

Digital Health Transformation in Papua New Guinea

Regina DUMA Peter

Papua New Guinea University of Technology

*Correspondence author email: 25986758repe@pgs.pnguot.ac.pg

Abstract: Papua New Guinea's healthcare system faces persistent challenges, including limited infrastructure, fragmented service delivery, and a predominantly paper-based system that hinders timely, effective care. This thesis paper investigates how digital technologies can transform healthcare delivery at Angau Provincial Hospital, one of PNG's key referral and teaching hospitals. Positioned within the broader context of national health priorities and UN's Sustainable Development Goals (SDGs 3, 9, and 17), the research study evaluates the hospital's readiness for digital health transformation and proposes phased, context-specific interventions to improve operational efficiency, patient safety, and healthcare accessibility. Using a qualitative case study methodology, supported by stakeholder analysis and comparative insights from international implementations, including Kenya's mobile health platforms, India's hospital information systems, and Port Moresby General Hospital's early telehealth adoption, the research identifies practical pathways for integrating electronic health records (EHRs), digital inventory systems, and telemedicine at Angau. In addition, comparative international case studies from India, Kenya, Estonia, and Rwanda underscore the feasibility and benefits of digital health interventions in resource-constrained settings. It also outlines strategies for overcoming PNG-specific constraints such as poor internet connectivity, low digital literacy, and limited funding. The study finds that with targeted investment in infrastructure, capacity-building, and collaborative partnerships with stakeholders such as UNDP, WHO, and DFAT, Angau can become a national model for digital health transformation. The thesis paper concludes with a roadmap for implementation and highlights future research needs in digital infrastructure scaling, policy development, and workforce training. This research contributes to the growing discourse on digital equity and health system modernization in low-resource settings, offering Angau and PNG a clear vision for inclusive, technology-enabled healthcare.

Keywords: Angau, Digital health transformation, healthcare, health information systems, Papua New Guinea (PNG).

1. INTRODUCTION

Healthcare systems worldwide are evolving rapidly, fueled by the integration of digital technology. The use of digital tools such as electronic health records (EHRs), telemedicine platforms, mobile health (mHealth) applications, and health information systems (HIS) has revolutionized service delivery in many countries, improving access, enhancing patient safety, and enabling real-time data-driven decisions (WHO, 2020). In high-income countries, such technologies have become central to patient care and hospital management, yet low- and middle-income countries (LMICs), including PNG, face significant barriers to implementation.

PNG's healthcare system is under severe pressure. Challenges such as inadequate infrastructure, poor road networks, chronic shortages of skilled personnel, lack of reliable power and internet connectivity, and limited public health funding severely restrict the quality and reach of healthcare services (World Bank, 2024; WHO, 2021). The COVID-19 pandemic further exposed the system's fragility and highlighted the urgent need for scalable, resilient healthcare solutions ((UNDP, 2023), PNGIMR, 2022; Vallely, 2024).

Moreover, Papua New Guinea (PNG) faces significant challenges in its healthcare system, including limited infrastructure, a shortage of skilled health professionals, and geographic barriers that hinder access to essential services. The World Health Organization (2023) recommends a ratio of one doctor per 1,000

people, but PNG currently has approximately 640 doctors, resulting in a ratio of one doctor per 20,000 people (ICT.gov.pg, 2025).

In response to these challenges, PNG has initiated a national digital health strategy aimed at transforming its healthcare system through the integration of Information and Communication Technology (ICT). This strategy includes the development of an ICT policy, a digital health toolkit, and a comprehensive digital health roadmap to guide the implementation of ICT solutions in the health sector (World Bank, 2025).

Digital health interventions, such as mobile health applications, electronic health records, and telemedicine, offer promising solutions to improve healthcare delivery in remote and underserved areas. For instance, mobile technologies and geographic information systems have been utilized to enhance health information systems in PNG, facilitating better data management and decision-making (Rosewell, 2021).

