

Digital Transformation in Indonesia's Primary Healthcare: Navigating Regulatory Pressure and Perceived Threats in Electronic Medical Records Adoption

ABSTRACT

Aims: This study explores the dynamics of Electronic Medical Records (EMRs) adoption and use in primary healthcare facilities in Indonesia. It specifically examines the role of regulatory pressure and perceived technological threats within the framework of mandatory national health policies.

Material and Methods: A multisite cross-sectional survey was conducted among 688 healthcare workers from 27 community health centers in Bantul Regency, Indonesia. The study utilizes an analytical framework incorporating regulatory pressure, perceived threat, performance expectancy, effort expectancy, facilitating conditions, behavioral intention, and actual use, analyzed through structural equation modeling.

Findings: The analysis reveals that perceptions of utility, ease of use, and organizational support play a vital role in shaping the intention to adopt EMRs. Regulatory pressure emerges as a primary driver that shapes facility readiness and practitioners' psychological response, directly strengthening behavioral intention. Notably, actual system usage is driven by the synergy between regulatory mandates and institutional readiness.

Conclusion: Successful digital transformation in primary healthcare requires coherence among regulatory enforcement, institutional readiness, and the adaptive responses of healthcare workers to technological change.

Keywords: *Electronic Medical Records; Primary Healthcare; Regulatory Pressure; Perceived Threat; Digital Health; Indonesia*

INTRODUCTION

Digital transformation has become a strategic priority in health system reform across many developing countries, including Indonesia. In this context, Indonesia's Ministry of Health (Kementerian Kesehatan Republik Indonesia—Kemenkes) is actively promoting the adoption of Electronic Medical Records (EMRs) as part of the national agenda to strengthen the health system. This initiative is outlined in the 2020-2024 National Medium-Term Development Plan (RPJMN) and will continue through the 2025-2029 RPJMN. The agenda is supported by various regulatory frameworks, including Law (Undang-Undang—UU) Number 17 of 2023 concerning Health, the Health Digital Transformation Strategy policy, and Minister of Health Regulation (Peraturan Menteri Kesehatan—Permenkes) No. 24 of 2022, Article 45, which mandates that all health facilities implement EMR within a specified timeframe. Collectively, these policies aim to establish an integrated digital health ecosystem through the SATUSEHAT platform.

At the macro level, Indonesia has made significant progress in digitizing the health sector. The WHO Global Health Monitor ranks Indonesia at digital maturity level 4 [1], indicating that the use of digital technology is mature and functional. However, achievements in national-level policy are not fully reflected in implementation at the health facility level. Data from the Center for Indonesia's Strategic Development Initiatives (CISDI) reveal that 48.9% (4,807) of community health centers (Pusat Kesehatan Masyarakat—Puskesmas) have yet to adopt electronic medical records (EMRs), with low technological literacy among healthcare workers identified as the primary obstacle [2].

These findings align with numerous studies confirming that barriers to health technology adoption in developing countries arise not only from limited exposure to technology but also from psychological and structural factors, such as low self-efficacy [3], intrinsic motivation [4,5], and low trust in technology [6]. Furthermore, digitizing health system—particularly those requiring interoperability—demands maturity in resources, infrastructure, and governance, which developing countries often lack [7–9]. Under these conditions, governments tend to rely on mandatory policies to accelerate the adoption of health technologies.

This coercive regulatory approach generates institutional pressure that potentially shapes healthcare workers' technology use behaviors. Several studies demonstrate that public policy can affect behavioral intentions both directly and indirectly through attitudes, perceived control, and risk perceptions [10–12]. However, policy factors are generally not yet systematically incorporated into mainstream health technology adoption frameworks. In the context of developing countries,

regulation functions not merely as a supportive tool but as a coercive mechanism that demands compliance and may induce psychological stress due to the threat of sanctions.

In institutional literature, coercive pressure from regulators is recognized as a major driver of organizational change, particularly during the formal technology adoption phase [13]. In the health sector, responses to this pressure manifest through coercive, normative, and mimetic mechanisms [14]. Recent studies indicate that coercive pressure not only promotes compliance but also heightens sanction-based strain, which is likely to influence how individuals interpret and utilize technology [15].

In line with this, research on health technology adoption heavily relies on the Unified Theory of Acceptance and Use of Technology (UTAUT) as the primary analytical framework [16]. Various adaptations of UTAUT have incorporated contextual factors, including policy and risk perception [17–19]. However, most studies treat policy as a form of facility support that enhances trust and reduces risk [20–22], rather than as coercive pressure that mandates technology adoption.

