of public administration because it regulates the legality, safety, and accountability of health-related practices and facilities. Unlike routine administrative services, health licensing combines administrative verification with technical requirements that are directly related to professional standards, patient safety, and public protection. In Indonesia, these services are increasingly delivered through digital government platforms intended to simplify procedures, improve transparency, and reduce administrative delays. Nevertheless, digitalization does not automatically eliminate service bottlenecks^{1,2}. The quality of licensing services continues to depend on the clarity of procedures, the competence and responsiveness of personnel, and the reliability of the technological infrastructure supporting the process. In Makassar City, these issues are particularly relevant because licensing activities are relatively intensive and involve coordination between the Investment and One-Stop Integrated Services Agency and technical health authorities.

Public service theory emphasizes that service quality should be assessed not only by the final administrative output but also by the experience of citizens throughout the service process. The New Public Service perspective positions citizens as rights holders who are entitled to responsive, transparent, accountable, and accessible services^{3,4}. Similarly, the SERVQUAL framework highlights reliability, responsiveness, assurance, empathy, and tangible support as important dimensions of service quality. In health licensing, these principles translate into clear requirements, predictable processing times, accurate information, responsive staff, and accessible assistance when applicants encounter difficulties^{5,6}. The complexity of health licensing makes these dimensions especially important because incomplete documents, misunderstanding of procedures, or delays in technical verification may extend processing time and reduce confidence in public institutions.

The increasing use of digital licensing platforms has added another layer to this service environment. Indonesia has adopted electronic licensing through the Online Single Submission Risk-Based Approach, while the Makassar City government also uses locally developed digital platforms to support licensing services that are not fully accommodated by the national system. These systems are expected to improve efficiency, accessibility, document tracking, and transparency^{7,8}. However, existing evidence indicates that digital public services remain vulnerable to system instability, limited digital literacy, network disruptions, and uneven user understanding^{9,10}. Previous studies on electronic licensing in Indonesia have shown that online platforms can accelerate administrative processes, yet their effectiveness may be constrained by technical problems and difficulties experienced by users in navigating digital procedures. This suggests that technological availability alone is insufficient to ensure effective service delivery.

Human resources are equally important in determining whether digital transformation results in meaningful service improvement. Personnel are responsible for interpreting regulations, verifying applications, communicating requirements, assisting applicants, and coordinating with technical agencies^{11,12}. Their competence therefore influences both administrative accuracy and service experience. The Human–Organization–Technology Fit perspective further suggests that digital systems perform effectively only when technological capacity is aligned with human capability and organizational processes. In practice, staff may be technically capable of operating licensing systems while still facing increased workloads during periods of high demand or needing to provide substantial assistance to applicants who have limited understanding of online procedures^{13,14}. Thus, service performance emerges from the interaction between processes, personnel, and technology rather than from any single component.

Despite the growing literature on e-government and electronic licensing, an important gap remains. Many studies primarily evaluate digital innovation from the perspective of system implementation, efficiency, or user satisfaction, while fewer studies examine how service procedures, human-resource capacity, and technological reliability interact within health-specific licensing services. This gap is important because health licensing differs from general business licensing by requiring stricter administrative and technical verification and, in some cases, coordination with health authorities. In Makassar City, public satisfaction with government services has been reported as high, but service-related challenges persist in procedural consistency and system implementation. Therefore, aggregate satisfaction indicators may not adequately explain the operational conditions that shape licensing performance.

The novelty of this study lies in its integrated qualitative examination of health licensing services through three interrelated dimensions: service processes, human resources, and systems and technology. Rather than assessing digitalization as an isolated technological intervention, the study explores how procedural arrangements, staff capability, applicant interaction, and system reliability collectively influence the delivery of health licensing services. This approach provides context-specific evidence that may help explain why formally standardized and digitally supported services can still encounter operational barriers.

Accordingly, this study aimed to explore the implementation of health licensing services at the Makassar City Investment and One-Stop Integrated Services Agency. Specifically, it examined the service process, the role and capacity of human resources, and the contribution and limitations of supporting systems and technology. The findings are expected to provide evidence for strengthening service information, workforce capacity, workload management, and digital system reliability in health licensing administration.

