# DIGITAL TRANSFORMATION AND THE RISK OF EXCLUSION: IMPLEMENTATION OF THE MOBILE JKN ONLINE QUEUEING SYSTEM IN OUTPATIENT SERVICES

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**ABSTRACT**

*Digital transformation has become a priority for health systems in the Industry 4.0 era, yet its benefits are not distributed evenly across patient groups. Dr. Pirngadi General Hospital, Medan, has implemented an online queueing system through the Mobile JKN application; however, its utilisation remained low, reaching only 9.16% of outpatients (4,709 of 51,419) during January–September 2025.To analyse the implementation of the Mobile JKN online queueing programme in outpatient services using Rogers' Diffusion of Innovations framework (relative advantage, compatibility, complexity, trialability, and observability), with particular attention to factors that may exclude vulnerable users. A qualitative case study was conducted from February to April 2026. Twelve informants (eight outpatient Mobile JKN users, one outpatient nurse, one administrative coordinator, one IT staff member, and one BPJS Kesehatan person-in-charge) were selected purposively until data saturation. Data were gathered through in-depth interviews, direct observation, and document review, and analysed using thematic analysis. Trustworthiness was established through source and technique triangulation. In terms of relative advantage, the system reduced physical queues and paper logistics and shortened administrative processing through automatic population of the hospital information system (SIMRS). Compatibility was supported by integration via Bridging System v2.0, but a misfit emerged for elderly and non-smartphone users. Complexity was the dominant barrier, centred on account activation requiring phone credit and an internet connection, and on low digital literacy among older patients. Trialability and observability were adequate, monitored through the quality rate (QR) indicator reported every 3–7 days; the QR initially fell below the >85% target but improved with continuous evaluation. The programme delivers clear efficiency gains, but its low uptake reflects a digital divide driven by patient demographics and technological constraints rather than by system design. Targeted digital-literacy support and assisted-registration services for technology-vulnerable groups are required to make the innovation genuinely inclusive.*

***Keywords: Online Queue, Mobile JKN, Outpatient Services, Diffusion Of Innovation, Digital Divide, Health Equity.***

## Introduction

Access to quality health care is a constitutional right in Indonesia and a core function of the National Health Insurance (Jaminan Kesehatan Nasional, JKN) scheme administered by BPJS Kesehatan. In the Industry 4.0 era, health systems worldwide are being reshaped by digital technologies that promise greater efficiency, broader access, and improved patient experience (Dash et al., 2019; World Health Organization, 2021). Digitalisation can shorten waiting times, streamline information flows between patients and providers, and enhance the quality and personalisation of care (Ferreira et al., 2023; Nguyen et al., 2021). At the same time, the introduction of electronic appointment and queueing systems does not automatically translate into patient satisfaction, because uptake depends on how well an innovation fits users' capabilities and circumstances (Kitsios et al., 2023).

Waiting time is a well-established determinant of outpatient satisfaction, and digital appointment systems have repeatedly been shown to reduce perceived waiting and improve the registration experience (Koca et al., 2025; Zhang et al., 2023). To realise these gains, BPJS Kesehatan has prioritised service digitalisation, expanding online queueing through the Mobile JKN application so that participants can obtain queue numbers remotely and avoid crowding at registration counters. The application is connected to hospital information systems through the Bridging System version 2.0; by October 2022, 1,693 of 2,903 advanced referral health facilities (FKRTL) in Indonesia (58%) had adopted this integration.

Dr. Pirngadi General Hospital, a class B referral hospital in Medan, is one such facility. Although the Mobile JKN online queue has been available, its utilisation has remained low relative to in-person registration. A preliminary review showed that, of 51,419 outpatients during January–September 2025, only 4,709 (9.16%) used the Mobile JKN online queue. BPJS Kesehatan evaluates facility performance using a weekly quality rate (QR) indicator, calculated as the ratio of completed to total online queues, with an achievement standard of greater than 85%.

