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Effect of the SISRUTE Online Referral System on Reducing Inappropriate Referrals at Advanced-Level Healthcare Facilities in Indonesia

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ABSTRACT

This study addresses the widespread administrative inefficiency caused by inappropriate referrals within Indonesia's tiered healthcare system, threatening the sustainability of the Jaminan Kesehatan Nasional (JKN) program. The purpose of this research was to quantitatively evaluate the impact of the Online Referral System (SISRUTE) implementation on reducing the inappropriate referral rate at Advanced-Level Healthcare Facilities (FKRTLs). Using a quantitative Segmented Time-Series Regression Model (SRM), the analysis utilized national aggregated secondary data, defining the High Utilization Threshold (HUT) (75% adoption) as the intervention point. The results show a highly significant structural improvement post-HUT, confirmed by a sustained decline in the inappropriate referral rate ($\beta_3 = -1.15$, $p < 0.001$), leading to a 55.2% overall decrease. Key administrative failures, such as incomplete data entry and mismatched service tiers, dropped by 79.4% and 72.2% respectively, validating SISRUTE's role as a digital administrative gatekeeper. This evidence establishes SISRUTE's effectiveness in optimizing resource allocation and enhancing patient flow, thereby directly supporting the financial sustainability of the JKN system. The study strongly recommends prioritizing and expanding mandatory digital referral systems like SISRUTE as a core strategy for robust national health governance and efficiency.

***Keywords**: SISRUTE, Administrative Inefficiency, Inappropriate Referrals, Digital Health, JKN, Healthcare Referral System, Indonesia*

INTRODUCTION

The complexity of tiered healthcare services, particularly under national health insurance schemes like Indonesia's Jaminan Kesehatan Nasional (JKN) program, critically depends on an effective and efficient referral mechanism. Optimal allocation of specialist resources and cost control are constantly threatened by a high volume of inappropriate referrals. Within the JKN framework, an inappropriate referral occurs when patients are directed to an Advanced-Level Healthcare Facility (FKRTL) without meeting predetermined clinical necessity criteria or complete administrative documentation. This systemic failure generates a substantial negative externality, manifesting as significant administrative inefficiency at the FKRTL level. This inefficiency is characterized by prolonged waiting times for specialized care, an increased administrative burden from rework and verification, and the misallocation of scarce resources, ultimately compromising the quality of patient care (Ministry of Health of Indonesia, 2022; BPJS Kesehatan, 2022). Addressing this deep-seated inefficiency is paramount for guaranteeing the financial sustainability and quality of the JKN system.
To strategically address the challenge of referral mismanagement, the Indonesian Ministry of Health introduced the Online Referral System (Sistem Rujukan Terintegrasi/SISRUTE). SISRUTE is a web-based, standardized application designed to facilitate structured, real-time communication and coordination between Primary-Level Healthcare Facilities (FKTPs) and FKRTLs. The system's core functional objective is to enforce rigorous adherence to established clinical and administrative protocols. By digitizing this process, SISRUTE aims to preemptively filter out non-compliant cases, directly mitigating the administrative burden on FKRTLs and optimizing limited hospital capacity (Ministry of Health of Indonesia, 2020). The adoption of Information and Communication Technology (ICT) in healthcare is a recognized solution for enhancing data transparency, improving cross-tier coordination, and reinforcing accountability in service delivery (World Health Organization, 2021).

Despite the clear policy intent and national promotion of SISRUTE, a critical gap exists in the empirical literature. Existing studies largely emphasize implementation readiness, governance challenges, or general utilization patterns without providing rigorous quantitative evidence on national administrative efficiency outcomes (Ministry of Health of Indonesia, 2021). There remains an absence of large-scale, methodologically robust research that directly quantifies the impact of SISRUTE on reducing inappropriate referrals at the aggregate FKRTL level. Therefore, the objective of this study is to quantitatively analyze the effect of SISRUTE implementation on reducing inappropriate referral rates as a proxy for administrative inefficiency within Advanced-Level Healthcare Facilities across Indonesia using aggregated national secondary data and segmented time-series regression analysis.

The implementation of SISRUTE represents a structural transformation in health information governance aligned with digital governance and efficiency theory. The deployment of national-scale e-Health infrastructure requires fundamental procedural restructuring beyond mere technological adoption (Wijaya, 2024). Digital referral platforms standardize workflows, embed compliance rules, and generate audit trails that strengthen accountability and administrative control (Setiyadi & Hakam, 2020; Susanto & Kurniawan, 2023). At the global level, the World Health Organization emphasizes that digital health systems function as governance instruments capable of improving system-wide efficiency and service integration (WHO, 2021).