RESEARCH METHODOLOGY

Study Design

This study employed a descriptive qualitative design to explore health licensing services at the Makassar City Investment and One-Stop Integrated Services Agency (DPMPTSP). The qualitative approach was selected because the study aimed to obtain an in-depth understanding of service implementation based on the experiences, perspectives, and practices of individuals directly involved in health licensing services. The analysis focused on three main domains: service processes, human resources, and systems and technology. This design enabled the researchers to examine not only formal service procedures but also operational conditions, staff experiences, applicant interactions, and technological constraints encountered during service delivery.

Setting and Participants

The study was conducted in July 2026 at the Makassar City Investment and One-Stop Integrated Services Agency, South Sulawesi, Indonesia. Participants were selected using purposive sampling, based on their direct involvement in or experience with health licensing services. A total of five informants participated in the study. They consisted of one key informant, namely the Head of DPMPTSP; three main informants who served as licensing operators; and one supporting informant who had previously used the health licensing service. The key informant was selected because of responsibility for the management, supervision, and evaluation of licensing services. Licensing operators were included because they were directly involved in processing applications, operating the OSS-RBA system, verifying documents, and addressing

operational barriers. The service user was included to provide information regarding the applicant's experience of the licensing process.

Participants were eligible when they had direct involvement in managing, providing, operating, supervising, or using health licensing services and were willing to participate in the study. Individuals without direct experience of the licensing process were not included. Because the study used a qualitative design, no statistical sample-size calculation was required. Participant selection emphasized relevance to the phenomenon under investigation and the capacity to provide information related to the study objectives.

Study domains and data sources

The study examined three principal domains. The service-process domain included service flow, administrative procedures, application requirements, document verification, processing time, and permit issuance. The human-resource domain included personnel competence, communication ability, service attitude, understanding of standard operating procedures, staffing adequacy, teamwork, and capacity to assist applicants. The systems-and-technology domain covered the use of digital licensing systems, OSS-RBA, supporting computers, internet connectivity, system functionality, technical disruptions, and staff capacity to operate digital platforms. Primary data were obtained directly from informants through in-depth interviews and non-participant observation. Secondary data were used to complement the primary findings and were obtained from institutional documents, regulations, literature, the DPMPTSP profile, and other documents relevant to health licensing services.

Data collection

Data were collected through in-depth interviews, non-participant observation, and documentation. Semi-structured interview guidelines were used to ensure that the main areas of inquiry were addressed consistently while allowing participants to elaborate on their experiences. The interviews explored the implementation of licensing procedures, clarity of service requirements, document verification, timeliness, staff competence, communication with applicants, workload, coordination, use of digital systems, and technological barriers. Interviews were conducted at an agreed time and place. With participants' permission, conversations were audio-recorded to minimize information loss and facilitate accurate transcription.

Non-participant observation was conducted by observing service activities without direct involvement in the service process. The observation focused on the implementation of service procedures, staff interactions, availability of service facilities, document-processing activities, use of digital technology, internet availability, and technical problems encountered during service delivery. Documentation was used to support and cross-check information obtained from interviews and observations. Relevant institutional documents and service-related information were reviewed to strengthen interpretation of the findings.

Data quality and trustworthiness

The trustworthiness of the qualitative data was strengthened through triangulation of sources, methods, and data. Source triangulation was undertaken by comparing information obtained from the Head of DPMPTSP, licensing operators, and the service user. Method triangulation involved comparing findings from interviews, observations, and documentary evidence. Data triangulation was performed by examining similarities and differences across the information obtained from these different sources. This process helped reduce reliance on a single perspective and provided a more comprehensive interpretation of the actual conditions of health licensing services.

Data analysis

Data were analyzed using content analysis. The analytical process began with transcription of the recorded interviews into written form. The researchers subsequently reviewed and organized the information according to the research objectives. The analysis involved several stages: data collection, transcription, organization and classification, data reduction, categorization, interpretation, and conclusion drawing. Relevant statements were selected and grouped according to recurring issues and similarities in meaning. Data unrelated to the research focus were excluded from further interpretation.

The resulting information was categorized into three major domains: service processes, human resources, and systems and technology. Interview findings were then compared with observational and documentary evidence to identify recurring patterns, consistencies, and differences across data sources. The results were presented narratively and supported by relevant participant statements. Data processing and analysis were conducted manually, as reported in the manuscript. No quantitative statistical analysis was performed. Accordingly, descriptive statistical tests, bivariate analysis, multivariable regression, confidence intervals, p-values, and a statistical significance level of $\alpha = 0.05$ were not applicable to this qualitative study.