In addition to regulatory factors, perceived threat is increasingly recognized as a crucial determinant in technology adoption, especially in environments with low digital literacy and limited infrastructure [23,24]. Perceived threats—whether technological risks or psychological pressures such as technostress—can play a role in shaping perceptions of ease of use, intention, and actual utilization of digital systems [25,26]. In the context of mandatory EMR implementation, there is a significant interest in exploring how regulatory pressure and perceived threat may interact to shape healthcare workers' behavior.

Studies on EMR adoption in Indonesia have highlighted the benefits of EMR for data security and service monitoring [27], while identifying various obstacles such as regional disparities [28], infrastructure limitations [29,30], and low literacy levels [31]. However, empirical evidence remains limited regarding the simultaneous influence of coercive regulatory pressure and perceived threat simultaneously influence the cognitive determinants of EMR adoption. To address this gap, this study analyzes EMR adoption in Indonesia by utilizing a UTAUT framework that integrates regulatory pressure and perceived threat as key factors. By positioning EMR as a tool for health policy and service system development, this study aims to provide empirical contributions to strengthening the governance of digital health transformation in developing countries, while offering policy implications to enhance the effectiveness of EMR implementation at the primary care level.

METHODS

This study employs an analytical framework that integrates the Unified Theory of Acceptance and Use of Technology (UTAUT) with two additional constructs—regulatory pressure and perceived threat—to examine EMR adoption within the context of health policy in developing countries [16,32]. UTAUT identifies the core cognitive determinants of EMR adoption: performance expectancy, effort expectancy, social influence, and facilitating conditions, all of which are explored in relation to behavioral intention and actual use [16]. To capture the context of mandatory EMR implementation, the model is expanded to include regulatory pressure, representing coercive influence from government policies and regulations on institutional compliance [33–35].

Additionally, perceived threat is considered a psychological response to the risks, uncertainties, and adaptation burdens associated with mandatory implementation, especially in environments with low digital literacy [36,37]. This framework guides the analysis of the structural relationships these factors, which were evaluated using partial least squares structural equation modeling (PLS-SEM). The conceptual associations between constructs are illustrated in Figure 1.