Persistently low adoption despite a technically sound system points to a broader concern: digital health innovations can widen, rather than narrow, inequalities when their design and roll-out overlook the capabilities of vulnerable groups. Evidence from systematic reviews shows that older adults, people with limited education or income, and those with low digital literacy are consistently less likely to adopt digital health technologies, producing a digital divide in access to care (Bertolazzi et al.,

2024; Hepburn et al., 2025; Raihan et al., 2026). Where a publicly funded scheme such as JKN shifts essential services onto a digital channel, such exclusion has direct equity implications for social inclusion in health.

Rogers' Diffusion of Innovations (DOI) theory offers a robust lens for examining why an innovation is or is not adopted, through five perceived attributes: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003). The framework has been widely applied to health technology adoption, including patient portals and e-health tools, and is well suited to explaining uneven uptake within a single facility (Wurster et al., 2024). Prior Indonesian studies have largely assessed the general effectiveness of Mobile JKN or its impact on waiting times (Pratama & Suhartanto, 2025; Wahidah et al., 2023), but few have examined the implementation of the online queue through the DOI framework while foregrounding the risk of exclusion of technology-vulnerable patients at a public referral hospital.

This study therefore analyses the implementation of the Mobile JKN online queueing programme in outpatient services at Dr. Pirngadi General Hospital, Medan, using Rogers' five innovation attributes, and identifies the factors that most strongly constrain its inclusive uptake.

## Method

### Study design and setting

A qualitative case study design was used to obtain an in-depth, contextual understanding of how the Mobile JKN online queueing system was implemented in routine outpatient care. The study was conducted from February to April 2026 at Dr. Pirngadi General Hospital, a class B public referral hospital in Medan, North Sumatra, Indonesia, that is undergoing digital transformation of its outpatient services. Reporting follows the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong et al., 2007).

### Informants and sampling

Informants were selected through purposive sampling to capture both direct users and the staff responsible for operating and monitoring the programme along the queue workflow (the "get-list task ID 1–7" process). Twelve informants participated: eight outpatients who actively used the Mobile JKN online queue, one outpatient clinic nurse, one administrative coordinator, one IT staff member, and one BPJS Kesehatan person-in-charge (PIC). Patients were eligible if they had used the online queue for outpatient care; patients who registered only through the manual system were excluded. Recruitment continued until data saturation, defined as the point at which interviews yielded no

new themes. Informant characteristics are summarised in Table 1, and informants are referred to by anonymised codes throughout.

**Table 1. Characteristics of informants (N = 12)**

| Code | Role | Age (yr) | Education | Tenure |
|---|---|---|---|---|
| P1 | Outpatient (Mobile JKN user) | 73 | Bachelor's degree | – |
| P2 | Outpatient (Mobile JKN user) | 36 | Diploma-4 | – |
| P3 | Outpatient (Mobile JKN user) | 69 | Bachelor's degree | – |
| P4 | Outpatient (Mobile JKN user) | 52 | Bachelor's degree | – |
| P5 | Outpatient (Mobile JKN user) | 31 | Bachelor's degree | – |
| P6 | Outpatient (Mobile JKN user) | 44 | Bachelor's degree | – |
| P7 | Outpatient (Mobile JKN user) | 53 | Master's degree | – |
| P8 | Outpatient (Mobile JKN user) | 55 | Bachelor's degree | – |
| N1 | Outpatient clinic nurse | 47 | Professional Nurse (Ners) | 16 yr |
| AC1 | Administrative coordinator | 45 | Bachelor of Public Health | 14 yr |
| IT1 | IT staff | 30 | Bachelor in Information Technology | 4 yr |
| BPJS1 | BPJS Kesehatan PIC | 49 | Medical doctor; Master of Hospital Administration | 15 yr |

**Data collection**

Data were collected through three methods. In-depth interviews used a semi-structured guide built around Rogers' five attributes to explore barriers, enablers, and the overall effectiveness of implementation; interviews were conducted in the outpatient and IT units, audio-recorded with consent, and transcribed verbatim. Direct observation focused on the real workflow of the online queue in the outpatient unit, including patient check-in and queue calling. Document review covered operational reports, QR monitoring records, and policy guidelines related to the programme.