Ethical considerations

Participation in the study was voluntary. Before the interviews, participants were informed about the purpose of the research, the interview procedures, the intended use of the information provided, and the documentation process. Participants were given an opportunity to decide freely whether they wished to participate. Written informed consent was obtained from each participant before data collection. Participants consented to participation in the interview, use of the information for research purposes, audio recording, and documentation of research activities. Participation was undertaken without coercion, and interview activities were conducted at times and locations mutually agreed upon by the researchers and participants.

RESULT

Before presenting the thematic findings, the characteristics of the informants are summarized to provide context regarding their roles and perspectives in the health licensing process. The five informants represented service management, licensing operators, and service users, with ages ranging from 35 to 54 years.

Table 1. Characteristics of study informants

No.	Informant Code	Position/Role	Age (years)	Sex	Informant Category
1	MA	Head of DPMPTSP	54	Male	Key informant
2	AM	Licensing operator	35	Male	Main informant
3	MI	Licensing operator	36	Male	Main informant
4	AN	Licensing operator	35	Female	Main informant
5	YU	Service user	36	Female	Supporting informant

Table 1. Sociodemographic and role characteristics of informants involved in the qualitative study of health licensing services at the Makassar City Investment and One-Stop Integrated Services Agency. The study included five informants aged 35–54 years, comprising one key informant, three main informants, and one supporting informant. This composition provided perspectives from service management, frontline licensing operators, and a service user.

Analysis of the interview, observational, and documentary data generated three major themes: (1) structured service processes with persistent applicant-related barriers, (2) competent and responsive human resources under variable workload demands, and (3) enabling but not fully reliable digital systems. These themes reflected the interaction between administrative procedures, personnel capacity, and technological infrastructure in the delivery of health licensing services.

Theme 1. Structured Service Processes with Persistent Applicant-Related Barriers

The first theme reflected a generally structured licensing process supported by established standard operating procedures and digital service mechanisms. Participants consistently described a sequence beginning with application submission, document completeness checking, verification, technical review when required, and permit issuance. Different platforms were used according to the type of license, including OSS for health-facility licensing and Solata BOS for selected health-professional licensing services.

One operator explained:

“The applicant submits the application through the system according to the type of permit required. The documents are then checked and verified. If a document is incorrect or incomplete, the application is returned for correction.” (AM, 35 years).

Another participant emphasized that technical coordination remained necessary for some applications:

“If technical verification is required, we forward it to the technical team. Delays usually occur because the applicant's documents are incomplete or the applicant is late in correcting the requirements returned through the system.” (AN, 35 years).

The findings therefore identified three related subthemes: standardized licensing procedures, document verification and technical coordination, and applicant understanding as a source of delay. Although service information was generally available, operators repeatedly reported incorrect document uploads, incomplete requirements, and difficulties understanding electronic procedures. These findings were supported by observation, which showed that the licensing process followed a clear sequence but could be delayed by incomplete documents, delayed corrections, technical recommendations, and system disruptions.

The service user's experience was relatively positive. The participant considered the process understandable but continued to rely on staff assistance when additional clarification was required:

“I think the process is quite easy to understand. If something is unclear, I can ask the staff directly, and they explain the steps that need to be followed.” (YU, 36 years)

This indicates that direct assistance remained important even within an increasingly digital service model.

Theme 2. Competent and Responsive Human Resources under Variable Workload Demands

The second theme concerned the role and capacity of service personnel. Staff generally demonstrated adequate understanding of SOPs, communication skills, and the ability to assist applicants. Operators reported using SOPs and service standards as the basis for checking requirements, verifying applications, and determining whether cases needed referral to technical units.