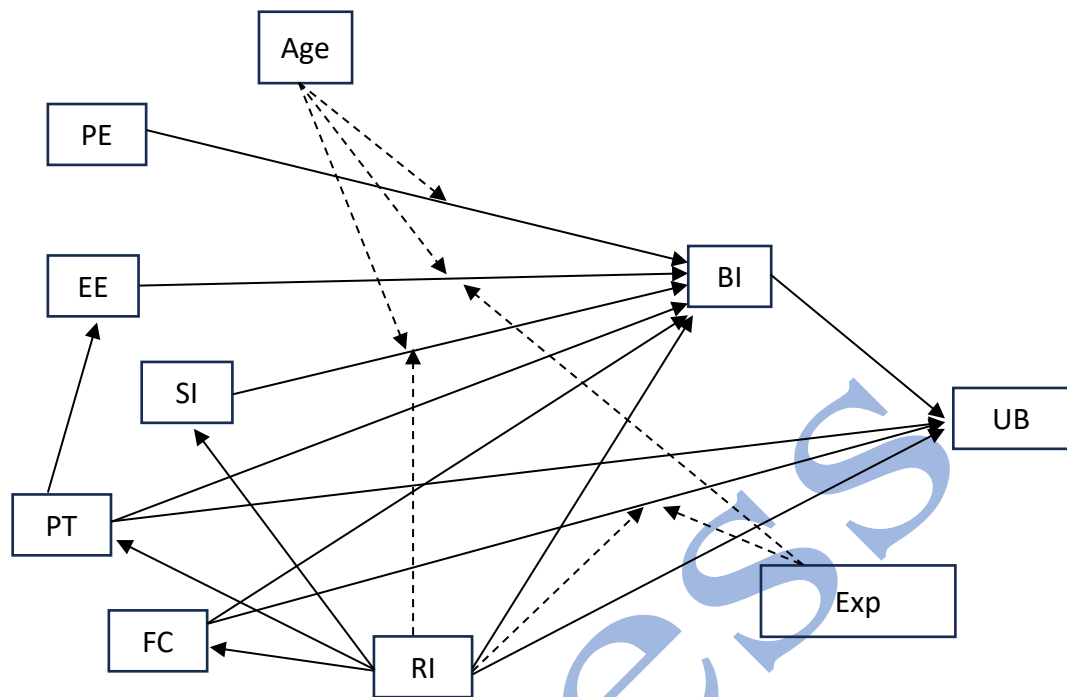


Figure 1. Theoretical Framework Model

Research Instrument

This study developed an instrument to measure EMR adoption by adapting and expanding the UTAUT model, incorporating the constructs of perceived threat and regulatory influence. The questionnaire was based on relevant literature concerning technology adoption and health information systems, the tailored specifically to the context of EMR use by healthcare workers. The initial draft was refined through consultations with experts in digital transformation and healthcare management to ensure both conceptual accuracy and contextual relevance.

The questionnaire consists of four sections: basic respondent information, core UTAUT construct, perceived threat, and regulatory influence. All items are measured using a five-point Likert scale. The instrument was translated into Indonesian through a back-translation procedure and piloted to ensure clarity of wording. Reliability testing produced Cronbach's alpha values exceeding the acceptable threshold for all constructs. Details of the measurement items are presented in Table 1.

Table 1 Question items

Measure	Code
<i>Basic Information</i>	
Gender (select one answer choice): A. Male B. Female	
Age (select one answer choice): A. < 25 B. 25-40 C. 41-45 D. 46-55 E. > 55	
Education level (select one answer choice): A. High School or less B. Diploma C. Undergraduate D. Postgraduate	
Work experience (select one answer choice): A. < 1 year B. 1-5 years C. 6-10 years D. 11-20 years E. >20 years	
<i>Experience (Exp)</i>	
I feel that I have become increasingly familiar with using the EMR system over time	EXP1
I feel that I have become more proficient in using the EMR compared to when I first started using it	EXP2
I have participated in training or mentorship related to the EMR	EXP3
<i>Performance Expectancy (PE)</i>	
I believe that implementing or using the Electronic Medical Record (EMR) can improve my performance in documenting patient data	PE1

I believe that using the EMR enables me to complete patient documentation tasks more quickly	PE2
I consider the EMR to be useful in supporting healthcare services	PE3
<i>Effort expectancy (EE)</i>	
I feel that I can easily learn how to use the EMR system	EE1
I feel that I can interact with and understand the EMR system clearly and easily	EE2
I feel that the EMR system will be easy to use for documenting patient data	EE3
<i>Social influence</i>	
I feel that recommendations from colleagues or supervisors who are important to me encourage me to use the EMR	SI1
Recommendations from people whose opinions I value encourage me to use the EMR	SI2
I feel more motivated to use the EMR when my colleagues or supervisors give personal support or appreciation for using it	SI3
<i>Facilitating conditions (FC)</i>	
With the existing infrastructure, I feel that my environment supports the use of the EMR system for documenting patient data	FC1
I have the resources and knowledge necessary to use the EMR	FC2
With the facilities and resources available in my work environment, I believe I will receive technical assistance if I encounter difficulties using the EMR	FC3
<i>Behavioral intention (BI)</i>	
I intend to use the EMR to document patient data	BI1
I intend to use the EMR to improve my work efficiency as a healthcare worker	BI2
I plan to continue using the EMR in my work	BI3
<i>Usage Behavior (UB)</i>	
I use the EMR in most of my patient documentation activities	UB1
I routinely use the EMR to record patient data in my daily work	UB2
I use the EMR whenever I perform patient documentation tasks	UB3
<i>Perceived threats (PT)</i>	
I am worried that I may become stressed when using the EMR system	PT1
I am concerned that using the EMR may threaten patient data privacy and security	PT2
I am worried that I may not be able to use the EMR without assistance from others	PT3
<i>Regulatory influence (RI)</i>	
Internal rules and standard operating procedures in my unit strongly require the use of the EMR	RI1
I use the EMR, because not complying with EMR policies in my workplace may have consequences	RI2
Government regulations play a decisive role in driving EMR adoption in our unit	RI3

Research Design

This study employed a multisite cross-sectional survey design. Data analysis was conducted using partial least squares structural equation modeling (PLS-SEM) with SmartPLS 4 software. The PLS-SEM approach was chosen because it is well-suited for analyzing complex relationships involving multiple constructs simultaneously [38,39]. The measurement model evaluation included assessments of indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Structural model evaluation involved a bootstrapping procedure to examine the strength and direction of associations between constructs, as well as model explanatory power (R^2), predictive relevance (Q^2), and effect size (f^2). The role of mediation and moderation were also assessed in accordance with the proposed model. To enhance methodological validity, common method bias (CMB) was assessed using the full collinearity variance inflation factor (VIF) and Harman's single-factor test.