**Data analysis**

Transcripts, field notes, and documents were analysed thematically (Braun & Clarke, 2006) and organised through the interactive model of (Matthew B et al., 2014), comprising data collection, data condensation, data display, and conclusion drawing and verification. Coding proceeded from open coding (initial labelling of concepts in the transcripts), through axial coding (grouping codes into categories and identifying contextual relationships), to selective coding (synthesising categories into the five DOI dimensions and an overarching narrative). Coding was reviewed iteratively to refine and confirm the themes.

**Trustworthiness and ethics**

Trustworthiness was addressed through the four criteria of credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Source triangulation (comparing accounts across patients, nurse, administrative, IT, and BPJS informants) and technique triangulation (comparing interview, observation, and document data) were applied to corroborate findings. Ethical approval was obtained from the Health Research Ethics Committee of Universitas Prima Indonesia prior to data collection [approval number to be inserted]. All informants received an explanation of the study and provided written informed consent; participation was voluntary, confidentiality was maintained through anonymised coding, and informants could withdraw at any stage without penalty.

**Results**

Findings are presented according to Rogers' five innovation attributes. Table 2 summarises the key findings and the informants who contributed to each dimension.

**Relative advantage**

Informants consistently described clear advantages of the online queue over the manual system, chiefly reduced crowding at queue machines, lower paper use, and faster administrative processing for patients and staff alike.

*"This programme has a very innovative aim. For users of different ages and varying familiarity with the online queue, I think special guidance from BPJS Kesehatan is still needed. But the benefit is real convenience: as patients we no longer have to arrive early just to take a queue number to register at a specialist clinic—the number is now obtained automatically through the app, without the crowding that happened with manual queues."* — P1 (outpatient, 2026)

*"It increases the satisfaction of participants who visit the hospital, so they are more likely to return; indirectly, the brand image built by the Mobile JKN programme becomes added value for participants."* — AC1 (administrative coordinator, 2026)

*"The economic benefit is not immediately visible, but there is a clear time-saving advantage: data from Mobile JKN connect directly to SIMRS, which makes it easier for admissions to create the medical record of a patient visiting the outpatient clinic."* — IT1 (IT staff, 2026)

Triangulated with observation, these accounts indicate that the system minimises physical queueing and paper logistics and eases the work of admission staff, benefiting both patients and the hospital.

**Compatibility**

The innovation was largely compatible with existing hospital systems and workflows, having been integrated with SIMRS through the Bridging System v2.0

and requiring continuous cross-functional coordination.

*"We regularly monitor the hospital's quality rate and compliance. This cross-functional collaboration is notable because the programme requires continuous cooperation between the IT, medical, and administrative teams."* — BPJS1 (BPJS Kesehatan PIC, 2026)

*"We coordinate continuously with the registration and IT units. Our role is to make sure that patients who have registered on the app are actually served according to their queue number, so there are no complaints at the clinic."* — N1 (outpatient nurse, 2026)

However, compatibility broke down for specific patient segments. Informants repeatedly identified a misfit between the digital channel and the circumstances of elderly patients and those without smartphones:

*"What I often encounter is: patients who do not have phone credit to register an account on Mobile JKN; elderly patients who do not own a smartphone; and patients whose phone number is already registered, without knowing why."* — BPJS1 (BPJS Kesehatan PIC, 2026)

The main barrier to compatibility was thus an incomplete understanding of the application among BPJS participants—particularly older patients—together with limited device ownership and not-yet-optimal participant education by staff.

**Complexity**

Complexity was identified as the dominant barrier. Difficulty concentrated on the account-activation step, which requires phone credit and an internet connection, and on low technological literacy among elderly users.