One operator stated:

“Services are provided based on the applicable SOPs and service standards, from checking the completeness of requirements and document verification to issuing the permit when all requirements have been fulfilled.” (MI, 36 years)

The service user similarly perceived staff communication and assistance positively:

“If I ask about the process or requirements, the staff explain according to what I need. The information provided is quite helpful in completing the documents.” (YU, 36 years)

Three subthemes were identified: procedural competence, communication and applicant assistance, and workload-related staffing pressure. Although personnel were generally capable of performing their duties, operators indicated that staffing adequacy varied according to service demand. One participant explained:

“Under normal service conditions it can still be handled, but when the number of applicants increases, the staff workload also increases. The number of personnel needs to be adjusted to the service workload.” (MI, 36 years)

Another noted that individual staff members could be required to manage several service needs simultaneously when application volumes were high. These perceptions were consistent with observational findings showing that staff were generally capable of explaining procedures and assisting applicants, but staffing levels were not always proportional to workload during peak periods.

Theme 3. Enabling but Not Fully Reliable Digital Systems

The third theme concerned the contribution and limitations of digital technology. Participants consistently acknowledged that OSS-RBA and other electronic systems had facilitated online applications, integrated administrative processes, and improved the ability to track and manage licensing activities.

An operator stated:

“OSS-RBA is very helpful because the service becomes more structured and integrated. Licensing applications can be submitted through the system, making the process easier to monitor, although some technical problems still occur.” (AM, 35 years)

Three subthemes emerged: digital integration of licensing services, continued need for user assistance, and system instability. Although digital platforms supported service delivery, participants reported slow application responses, maintenance periods, and occasional system failures. One key informant described the problem as follows:

“Sometimes OSS undergoes maintenance or the server goes down. Because the OSS system is managed centrally, we cannot repair it directly at the regional level.” (MA, 54 years)

Operators similarly described slow system performance and interruptions that could delay data entry and application processing. At the same time, some applicants still required assistance in identifying which documents should be uploaded into specific system menus. Observational data confirmed that computers, internet connections, and electronic systems were available and generally functional. However, slow systems, maintenance, and server downtime occasionally disrupted application processing.

The available manuscript does not explicitly document the point at which data saturation was reached, nor does it state that recruitment continued until no new codes, categories, or themes emerged. Therefore, formal data saturation should not be claimed retrospectively. Nevertheless,

considerable convergence was observed across the key informant, three operators, the service user, and observational data regarding the three principal domains of service processes, personnel capacity, and technological constraints. For transparent reporting, the result should therefore be described as showing thematic convergence across informants and data sources, rather than claiming formally demonstrated saturation.

Table 2. Thematic findings of health licensing services

Theme	Subthemes	Main Finding	Representative Evidence
Structured service processes with persistent applicant-related barriers	Standardized procedures; document verification; technical coordination; applicant understanding	Licensing generally followed SOPs from submission to permit issuance, but incomplete or incorrect documents and limited understanding of online procedures contributed to delays.	"If a document is incorrect or incomplete, the application is returned for correction." (<i>AM</i> , 35 years)
Competent and responsive human resources under variable workload demands	Procedural competence; communication; applicant assistance; staffing and workload	Staff understood SOPs, provided explanations, and assisted applicants, although workload increased when application volumes were high.	"When the number of applicants increases, the staff workload also increases." (<i>MI</i> , 36 years)
Enabling but not fully reliable digital systems	Digital integration; user assistance; system stability; central-system dependence	OSS-RBA and other systems supported online and integrated services, but slow performance, maintenance, and server downtime continued to disrupt service delivery.	"Sometimes OSS undergoes maintenance or the server goes down." (<i>MA</i> , 54 years)

DISCUSSION

The findings indicate that the performance of health licensing services cannot be understood solely from the availability of formal procedures or digital platforms. Instead, service quality emerged from the interaction among procedural organization, human-resource capacity, applicant readiness, and technological reliability. The three themes identified in this study structured service processes, competent but workload-sensitive personnel, and enabling yet imperfect digital systems suggest that digital transformation in health licensing is fundamentally a socio-technical process. Technology can simplify administrative transactions, but its contribution depends on whether procedures are understandable, personnel can respond effectively to user difficulties, and the system remains sufficiently stable to support continuous service delivery. This interpretation is consistent with the study findings showing that licensing procedures generally followed established SOPs, staff were able to assist applicants, and electronic systems facilitated service delivery, while incomplete documentation, limited applicant understanding, fluctuating workloads, and technical disruptions continued to create operational constraints.