The Angau Hospital entirely reliant on paper-based processes leads to delays in patient care, duplication of services, and data loss. In rural areas, where access to specialist care is limited, telehealth could expand access and improve patient outcomes. Integrating digital health into Angau's operations is not only feasible but necessary to modernize its service delivery and align with national and global health objectives. Digital transformation presents a unique opportunity to address these systemic issues. For instance, EHR systems can help reduce medical errors and improve continuity of care, while mobile technologies can extend healthcare access to rural and remote communities. Moreover, telemedicine has proven particularly effective in areas with few specialists, as evidenced by initiatives in Kenya, India, and Indonesia, where similar socioeconomic challenges have been mitigated through digital health innovations (WHO, 2020).

The United Nations Sustainable Development Goals (SDGs) further underscore the relevance of digital health. Specifically, SDG 3 aims to ensure healthy lives and promote well-being for all at all ages (UN, 2015), while SDG 9 promotes innovation and sustainable infrastructure (United Nations, 2015) and SDG 17 calls for international cooperation to achieve development outcomes (UN, 2015). Papua New Guinea's Vision 2050 and National Health Plan 2021–2030 echo these priorities, emphasizing universal health coverage, equity in service delivery, and strengthened governance through ICT (Department of National Planning & Monitoring, 2020; Department of Health, 2020).

Angau Hospital, one of PNG's largest public healthcare institutions, serves as an ideal case study to explore these transformative opportunities. The hospital's infrastructure investments under the PNG-Australia Partnership have created a baseline for integrating digital health systems. However, to fully leverage these advancements, targeted digital strategies are necessary to overcome persistent operational challenges and improve healthcare delivery.

This research examines how digital health tools can be effectively integrated into Angau's operations to enhance clinical outcomes, streamline administration, and support health system strengthening. By analyzing local context, stakeholder readiness, and international case studies, the research seeks to provide practical, cost-effective, and sustainable digital health solutions for PNG.

2. LITERATURE REVIEW

The World Health Organization emphasizes the potential of digital health to address pressing global challenges through innovations such as mHealth applications, telemedicine, and data analytics (WHO, 2021; UNDP, 2023). Telehealth has been shown to overcome geographical barriers and improve healthcare access in resource-constrained settings (Scott & Mars, 2015). Similarly, successful adoption of ICT in healthcare depends on enabling factors such as strong leadership, staff training, and reliable infrastructure (Gagnon et al., 2016).

In the Pacific Islands, including Papua New Guinea, adoption of digital health has been limited. However, pilot initiatives show promise when designed to align with cultural contexts and logistical realities (MacLaren et al., 2020). These findings suggest that while barriers remain, digital health tools can be transformative when adapted to local needs and supported by effective policy frameworks.

2.1. Global Context of Digital Health Transformation

In Kenya, the use of the AMREF Health Africa telemedicine platform has facilitated remote diagnosis and specialist consultations in hard-to-reach rural clinics (Kamau, 2021). The program has reduced patient travel time and improved access to maternal and child health services, demonstrating cost-efficiency and scalability (AMREF, 2020). Kenya's M-TIBA platform allowed users to save and manage health funds through mobile phones, improving transparency and access to care (Kamau, 2021). The system strengthened health financing and accountability.

Similarly, India's eSanjeevani initiative, launched by the Ministry of Health and Family Welfare, provided over 30 million teleconsultations by 2022, significantly expanding healthcare access during the COVID-19 pandemic (MOHFW, 2021).

In Indonesia, the Puskesmas model, community-based primary health centers has integrated digital platforms to monitor patient data and manage referrals, resulting in improved care coordination and faster patient throughput (PATH, 2025; Ministry of Health Indonesia, 2024). These global examples offer practical insights into how Angau Provincial Hospital might integrate digital solutions despite infrastructural and budgetary limitations.

Estonia's health system is often highlighted for its advanced digital transformation. By 2020, over 99% of prescriptions and health records were digitized. This resulted in reduced administrative costs, faster service delivery, and improved chronic disease management (Aaviksoo et al., 2020).

India's eSanjeevani, a government-led telemedicine service, conducted over 50 million consultations during the COVID-19 pandemic, especially in underserved rural areas (MOHFW, 2021). The platform demonstrated the power of low-cost, scalable digital infrastructure in a resource-constrained setting.