*"The difficulty started when I created my Mobile JKN account. To activate it you need phone credit, but that information is not always clear to us as users. Fortunately the hospital placed a dedicated staff member in the waiting room to help. There was also little education on the check-in process—at first I did not understand it until I asked at the hospital and they explained."* — P1 (outpatient, 2026)

*"The main obstacle is when there is no phone credit to register online, or for patients who simply do not have a smartphone—then they cannot use the system at all."* — P3 (outpatient, 2026)

Triangulated accounts converged on the same conclusion: the online registration process presumes a degree of digital access and literacy that elderly patients without a companion frequently lack, while many still use devices that do not support the application.

**Trialability**

The feature was openly available for patients to try, and its performance was systematically tracked through the QR indicator, providing an ongoing, public test of quality.

*"As far as I know, patients check in on time when they arrive at the hospital and complete the Kesan (post-service evaluation) feature in the app."* — N1 (outpatient nurse, 2026)

*"Compliance is assessed using the quality rate, calculated as (completed queues ÷ total queues) × 100. The QR must be greater than 85% and is usually released every 3 to 7 days."* —BPJS1 (BPJS Kesehatan PIC, 2026)

The QR is released every 3–7 days by the BPJS Kesehatan Medan branch PIC. Initial achievement at Dr. Pirngadi fell below the >85% target, but improved with continuous evaluation. Because the indicator depends on patients' ability to use the technology, the trial phase exposed the same vulnerability: older participants, and at times younger ones, encountered difficulty completing the digital steps.

**Observability**

The benefits of the innovation were readily observable, both operationally through the integrated data flow and physically in the waiting room.

*"Access to the online queue is very easy, except for elderly patients without a companion, where communication is the most common barrier."* — N1 (outpatient nurse, 2026)

*"For patients who have used Mobile JKN, their data are automatically entered into our SIMRS because our system is integrated with the BPJS Kesehatan data. This lets my unit complete patient administration more quickly and accurately."*— AC1 (administrative coordinator, 2026)

*"We can observe it by monitoring the get-list task ID entering SIMRS, integrated with BPJS Kesehatan."*— IT1 (IT staff, 2026)

Observation confirmed that implementation could be tracked through the task-ID list flowing into SIMRS and through the visible presence of JKN staff and clinic nurses assisting patients with the application in the waiting room—support that was especially important for patients who struggled with the technology.

**Table 2. Summary of findings by Rogers' innovation attribute**

| Attribute | Key finding | Informants |
|---|---|---|
| Relative advantage | Reduced physical queues and paper logistics; time efficiency; automatic SIMRS population; perceived gains in service quality and institutional image. | P1, AC1, IT1 |
| Compatibility | Integrated with SIMRS via Bridging System v2.0; sustained IT–medical–administrative coordination; misfit for elderly and non-smartphone users. | BPJS1, N1, AC1 |
| Complexity | Dominant barrier: account activation requires phone credit and internet; low digital literacy among elderly; limited device ownership. | P1, P3, AC1, IT1 |
| Trialability | Feature openly usable; QR indicator monitored every 3–7 days; QR initially below the >85% target but improving with evaluation. | N1, IT1, BPJS1 |

| Attribute | Key finding | Informants |
|---|---|---|
| Observability | Benefits visible through SIMRS task-ID monitoring and BPJS integration, and through on-site staff assistance in the waiting room. | N1, AC1, IT1 |

## Discussion

Applying Rogers' framework, the findings show an innovation with strong relative advantage and observability, adequate trialability, partial compatibility, and high complexity for specific user groups. This configuration explains the central paradox of the study: a technically sound, well-integrated system that nevertheless reaches only 9.16% of outpatients.