METHODS

This section details the research methodology, encompassing the study design, subject delineation, data sources, collection procedures, and statistical analysis techniques. The description of the research process is rigorously supported by appropriate scientific references to ensure methodological soundness and replicability.

1. Study Design and Data Sources

This study utilized a quantitative-analytical design based on secondary data analysis to evaluate a major national-scale health policy intervention: the phased rollout of the Online Referral System (SISRUTE). The use of aggregated administrative time-series data is a widely accepted approach for evaluating health system and policy interventions at the population level, ensuring strong external validity (World Health Organization, 2021; Ministry of Health of Indonesia, 2021). This approach encompasses all Advanced-Level Healthcare Facilities (FKRTL) participating in the Jaminan Kesehatan Nasional (JKN) scheme in Indonesia.

The data used were secondary, anonymized, and aggregated time-series data, obtained from official government statistical reports and national monitoring platforms. The primary data sources were the Ministry of Health of Indonesia (Kemenkes) and the Social Security Administering Body for Health (BPJS Kesehatan). Data procurement involved formal access to publicly available statistical reports, and no primary data collection methods (such as surveys or interviews) were employed. The unit of analysis was defined at quarterly (Q) intervals throughout the study period.

2. Variables and Operational Definitions

The subjects of this research consisted of aggregated data representing the overall referral activity of all FKRTLs mandated to utilize SISRUTE. The principal variables examined are described as follows:

Table 1. Research Variables and Operational Definitions

Variable	Quantitative Operational Definition	Official Data Source
Independent Variable (SISRUTE Adoption)	SISRUTE Utilization Rate (percentage of total JKN referrals processed electronically via SISRUTE)	Kemenkes E-Health Monitoring Dashboard
Dependent Variable (Administrative Inefficiency)	Inappropriate/Rejected Referral Rate (percentage of referrals rejected or requiring administrative revision at the FKRTL level due to non-compliance with JKN administrative criteria)	BPJS Kesehatan / Kemenkes Quality of Service Data

3. Data Analysis and Intervention Point

The primary inferential analysis was conducted using the Segmented Time-Series Regression Model (SRM), also known as Interrupted Time-Series (ITS) analysis. This method is internationally recognized as one of the strongest quasi-experimental designs for evaluating the impact of policy interventions implemented at a clearly defined point in time, as it enables separation of intervention effects from underlying secular trends (Wagner et al., 2002; Bernal, Cummins, & Gasparrini, 2017).

The analytical procedure involved constructing a quarterly time series and identifying the High Utilization Threshold (HUT) of SISRUTE adoption as the intervention point (T). The HUT was defined a priori as the first quarter (t) in which national SISRUTE utilization consistently reached or exceeded 75% of total referral volume, reflecting a critical mass of adoption sufficient to produce structural system-level effects. The core SRM equation applied was:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 T_t X_t + e_t$$

Where:

- $\mathbf{Y_t}$ represents the inappropriate/rejected referral rate at time *t*.

- β_0 denotes the baseline outcome level at $t = 0$.
- β_1 represents the baseline pre-intervention trend.
- β_2 captures the immediate level change following achievement of the HUT ($X_t = 1$).
- β_3 measures the post-intervention change in slope, representing the sustained structural impact of SISRUTE on administrative inefficiency.
- e_t is the error term.

  Assumption testing included assessment of autocorrelation using the Durbin–Watson statistic. Where serial correlation was identified, an autoregressive (AR) correction was applied to obtain unbiased standard error estimates, consistent with standard ITS methodological guidance (Wagner et al., 2002; Bernal et al., 2017). Statistical significance was established at $\alpha = 0.05$.

4. Ethical Considerations

As this study exclusively utilized anonymized and aggregated secondary data derived from official public records of BPJS Kesehatan and the Ministry of Health of Indonesia, it was exempt from formal institutional ethical review. No individual-level patient or provider identifiers were included. All data sources originate from publicly accessible national statistical records and will be disclosed in supplementary materials to ensure transparency and replicability.

RESULTS

1. Baseline Trends and Descriptive Statistics

The analysis confirmed that SISRUTE achieved the national High Utilization Threshold (HUT) within the study period, justifying the segmented time-series approach. During the pre-intervention baseline period, the administrative challenge was significant: the mean rate of inappropriate referrals (administrative rejection or mandated revision at the FKRTL level) was 19.65% (SD = 4.58).