Rwanda's national eHealth strategy emphasized maternal health monitoring and digital health worker training. In five years, maternal mortality rates dropped by 60%, attributed to improved digital referral systems and real-time data management (WHO, 2020).

Bangladesh implemented a national Health Information System with EHRs at the primary healthcare level. Despite infrastructure constraints, the initiative improved immunization tracking and rural health monitoring (Islam, 2018).

Brazil's Telessaúde Brasil Redes expanded telemedicine services to remote Amazonian regions, enhancing specialist access and professional development among rural health workers (Giovanella, 2019).

Fiji adopted the DHIS2 platform for real-time data reporting. Supported by WHO and international donors, the system improved vaccination coverage and disease surveillance across islands (WHO Pacific Office, 2020).

These cases demonstrate that low- and middle-income countries can successfully implement digital health technologies by leveraging partnerships, open-source platforms, and strong policy frameworks.

2.2. PNG's Digital Health Landscape

PNG's 2023 Digital Health Strategy identified several barriers: poor ICT infrastructure, limited digital literacy, and lack of system interoperability (UNDP, 2023). However, the strategy outlines opportunities for progress through donor partnerships, mobile phone penetration, and alignment with national health plans. The Angau Provincial Hospital case study is crucial in testing and scaling these opportunities.

2.2.1. PNG's Digital Health Landscape: The Case Study of Port Moresby General Hospital

Port Moresby General Hospital (PMGH), is the largest referral hospital in Papua New Guinea, has taken early steps toward adopting digital health practices, making it a relevant comparator for Angau. PMGH's experience illustrates the gradual shift from paper-based to semi-digital systems in PNG's public health sector. For example, PMGH has implemented a pilot Electronic Medical Record (EMR) system within selected departments such as outpatient, radiology, and laboratory services. According to a report, the Electronic Medical Record (EMR) system in Papua New Guinea has improved data accuracy, reduced patient wait times, and facilitated better

coordination between clinicians (PNG NDoH, 2021). Moreover, PMGH has collaborated with international partners including WHO and DFAT to integrate digital reporting for infectious diseases. This has enabled real-time surveillance of COVID-19 cases and enhanced national coordination of pandemic responses.

Additionally, the hospital has started using mobile health apps to send reminders to patients about follow-up appointments and medication schedules, thereby improving patient compliance and reducing hospital readmissions (PNG NDoH, 2022).

Despite these gains, challenges persist. The rollout of digital systems at PMGH has been hindered by inadequate training for staff, irregular power supply, and limited IT support. Nonetheless, PMGH's partial digitization serves as an instructive model for Angau, highlighting both opportunities and pitfalls in implementing digital health strategies in the PNG context. Lessons from PMGH suggest that strong leadership commitment, external funding, and phased implementation are essential to success (PNG NDoH, 2022).

2.2.2 Case Study: Angau Provincial Hospital

Angau Provincial Hospital exemplifies many of the systemic challenges facing PNG's healthcare system. As one of only four regional referral hospitals in the country, Angau serves as the primary medical facility for the northern half of PNG. With an estimated patient volume of over 70,000 outpatient visits per year, the hospital's infrastructure is under significant strain (PNG NDoH, 2022).

Currently, all patient records are maintained manually. Paper files are susceptible to misplacement, duplication, and delayed retrieval, leading to diagnostic errors and inefficient patient flow. Staff rely on handwritten notes, which are often illegible, especially in emergency care. There is no centralised patient database or referral tracking system, making continuity of care difficult when patients are referred between departments or other provincial clinics.

The hospital's pharmacy department also operates on a paper-based inventory system, contributing to frequent medicine stock-outs and wastage from expired drugs. Without digital inventory management, tracking/monitoring procurement, usage trends, or urgent supply needs is nearly impossible. Similarly, laboratory and radiology departments suffer from long processing times and miscommunications due to the lack of integrated information systems.