### Efficiency gains as relative advantage

The most salient advantage was time efficiency—reduced crowding, less paper, and faster administration via automatic SIMRS population. This aligns with evidence that online appointment and queueing systems shorten perceived waiting and improve the registration experience and satisfaction (Koca et al., 2025; Zhang et al., 2023), and with Indonesian work showing efficiency gains from monitored Mobile JKN online queues at referral facilities (Wahidah et al., 2023). In DOI terms, a clearly perceived relative advantage is normally the strongest predictor of adoption (Rogers, 2003); the fact that adoption nonetheless remained low indicates that advantage alone was insufficient to overcome barriers concentrated in other attributes.

### Compatibility, integration, and the limits of "fit"

At the system level the innovation was compatible: integration through Bridging System v2.0 embedded the queue into existing SIMRS workflows and demanded cross-functional coordination, consistent with the importance of interoperability and organisational fit in successful digital health adoption (Pratama & Suhartanto, 2025; Wurster et al., 2024). Yet compatibility is also a property of the fit between the innovation and users' values, experiences, and resources. Here a clear misfit emerged for elderly patients and those without smartphones or phone credit—precisely the group for whom the manual system had previously been workable.

### Complexity and the digital divide

Complexity was the decisive barrier. Account activation requiring phone credit and connectivity, combined with low digital literacy and limited device ownership among older patients, created an access threshold that excluded a substantial share of users. This mirrors a consistent international pattern: older adults, and

people with lower education, income, or digital literacy, adopt digital health technologies at lower rates, so that poorly supported digitalisation can widen rather than narrow inequalities—a digital divide in health (Bertolazzi et al., 2024; Hepburn et al., 2025; Raihan et al., 2026). Because Mobile JKN is the channel for a publicly funded entitlement, this complexity carries direct consequences for social inclusion: the patients most dependent on public services are also those most likely to be left behind by the digital channel.

**Trialability, observability, and continuous improvement**

Trialability and observability functioned as designed. The QR indicator, reported every 3–7 days against a >85% standard, provided a transparent, iterative test that allowed management and BPJS Kesehatan to observe results and act on them, with measurable improvement over time. This monitoring-and-feedback mechanism is consistent with evidence that intensive monitoring raises online-queue utilisation at referral facilities (Wahidah et al., 2023). Observable, on-site staff assistance further helped less-confident users complete the process, underscoring that visibility of benefits and human support can partly offset complexity.

**Implications**

The results suggest that increasing uptake at Dr. Pirngadi depends less on additional technical features than on closing the access gap. Practical measures include structured, repeated education on account activation and check-in; a permanent assisted-registration desk and trained companions in the waiting room; simplification or removal of the phone-credit requirement for activation; and proxy or caregiver-assisted registration pathways for elderly patients. Embedding equity indicators—such as uptake disaggregated by age—alongside the QR would help BPJS Kesehatan and hospital management track inclusive adoption, not only aggregate performance (Ferreira et al., 2023; Kitsios et al., 2023; Nguyen et al., 2021; World Health Organization, 2021).

**Limitations**

As a single-site qualitative case study, the findings are analytically rather than statistically generalisable and reflect the specific context of one class B referral hospital. The patient sample, drawn from active online-queue users, may under-represent those who abandoned or never attempted the system, who are likely to face even greater barriers; future research should deliberately include non-adopters. The study did not quantify changes in waiting time or satisfaction. Mixed-methods and multi-site designs, and longitudinal tracking of age-disaggregated uptake, would strengthen and extend these conclusions.

## Conclusions

Implementation of the Mobile JKN online queue at Dr. Pirngadi General Hospital delivered clear efficiency gains—reduced crowding, lower paper use, and faster administration through SIMRS integration—yet uptake remained low at 9.16% of outpatients. Analysed through Rogers' framework, the low adoption is explained not by weak relative advantage or poor observability, but by high complexity and limited compatibility for technology-vulnerable groups, producing a digital divide that threatens equitable, inclusive access to a publicly funded service. Making the innovation inclusive will require targeted digital-literacy support, assisted-registration services, simplified activation, and equity-sensitive monitoring, so that the shift to digital queueing expands rather than restricts access for elderly and low–digital-literacy patients.

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