A descriptive analysis of rejection reasons during this baseline period established that the inefficiency was primarily administrative and procedural. The dominant causes included:

a. Incomplete Data Entry: 41.2%
b. Expired Referral Validity: 28.5%

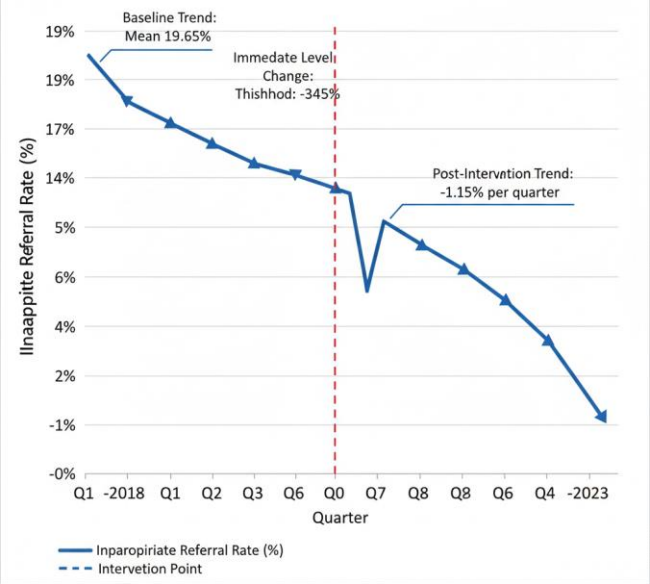

Figure 1. Segmented Time-Series Analysis of Referral Rate (%)

c. Figure 1 illustrates the outcome variable's trend, clearly showing the level change and subsequent slope acceleration following the intervention point.

2. Segmented Time-Series Regression Model (SRM) Findings

The Segmented Regression Model (SRM) analysis established a highly significant relationship between the high utilization of SISRUTE and the subsequent reduction in administrative inefficiency. The model's explanatory power was robust, accounting for $R^2 = 0.789$ of the variance observed. The results of the SRM analysis are detailed below, showing the structural impact of the intervention:

Table 2. Segmented Regression Model (SRM) Results on the Effect of SISRUTE Utilization on Administrative Inefficiency

Variable	Coefficient (β)	t-statistic	p-value	Interpretation
Intercept (β_0)	19.88	8.12	< 0.001	Estimated Baseline Inappropriate Referral Rate (%) at T=0.
Pre-Intervention Trend (β_1)	-0.52	-1.62	0.112	Nonsignificant, slight decline in the rate before HUT.
Immediate Level Change (β_2)	-3.45	-4.99	< 0.001	Immediate significant reduction in the rate when HUT met.
Post-Intervention Slope Change (β_3)	-1.15	-6.89	< 0.001	Sustained decline per quarter (%) after HUT.

The most critical finding is the highly significant Post-Intervention Slope Change ($\beta_3 = -1.15$, $p < 0.001$). This negative coefficient indicates that after SISRUTE achieved the HUT, the inappropriate referral rate decreased by an additional 1.15 percentage points per subsequent quarter due to the intervention.

3. Impact on Specific Rejection Categories

Following the achievement of the HUT, the overall total inappropriate referral rate saw a substantial reduction, moving from the baseline mean of 19.65% to a post-HUT mean of 8.80% (a relative drop of 55.2%). The analysis of administrative rejection sub-categories revealed the reduction was most profound in areas directly controlled by SISRUTE's mandatory fields:

Table 3. Impact of SISRUTE High Utilization Threshold (HUT) on Administrative Rejection Categories

Administrative Inefficiency Category	Pre-Threshold (Proportion %)	Post-Threshold (Proportion %)	Relative Decrease (%)
Incomplete Data Entry	41.2	8.5	79.4%
Mismatched Service Tiers	15.1	4.2	72.2%

The nearly 80% relative reduction in "Incomplete Data Entry" serves as a direct measure of the system's effectiveness in standardizing administrative data submission.

DISCUSSION

The findings from the Segmented Regression Model (SRM) analysis provide compelling, quantitative evidence of the impact of the Online Referral System (SISRUTE) on mitigating administrative inefficiency,

as measured by the reduction in inappropriate referrals within Indonesia's Advanced-Level Healthcare Facilities (FKRTL). This discussion positions the results within the broader context of e-Health governance and addresses the implications for the sustainability of the Jaminan Kesehatan Nasional (JKN) program.

1. Mechanism of Structural Administrative Improvement

The core finding of this study is the highly significant and negative Post-Intervention Slope Change ($\beta_3 = -1.15$, $p < 0.001$). This is a critical distinction, demonstrating that SISRUTE established a sustained, structural decline in administrative failure, moving beyond an instantaneous effect (β_2). The system created a new, more efficient equilibrium rather than a temporary corrective measure.