Sampling and Data Collection

The questionnaire was distributed to healthcare workers in Bantul Regency, Indonesia, through both an online survey (Google Forms) and offline printed questionnaires. Of the 748 targeted healthcare workers, 688 completed valid questionnaires, resulting in a response rate of 91.98%. All returned questionnaires met the inclusion criteria, and no data were excluded during screening.

In the sample, 603 respondents (88%) were female, and 85 (12%) were male. The age distribution was as follows: 11 (2%) were under 25 years; 371 (54%) were aged 55-40 years; 129 (19%) were aged 41-45 years; 135 (20%) were aged 46-55 years; and 42 (6%) were over 55 years.

Regarding work experience, most respondents had 11-20 years (31%), followed by more than 20 years (24%), 6-10 years (23%), 1-5 years (19%), and less than 1 year (4%).

ANALYSIS AND RESULT

Measurement Model Evaluation

The evaluation of the measurement model confirmed the reliability of the indicators through outer loadings. All indicators showed values between 0.828 and 0.961, consistently exceeding the 0.70 threshold. Internal consistency and convergent validity were confirmed, with average variance extracted (AVE) values ranging from 0.726 to 0.914, indicating that each construct adequately explains the variance in its indicators (see Table 2).

Table 2. Result summary of the Measurement Model

Latent Variable	Indicators	Reliability				
		Indicator Reliability	Internal consistency	Reliability	Convergent Validity	Discriminant Validity
		Factor Loadings	Cronbach's Alpha	Composite Reliability (CR)	AVE	HTMT
		Loading ≥ 0.70	$\alpha \geq 0.70$	CR ≥ 0.70	AVE ≥ 0.50	HTMT ≥ 0.90
UB	UB1	0.875	0.892	0.933	0.822	Yes
	UB2	0.909				
	UB3	0.935				
BI	BI1	0.961	0.953	0.970	0.914	Yes
	BI2	0.950				
	BI3	0.957				
EE	EE1	0.923	0.904	0.940	0.840	Yes
	EE2	0.941				
	EE3	0.885				
FC	FC1	0.912	0.901	0.938	0.835	Yes
	FC2	0.914				
	FC3	0.915				
PE	PE1	0.912	0.903	0.939	0.838	Yes
	PE2	0.913				
	PE3	0.922				
PT	PT1	0.897	0.819	0.893	0.735	Yes
	PT2	0.828				
	PT3	0.846				
RI	RI1	0.832	0.811	0.888	0.726	Yes
	RI2	0.833				
	RI3	0.889				
SI	SI1	0.930	0.900	0.937	0.833	Yes
	SI2	0.939				
	SI3	0.868				

To ensure the conceptual distinctness of the variables, an assessment of discriminant validity was performed. The analysis confirmed that each construct in the model is empirically unique and does not overlap with others. Both the correlation matrix and the ratio of shared variance across constructs demonstrated that the measures for each variable specifically capture their intended concepts, thereby establishing the validity and independence of the framework's component.

Structural Model Evaluation

The structural analysis explored the relationships between the construct using a bootstrapping procedure. The results indicated that behavioral intention play a positive role in shaping usage behavior. Among the primary factors, effort expectancy, facilitating conditions, and performance expectancy emerged as contributors to behavioral intention, while social influence showed a minimal role.

Regulatory influence appeared as central determinant in the framework. It showed strong association with facilitating conditions, perceived threat, and social influence, while also directly relating to behavioral intention. Interestingly, perceived threat demonstrated a positive connection

with effort expectancy and usage behavior. This suggest that coercive regulatory environment, perceived threats do not necessarily hinder adoption but may instead reflect the urgency felt by healthcare workers to adapt to the system (see Table 3).