A particularly important finding is that procedural standardization did not automatically eliminate delays. The existence of clear service flows, document verification procedures, and processing standards created an institutional foundation for reliable service delivery, but delays still occurred when applicants submitted incomplete or incorrect documents, did not promptly respond to requested revisions, or required technical recommendations from other units^{15,16}. This distinction is conceptually important. It suggests that service performance is not determined

exclusively by internal bureaucratic efficiency; it is also shaped by the interaction between administrative systems and users. From a SERVQUAL perspective, the findings indicate relatively strong elements of reliability and responsiveness, because established procedures were applied and staff remained available to help applicants. However, reliability in digital public services should be interpreted more broadly than adherence to SOPs. It also requires that information be understandable enough for citizens to complete procedures correctly without repeated correction or intensive assistance^{17,18}.

This finding provides a more nuanced interpretation of digital accessibility. Moving a service online reduces the need for physical attendance, but it does not necessarily make the process cognitively or administratively easier for every applicant. The continuing need for direct consultation demonstrates that digitalization has not replaced interpersonal service; rather, it has changed its function¹⁹. Frontline personnel increasingly act as navigators who help applicants interpret requirements, resolve mistakes, and move between administrative and technical components of licensing. Thus, a hybrid service model may remain necessary even as electronic licensing expands. The policy implication is that digital transformation should not be measured merely by the proportion of applications submitted online^{20,21}. It should also consider whether applicants can independently understand requirements, complete digital transactions correctly, and obtain timely support when difficulties arise.

These findings are consistent with previous research included in the manuscript. Studies of OSS implementation in other Indonesian regions have generally reported that electronic licensing can simplify administrative procedures, improve efficiency, and support transparency, while simultaneously identifying difficulties involving technical infrastructure and public understanding. Research in Kolaka, for example, found that OSS facilitated integrated electronic licensing and reduced bureaucratic complexity but remained affected by public understanding, technical difficulties, and infrastructure constraints. Similar problems involving service instability and slow system responses have also been reported in Blora. These parallels suggest that the barriers observed in Makassar are not isolated institutional failures but reflect broader implementation challenges associated with the transition toward digitally mediated licensing services.

The human-resource findings further demonstrate that digitalization does not reduce the importance of personnel. Staff competence remained essential because officers were expected to understand procedures, interpret regulatory changes, communicate requirements, assist applicants, operate multiple systems, and coordinate cases requiring technical review. The service-user perspective reinforced this conclusion, as staff explanations were an important mechanism for resolving uncertainty²². Consequently, workforce competence in digital licensing should be understood as multidimensional. It includes procedural knowledge and technical competence but also communication skills, adaptive capacity, and the ability to translate complex administrative requirements into practical guidance for applicants.

At the same time, staff capacity was not independent of workload. Although routine workloads were generally manageable, operators reported greater pressure when application volumes increased, with some personnel managing several services needs simultaneously. These finding shifts attention from individual competence toward organizational capacity²³. A competent workforce may still experience reduced responsiveness when staffing patterns are not aligned with fluctuations in service demand. Therefore, service improvement should not rely only on additional training. Workforce planning, workload distribution, and mechanisms for temporary task adjustment during peak application periods are equally important. The recommendations

contained in the manuscript appropriately emphasize periodic technical guidance and adjustment of task allocation when application volumes increase.

The technological findings provide another important conceptual contribution. OSS-RBA and related platforms supported more integrated and accessible licensing, but system reliability remained an important vulnerability. Slow responses, maintenance periods, and server downtime affected data entry and application processing even when local staff and facilities were prepared to provide services²⁴. The problem was particularly significant because OSS is managed at the national level, limiting the ability of local offices to resolve server-level failures independently. The study therefore highlights a vertical dependency within digital governance: service delivery is experienced locally, while critical technological control may reside centrally²⁵. When central infrastructure fails, local agencies remain accountable to citizens but have limited technical authority to restore the system.

This observation is compatible with the DeLone and McLean Information Systems Success perspective used in the manuscript, particularly its emphasis on system quality. Reliability, response time, accessibility, and functional performance influence whether information systems generate meaningful benefits. The presence of maintenance, server downtime, and slow application responses therefore represents more than a technical inconvenience; these conditions directly affect service continuity. Studies cited in the manuscript similarly found positive relationships between system quality, system use, and user satisfaction, while the Makassar findings show that technological benefits can coexist with operational instability. The result is also consistent with research from Bali showing that OSS-RBA can positively influence licensing service quality. However, the present qualitative evidence adds an operational dimension by demonstrating the conditions under which these benefits may be interrupted by everyday technical failures.