In addition, field data collected from Angau revealed several systemic inefficiencies. Over 90% of patient records are paper-based, leading to frequent data loss and duplication. Referrals are poorly coordinated, resulting in delayed treatments. Supply chain management is manual, contributing to stock-outs. Staff expressed interest in digital solutions but cited lack of training and support.

The hospital could adopt a phased approach to digital health. Phase 1 could introduce EHRs in outpatient services using open-source platforms like OpenMRS. Phase 2 might involve inventory digitization and staff training. Phase 3 would launch telemedicine services targeting rural outreach. These interventions align with national goals and donor priorities.

Furthermore, efforts to pilot basic health data collection through mobile tablets provided under the Australian Government's support program were launched in 2021 but have not yet scaled due to inadequate staff training and poor internet connectivity (DFAT, 2022). Staff enthusiasm for digital solutions exists, but the lack of an institutional roadmap has resulted in fragmented attempts at digitization.

Despite these barriers, Angau's situation also presents an opportunity. A structured digital implementation plan, starting with a robust hospital information system (HIS), digital appointment scheduling, and e-prescriptions, could significantly improve efficiency and reduce the workload on frontline staff. The hospital could also implement a basic cloud-based EHR system, accessible to departments and affiliated clinics, to streamline referrals and follow-ups. Additionally, telemedicine pilot programs could link Angau with Port Moresby General Hospital or even international experts for complex cases. Such collaborations would enhance diagnostic accuracy, improve staff training through virtual learning, and reduce the need for expensive patient travel.

In summary, Angau's challenges reflect the broader state of healthcare in PNG, but they also highlight the transformative potential of targeted digital interventions. With phased investments, donor partnerships, and a focus on capacity building, Angau Provincial Hospital can evolve into a flagship for digital health transformation in PNG.

3. OBJECTIVES OF THE STUDY

1. To assess the current healthcare delivery challenges at Angau Provincial Hospital.
2. To explore suitable digital health technologies applicable to PNG.
3. To compare global best practices and case studies for relevance.
4. To recommend implementation strategies aligning with PNG's development goals and Sustainable Development Goals (SDGs).

4. METHODOLOGY

4.1 Research Design

A qualitative case study design was selected to provide an in-depth understanding of healthcare delivery challenges and digital transformation prospects at Angau Provincial Hospital.

4.2 Data Sources

Primary data were obtained through stakeholder interviews. While Secondary data were sourced from health policy documents, project evaluations, academic literature, hospital reports, and peer-reviewed literature.

4.3 Case Study Method

The case study method facilitated contextual analysis of challenges and potential digital solutions specific to Angau Provincial Hospital.

4.4 Data Analysis

Data were coded and analyzed thematically to identify recurring patterns in service delivery issues, stakeholder perceptions, and proposed digital interventions.

5. RESULTS / FINDINGS

- Staff frequently lose patient records due to manual filing.
- Referral delays are common due to lack of a centralized communication system.
- Mobile device usage among staff is high, indicating potential for mHealth.
- Staff lack digital skills but are open to training.
- Donor interest in digital pilots is evident, particularly from DFAT and WHO.

To evaluate the feasibility and readiness of Angau Provincial Hospital for digital transformation, data were collected from hospital reports, staff interviews, observational studies, and comparisons with national and international benchmarks. The table below presents key findings:

Table 1. Digital Transformation at Angau Provincial Hospital

Category	Angau Provincial Hospital (Current)	Benchmark/global comparison	Key Observations
Patient Record System	100% manual (paper-based)	70-90% digital in middle-income countries (e.g., India, South Africa)	Delays in retrieving records; risk of data loss.
Internet Connectivity	Intermittent; <1 Mbps average speed	10-50 Mbps in digital hospitals	Inadequate for real-time telehealth or cloud-based systems.
Staff Digital Literacy	~35% staff trained in basic IT usage	>85% in ICT-enabled hospitals	Training gap identified as critical barriers to adoption
ICT Infrastructure	Limited to administrative office and a few computers	Centralized HER servers, department-level devices	Lack of department-specific ICT systems
Power Reliability	Daily outages lasting up to 2-4 hours	<1 hour/month (backup systems in place)	Unreliable power hinders system uptime and data security.
Pharmacy Stock Tracking	Manual inventory logs, updated weekly	Real-time digital dashboards (e.g., Kenya's mSupply)	Prone to errors and stock-outs.
Telemedicine Access	None	Integrated video consultations in remote areas	High potential for implementation using mobile networks.
Data Reporting to NDoH	Monthly paper reports	Automated digital dashboards in many global systems	Reporting delays impact national planning and funding.
Stakeholder Readiness	High enthusiasm; low technical preparedness	Full integration teams in global case studies	Support available, but requires capacity-building.
SDG Alignment	Partial (aligned to SDG 3, but limited in practice)	Strategic alignment with SDG 3,9, and 17 in eHealth	Opportunities to align with international donors and frameworks.

These findings clearly show both the current gaps and the opportunities for digital transformation at Angau. The data suggests that with targeted infrastructure investments, capacity building, and strategic partnerships, the hospital can align with regional and global best practices in digital health.

6. DISCUSSION

Digital transformation is both timely and necessary for Angau Provincial Hospital. EHRs can reduce medical errors and improve data management. Mobile-based inventory systems can prevent stock-outs. Telemedicine could connect Lae-based doctors with remote patients. Lessons from Estonia, India, Rwanda, and Kenya demonstrate that resource-constrained settings can benefit from digital health when supported by proper planning, capacity building, and stakeholder engagement. A key success factor is leadership commitment and sustained funding. .

Furthermore, the results also demonstrate a critical need for digital transformation at Angau Provincial Hospital. Manual processes, lack of coordination, and inadequate record management undermine patient care and institutional efficiency. Similar to the international examples reviewed, implementing digital tools like EHRs and telemedicine can yield significant improvements in patient safety, timeliness of care, and staff productivity.

The hospital's current operational model fails to adequately serve a growing population. Yet the staff's openness to innovation and the presence of donor support indicate a readiness for change. The evidence from

India and Rwanda shows that even modest investments in mobile health and referral systems can dramatically reduce maternal mortality and improve access to care. The success of Estonia and Brazil in adopting digital solutions across the care continuum offers a scalable blueprint for Angau's transition. Another key insight is the role of partnerships and government alignment. The SDGs and PNG's national health policy both emphasize collaboration and technological innovation. Aligning Angau's digital strategy with these frameworks will enhance its ability to secure funding, training, and technical expertise from agencies like WHO, UNDP, and DFAT.

The discussion also highlights the importance of leadership and institutional culture. Digital transformation requires champions who can build consensus, manage change, and ensure accountability. Investment in capacity building, both technical and managerial, is crucial for sustaining digital health gains. The creation of a Digital Health Taskforce at Angau, comprising hospital administrators, clinicians, Information Communication and Technology (ICT) professionals, and donor representatives, could help coordinate implementation and monitor progress. Finally, the importance of a phased approach cannot be overstated. Starting with outpatient EHRs, followed by supply chain digitization, and culminating in a telemedicine rollout ensures manageable change, minimizes risk, and provides opportunities to refine systems before scaling.

7. RECOMMENDATIONS

1. Implement open-source EHRs starting in outpatient departments.
2. Partner with universities and NGOs for ICT training.
3. Pilot mobile health tools for community health workers.
4. Upgrade internet and hardware infrastructure with donor support.
5. Integrate digital health into national policies and hospital development plans.
6. Create a monitoring framework to evaluate digital health performance.

In addition, to improve, adopt, and implement new digital technologies despite challenges like poor internet connectivity, **Angau Provincial Hospital** can follow a **phased, adaptive, and context-specific strategy** that includes the following key components:

7.1. Conduct a Digital Readiness Assessment

- **Evaluate current infrastructure**, staff digital literacy, electricity reliability, and internet access.
- Identify **departments with the highest need** for digitization (e.g., patient records, pharmacy, and outpatient).

7.2. Adopt Hybrid Digital Systems

- Use **offline-first software** that syncs data when internet is available (e.g., CommCare, DHIS2).
- Deploy **local servers** for storing patient data, with regular backups to cloud systems when connectivity allows.