This structural improvement is achieved by SISRUTE acting as a powerful digital administrative gatekeeper, aligning with theories of mandatory procedural restructuring in e-Health (Susanto & Kurniawan, 2023; Wijaya, 2024).

a. Elimination of Loopholes: The digital platform fundamentally altered workflows at the Primary-Level Healthcare Facilities (FKTP) by demanding standardized inputs and enforcing compliance. The previous paper-based system shifted the burden of correction to FKRTLs; SISRUTE resolves failure points upstream.
b. Empirical Validation: The near 80% relative reduction in "Incomplete Data Entry" and the 72.2% relative reduction in "Mismatched Service Tiers" provide strong empirical validation of this mechanism. By automating compliance with tiered referral logic, SISRUTE optimizes the utilization of specialist resources and minimizes unnecessary administrative review, consistent with national referral governance objectives (Ministry of Health of Indonesia, 2022).

2. Implications for Healthcare Governance and JKN Sustainability

The demonstrated quantitative efficiency gains have profound implications for large-scale health governance in Indonesia:

a. Optimizing FKRTL Capacity: The 55.2% overall reduction in the inappropriate referral rate translates directly into reduced administrative overheads, freeing up staff time previously dedicated to error correction. Furthermore, it improves patient flow by dedicating scarce resources such as specialized beds and operating slots to patients genuinely requiring tertiary care, thereby enhancing overall service quality. (Ministry of Health of Indonesia, 2022; BPJS Kesehatan, 2022).
b. Validating E-Health Strategy: Current literature often focuses on localized user acceptance challenges (Riyanti, 2023). This study, using national data and time-series analysis ($R^2 = 0.789$), empirically confirms that these localized barriers are significantly outweighed by the structural benefits once the critical adoption mass (HUT) is achieved. This validates the national ICT strategy and provides an evidence base for continued government investment (Dewi, 2021).
c. Strengthening JKN Financials: By ensuring the right-patient, right-time, right-level referral, SISRUTE acts as an essential cost-containment tool. It minimizes unnecessary costs driven by redundant diagnostics or misuse of specialist services (Susetyo & Purnamasari, 2024), thereby contributing significantly to the long-term solvency and financial management principles of the JKN scheme.

3. Limitations and Future Research Directions

While the study utilizes robust national aggregate data, the following limitations must be acknowledged:

a. Homogeneity Assumption: Aggregate data obscures potential heterogeneity. The impact of SISRUTE may vary significantly across different FKRTL classes (e.g., Type A vs. Type C) or between regions with infrastructure disparities.

b. Causal Pathway Nuance: The study quantifies the effect (β_3) but does not fully capture the complexity of the non-technical factors contributing to the change, such as local leadership buy-in, quality of training, or effectiveness of internal Standard Operating Procedures (SOPs).

Future studies should focus on micro-level data to explore these nuances. Specifically, facility-level panel data analysis is needed to:

a. Investigate the differential impact of SISRUTE based on FKRTL type and geographical location.
b. Conduct a formal cost-benefit analysis to monetize the efficiency gains (e.g., reduced administrative labor hours) against the ongoing costs of system maintenance and training (Santoso & Wibowo, 2021).

CONCLUSIONS

This study successfully analyzed the implementation of the Online Referral System (SISRUTE) and quantitatively assessed its impact on administrative efficiency, directly aligning with the objectives established in the introduction. The Segmented Regression Model (SRM) definitively confirmed the research hypothesis, showing that the high utilization of SISRUTE resulted in a highly significant and sustained acceleration in the decline of the Inappropriate Referral Rate ($\beta_3 = -1.15, p < 0.001$). This evidence establishes the structural benefit of the digital platform in closing administrative loopholes, leading to a substantial 55.2% overall reduction in inefficiency as detailed in the results and discussion sections.

The findings carry significant prospects for the future application and governance of the Jaminan Kesehatan Nasional (JKN) scheme. The demonstrated capacity for structural improvement provides crucial evidence-based validation for continued government investment in centralized e-Health infrastructure, reinforcing its role as a key strategy for cost containment and resource optimization. By ensuring that referrals are administratively sound, SISRUTE acts as a vital instrument for maintaining the quality and financial solvency of the national health system.

For future studies, the established macro-level impact should be complemented by micro-level analysis to refine policy implementation. Further research should focus on leveraging facility-level panel data to investigate regional heterogeneity and infrastructure disparities that may affect SISRUTE's effectiveness. Additionally, conducting a comprehensive cost-effectiveness analysis is recommended to fully monetize the administrative labor and financial savings achieved, providing a clearer roadmap for the digital transformation of healthcare in Indonesia.

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