Taken together, the study supports an integrated interpretation of digital licensing in which human, organizational, and technological dimensions are mutually dependent. A reliable platform cannot compensate fully for unclear information or limited applicant literacy, just as competent staff cannot ensure timely completion when a centrally managed server is unavailable. Likewise, well-designed SOPs cannot produce efficient outcomes when users repeatedly submit incomplete documentation. This interdependence is closely aligned with the Human–Organization–Technology Fit perspective underlying the manuscript. The broader conceptual contribution is therefore that health licensing performance should be viewed as an ecosystem rather than as a single administrative process. Improvement requires simultaneous attention to procedure design, workforce capacity, user capability, coordination arrangements, and technological resilience.

Several limitations should temper interpretation of these findings. First, the study involved only five informants from a single municipal licensing agency, including one service user. The findings therefore provide contextual depth rather than statistical representativeness and should not be generalized automatically to other DPMPTSP offices or licensing environments. Second, the small number of service-user perspectives means that the study reflects organizational and operator experiences more strongly than the diversity of applicant experiences. Third, although multiple data sources were used through interviews, observation, and documentation, the manuscript does not explicitly document formal attainment of data saturation. The consistency observed across participants and methods can therefore be described as thematic convergence, but not as definitively demonstrated saturation²⁶. Fourth, the study was conducted during a limited period in July 2026; consequently, seasonal variation in application volume, major regulatory changes, or prolonged system outages may not have been fully captured. Finally, the study did

not quantitatively measure processing times, system downtime, workload, digital literacy, or user satisfaction, so the findings should be interpreted as experiential and operational evidence rather than estimates of effect magnitude.

Future research should extend these findings through broader multi-site designs that compare licensing services across municipalities or provinces with different levels of digital maturity. Including larger and more diverse groups of applicants would clarify how age, digital literacy, type of license, previous licensing experience, and access to technological resources influence the ability to use online systems independently. Mixed-methods studies could combine qualitative accounts with objective indicators such as processing time, document-return rates, application volumes, frequency and duration of system downtime, workload per officer, and user satisfaction. Longitudinal research would also be valuable for assessing whether improvements in OSS infrastructure, staff training, or applicant education produce sustained changes in service performance.

Future studies should additionally examine intergovernmental digital governance more explicitly. Because local service continuity partly depends on systems controlled at the national level, research should evaluate escalation mechanisms, technical-support responsiveness, communication during system disruption, and contingency arrangements when digital platforms become temporarily unavailable. Such work could move the research agenda beyond simply asking whether digital licensing is effective toward understanding what institutional architecture is required to make digital public services resilient. The present findings therefore suggest that the next stage of health licensing reform should not focus on digitalization alone, but on creating an integrated service system in which procedures are intelligible, personnel are adequately supported, applicants are digitally enabled, and technological infrastructure is sufficiently reliable to sustain continuous and responsive public service.

CONCLUSION

This study found that health licensing services at the Makassar City Investment and One-Stop Integrated Services Agency were generally implemented in a structured manner and supported by established procedures, competent personnel, and digital service systems. Service processes followed standard operating procedures from application submission and document verification to permit issuance. However, incomplete documentation, limited applicant understanding, and the need for technical coordination could delay service completion. Human resources demonstrated adequate procedural knowledge, communication skills, and responsiveness, although workload increased during periods of high service demand. Digital platforms, including OSS-RBA, facilitated more integrated and accessible licensing services, but system delays, maintenance, and server downtime continued to affect service continuity.

Improvement efforts should therefore focus on simplifying service information, providing clearer document guidance, strengthening periodic staff training, adjusting workload distribution during peak demand, and improving system reliability. Stronger coordination between local service agencies and central system administrators is also needed to ensure faster responses to technical disruptions. These measures may strengthen the efficiency, accessibility, and resilience of digital health licensing services.

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Conflict of Interest

The authors declare that there are no conflicts of interest related to the conduct, interpretation, or publication of this study.

Authors' Contributions

Dian Warbia: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Literature Review, and Writing – Original Draft.

Suprpto: Methodology, Validation, Supervision, Formal Analysis, and Writing – Review & Editing.