7.3. Improve Internet Access Strategically

- Partner with local telecom companies to install **dedicated VSAT (satellite internet)** or 4G hotspots in critical hospital departments.
- Use **mesh Wi-Fi networks** to extend coverage from a central hub to multiple buildings.
- Apply for **government or donor-supported connectivity initiatives**, such as those supported by DFAT or WHO.

7.4. Implement in Phases

- **Phase 1:** Digitize the patient registration and outpatient record system using tablets and local servers.
- **Phase 2:** Add pharmacy stock management, lab requests, and appointment scheduling.
- **Phase 3:** Expand to telemedicine and integrate with national health systems.

7.5. Build Capacity and Train Staff

- Conduct regular **digital literacy training** for clinical and admin staff.
- Appoint **digital champions** in each department to support adoption and troubleshooting.
- Collaborate with **universities or NGOs** to provide eHealth training modules.

7.6. Monitor and Evaluate Progress

- Create **KPIs** (e.g., patient wait times, stock-outs, record accuracy).
- Use simple **dashboards** to track data even without real-time internet.
- Adjust implementation plans based on feedback and periodic evaluation.

7.7. Collaborate and Seek Funding

- Align projects with **Sustainable Development Goals (SDG 3 and 9)** to attract support.
- Submit proposals to **UNDP, WHO, DFAT, and Asia-Pacific digital health donors** for infrastructure, training, and software support.

By combining local innovation, phased implementation, offline-capable technology, and partnerships, Angau can begin its digital health transformation even with limited connectivity.

8. CONCLUSIONS

In conclusion, digital health tools can significantly enhance healthcare delivery at Angau Hospital. By starting small and scaling sustainably, the hospital can serve as a model for nationwide implementation. Future studies should focus on patient experiences, cost-benefit analyses, and long-term health outcomes. This study has examined the critical role of digital technology in enhancing healthcare delivery at Angau and, by extension, across PNG's broader health system. The case study underscores that, despite significant structural and systemic challenges, including outdated infrastructure, poor internet connectivity, and limited digital literacy, there is enormous potential for transformation through the strategic implementation of cost-effective and context-specific digital health solutions. The hospital currently relies on manual, paper-based systems that compromise efficiency, patient safety, and service quality. However, global best practices and comparative studies, including examples from Kenya, India, and Australia's own telehealth outreach programs, demonstrate that with the right approach, even resource-constrained environments can successfully adopt and benefit from digital transformation.

Notably, PMGH has taken preliminary steps toward eHealth integration, offering a useful national model. Through phased digitization of health records, pharmacy inventories, scheduling, and telemedicine, Angau can significantly improve patient outcomes, operational efficiency, and clinical accuracy. Critical to this success will be investments in digital infrastructure, staff training, policy support, and collaboration with national and international stakeholders. This transformation must also align with Sustainable Development Goals (SDGs) 3 (Good Health and Well-being), 9 (Industry, Innovation and Infrastructure), and 17 (Partnerships for the Goals). In conclusion, Angau stands at a pivotal moment. With thoughtful planning, stakeholder commitment, and adaptive technologies, it can become a national leader in digital health, setting a benchmark for improving healthcare delivery across PNG. This transformation not only supports national health priorities but also contributes meaningfully to the global digital health movement.

In addition, while challenges such as infrastructure, funding, and workforce capacity persist, digital health technologies offer transformative potential for Angau and beyond. With political will, community involvement, and coordinated donor support, Angau can be positioned as a beacon of innovation within PNG's health sector. Strong leadership and ongoing evaluation will be essential in navigating this digital shift. To maximize the impact of digital technologies, it is imperative that Angau adopts a holistic digital health transformation roadmap. This should include comprehensive policy development, stakeholder engagement at all levels, investment in ICT infrastructure, and integration with national health and education systems. This multi-sectoral collaboration can enable a digitally empowered health ecosystem that supports equitable and quality healthcare delivery for all Papua New Guinean.

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