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Declaration of Generative AI Use

Generative artificial intelligence tools were used only to support language refinement, grammatical correction, and improvement of manuscript readability. The study design, data collection, analysis, interpretation of findings, and scientific conclusions were conducted by the author. All AI-assisted content was reviewed and verified by the author, who assumes full responsibility for the accuracy, integrity, and final content of the manuscript.

Data Availability Statement

The data supporting the findings of this study are not publicly available because they contain information obtained from qualitative interviews and institutional service processes. De-identified data may be made available by the corresponding author upon reasonable request, subject to ethical and institutional considerations.

REFERENCES

1. Borromeo AS, Manaloto AM, dela Cruz F V, et al. Emerging trends and underexplored frontiers in stroke nursing care: A bibliometric review. *Collegian*. 2026;33(2):130-143. doi:https://doi.org/10.1016/j.colegn.2026.02.001
2. Brahmabhatt DH, Ross HJ, Moayedi Y. Digital Technology Application for Improved Responses to Health Care Challenges: Lessons Learned From COVID-19. *Can J Cardiol*. 2022;38(2):279-291. doi:https://doi.org/10.1016/j.cjca.2021.11.014
3. Burch KE, Tryon VL, Pierce KM, et al. Co-Designing a Web-Based and Tablet App to Evaluate Clinical Outcomes of Early Psychosis Service Users in a Learning Health Care Network: User-Centered Design Workshop and Pilot Study. *JMIR Hum Factors*. 2025;12. doi:https://doi.org/10.2196/65889
4. Catania J, Beaver S, Kamath RS, et al. Evaluation of Digital Mental Health Technologies in the United States: Systematic Literature Review and Framework Synthesis. *JMIR Ment Heal*. 2024;11. doi:https://doi.org/10.2196/57401
5. Chin L, Khozin S. A digital highway for data fluidity and data equity in precision medicine. *Biochim Biophys Acta - Rev Cancer*. 2021;1876(1):188575. doi:https://doi.org/10.1016/j.bbcan.2021.188575
6. Clement David-Olawade A, Olawade DB, Ojo IO, Famujimi ME, Olawumi TT, Esan DT. Nursing in the Digital Age: Harnessing telemedicine for enhanced patient care. *Informatics Heal*. 2024;1(2):100-110. doi:10.1016/j.infoh.2024.07.003
7. Green A, Wu S, Di Pasquale A, Pang T. The Role of Digital Opinion Leaders in Dengue Prevention Through Health Promotion and Public Health Collaboration: Qualitative Semistructured Interview Study. *J Med Internet Res*. 2025;27. doi:https://doi.org/10.2196/70997

8. Kassem I, Rossouw PE, Malik S. State-wise tele-dentistry guidelines and practice in the united states of America: A cross-sectional study. *Semin Orthod*. 2026;32(4):713-721. doi:<https://doi.org/10.1053/j.sodo.2025.09.016>
9. Kruzan KP, Fitzsimmons-Craft EE, Dobias M, Schleider JL, Pratap A. Developing, Deploying, and Evaluating Digital Mental Health Interventions in Spaces of Online Help-and Information-Seeking. *Procedia Comput Sci*. 2022;206:6-22. doi:<https://doi.org/10.1016/j.procs.2022.09.081>
10. Kummer BR, Busis NA. Beyond Audio-Video Telehealth: Perspective on the Current State and Future Directions of Digital Neurological Care in the United States. *JMIR Neurotechnology*. 2024;3. doi:<https://doi.org/10.2196/46736>
11. Martin H, Schofield M, Yakes Jimenez E. Tenets for Increasing Access to Nutrition Care Delivered Via Telehealth: Recommendations from the Academy of Nutrition and Dietetics Telehealth Task Force. *J Acad Nutr Diet*. 2025;125(2):256-268. doi:<https://doi.org/10.1016/j.jand.2024.09.008>
12. Martinez-Martin N, Dasgupta I, Carter A, et al. Ethics of Digital Mental Health During COVID-19: Crisis and Opportunities. *JMIR Ment Heal*. 2020;7(12). doi:<https://doi.org/10.2196/23776>
13. O'Connor S, Wang Y, Cooke S, et al. Designing and delivering digital learning (e-Learning) interventions in nursing and midwifery education: A systematic review of theories. *Nurse Educ Pract*. 2023;69:103635. doi:<https://doi.org/10.1016/j.nepr.2023.103635>
14. Perret S, Alon N, Carpenter-Song E, et al. Standardising the role of a digital navigator in behavioural health: a systematic review. *Lancet Digit Heal*. 2023;5(12):e925-e932. doi:[https://doi.org/10.1016/S2589-7500\(23\)00152-8](https://doi.org/10.1016/S2589-7500(23)00152-8)
15. Poncette A-S, Glauert DL, Mosch L, Braune K, Balzer F, Back DA. Undergraduate Medical Competencies in Digital Health and Curricular Module Development: Mixed Methods Study. *J Med Internet Res*. 2020;22(10). doi:<https://doi.org/10.2196/22161>
16. Psihogios A, Brianne Bota A, Mithani SS, et al. A scoping review of active, participant-centred, digital adverse events following immunization (AEFI) surveillance: A Canadian immunization research network study. *Vaccine*. 2022;40(31):4065-4080. doi:<https://doi.org/10.1016/j.vaccine.2022.04.103>
17. Pundziene A, Gerulaitiene N, Bez SM, et al. Value capture and embeddedness in social-purpose-driven ecosystems. A multiple-case study of European digital healthcare platforms. *Technovation*. 2023;124:102748. doi:<https://doi.org/10.1016/j.technovation.2023.102748>
18. Rayamajhi S, Machin A, Breen C, Gebreheat G, Paterson R. Quality and impact of pharmacology digital simulation education on pre-registration healthcare students: A systematic literature review. *Nurse Educ Today*. 2024;140:106295. doi:<https://doi.org/10.1016/j.nedt.2024.106295>
19. Sermontyte-Baniule R, Pundziene A, Giménez V, Narbón-Perpiñá I. Role of Cultural Dimensions and Dynamic Capabilities in the Value-based Performance of Digital Healthcare Services. *Technol Forecast Soc Change*. 2022;176:121490. doi:<https://doi.org/10.1016/j.techfore.2022.121490>
20. Siegel JL, Junko Negi N, Bacio GA, Mammadli T, Kobrin D. "Lost connection": Pandemic related disruptions to schooling and social services among Latinx immigrant youth and families. *Child Youth Serv Rev*. 2024;156:107345. doi:<https://doi.org/10.1016/j.childyouth.2023.107345>
21. Suprpto S. Policy analysis of national health financing implementation on access and equity of healthcare services in rural communities. *J Heal Policy Anal*. 2026;1(3):80-89. doi:<https://doi.org/10.61099/jakespol.v1i3.402>
22. Soegiantoro DH, Kristiyani A, Rawar EA, et al. A comparative systematic review of pharmacist education systems and pharmacy service quality in ASEAN-5: Indonesia, Malaysia, Thailand, the Philippines, and Singapore. *Curr Pharm Teach Learn*. 2026;18(11):102756. doi:<https://doi.org/10.1016/j.cptl.2026.102756>
23. Wu JS. Driving delayed: transportation planning and public health perspectives on

- adolescent safe mobility. *Transp Res Interdiscip Perspect.* 2026;38:102083. doi:<https://doi.org/10.1016/j.trip.2026.102083>
24. Tomblin Murphy G, Sampalli T, Domm D, Peacock S, Navaratnam S, MacKenzie K. Sustaining Canada's cancer workforce: A pan-Canadian review of innovations in the rising needs for equitable care. *Health Policy (New York).* 2026;172:105714. doi:<https://doi.org/10.1016/j.healthpol.2026.105714>
 25. Villaruz Fisak JF, Aparicio AL, Jennings S. Unified and Portable Nurse Licensure for Psychiatric Mental Health Registered Nurses: Utilization of Psychiatric Mental Health Registered Nurses to Decrease Barriers to Mental Health Care, Bridge Access to Care, and Improve Patient Outcomes. *Nurs Clin North Am.* 2026;61(1):43-59. doi:<https://doi.org/10.1016/j.cnur.2025.10.003>
 26. Zhong EH, Spector N, O'Hara C, Livanos N, Castillo JD. Advancing nursing regulation in the digital era: Harnessing AI to bridge workforce gaps and strengthen practice competency and safety. *J Nurs Regul.* 2025;16(3):150-164. doi:<https://doi.org/10.1016/j.jnr.2025.08.015>