Table 3. Summary of Structural Relationships

Relationship	Path coefficients (β)	Resulting Observation
PE \rightarrow BI	0.081	Positive Association
EE \rightarrow BI	0.198	Positive Association
SI \rightarrow BI	-0.002	No Clear Association
FC \rightarrow BI	0.329	Positive Association
FC \rightarrow UB	0.124	Positive Association
BI \rightarrow UB	0.299	Positive Association
PT \rightarrow EE	0.657	Positive Association
PT \rightarrow BI	0.138	Positive Association
PT \rightarrow UB	0.386	Positive Association
RI \rightarrow PT	0.681	Very Strong Association
RI \rightarrow SI	0.717	Very Strong Association
RI \rightarrow FC	0.736	Very Strong Association
RI \rightarrow BI	0.203	Positive Association
RI \rightarrow UB	0.081	No Clear Association
Age x PE \rightarrow BI	0.040	No Clear Association
Age x EE \rightarrow BI	-0.033	No Clear Association
Age x SI \rightarrow BI	0.040	No Clear Association
Exp x EE \rightarrow BI	-0.033	No Clear Association
Exp x FC \rightarrow BI	-0.017	No Clear Association
RI x SI \rightarrow BI	0.006	No Clear Association
RI x FC \rightarrow UB	0.032	Positive Association

The analysis of interaction factors suggests that demographic variables, such as age and work experience, do not substantially alter the primary relationships within the model. However, a notable interaction between regulatory influence and facilitating conditions in relation to usage behavior ($\beta = 0.032$). This indicates that regulatory pressure acts as a catalyst, strengthening the role of infrastructure readiness and organizational support in encouraging the actual use of EMR.

Moderation and Predictive Power

The model demonstrated substantial explanatory power, with R^2 values of 0.698 for behavioral intention and 0.660 for use behavior. Regulatory pressure significantly shapes the mediating constructs, confirming its dominant role in the digital transformation process with this context. Predictive relevance analysis (Q^2) further supports the model's robustness, showing that regulatory influence has a large effect size on facilitating conditions and perceived threat. values above 0.40, indicating medium to high predictive relevance, along with relatively low RMSE and MAE values [40,41]. Effect size (f^2) analysis revealed that regulatory influence had large to very large effects on facilitating conditions, social influence, and perceived threat. In contrast, traditional UTAUT constructs and moderator variables contributed only modestly to the primary endogenous variables. The structural model predictive power and effect size results are presented in Table 4.

Table 4. The structural model predictive power and effect size results

Construct	Explanatory Power (R^2)	Key Predictor	Effect Size (f^2)	Interpretation
Effort Expectancy (EE)	0.431	Perceived Threat (PT)	0.759	Large
Social Influence (SI)	0.514	Regulatory Influence (RI)	1.059	Very Large
Facilitating Conditions (FC)	0.542	Regulatory Influence (RI)	1.185	Very Large
Perceived Threat (PT)	0.464	Regulatory Influence (RI)	0.865	Large
Behavioral Intention (BI)	0.698	Facilitating Condition (FC)	0.329	Medium

Usage Behavior (UB)	0.660	Perceived Threat (PT)	0.189	Medium
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To ensure the integrity of the data, potential biases were monitored using multiple diagnostic approaches, including collinearity assessment and factor analysis. The result confirm that the data is free from substantial bias, supporting the reliability and consistency of the study's findings.

DISCUSSION

The findings of this study indicate that EMR adoption in primary healthcare services in Indonesia cannot be explained solely by individual cognitive determinants factors but must be understood within the context of coercive health policies and systemic inequalities in developing countries. These results reinforce the argument that digital health transformation in such settings is driven more by structural and institutional factors than by the individual preferences of healthcare workers [33,34].

The primary element of the UTAUT framework—performance expectancy, effort expectancy, and facilitating conditions—showed a positive role in shaping behavioral intention. These findings align with existing literature, which demonstrates that perceptions of benefits and ease of use remain crucial in shaping technology adoption intentions, even under mandatory conditions [16,42,43]. However, the pronounced role of facilitating conditions highlights that infrastructure readiness and organizational support are essential prerequisites in resource-constrained primary healthcare settings burdened by high administrative demands [44,45].

The limited role of social influence on behavioral intention suggests that interpersonal pressure become less relevant when system use is mandated by policy. In top-down managed healthcare systems, compliance with regulations and institutional standards replaces informal social norms [46,47]. This indicates that social influence is highly contextual and diminishes in professional, mandated environments [48,49].

A key finding of this study is the positive role of perceived threat, which contributed to effort expectancy, behavioral intention, and usage behavior. This contrasts with the dominant technostress literature, which views technological threats as inhibitors of adoption [50,51]. In Indonesian health services, threat perceptions—arising from regulatory compliance demands, administrative risks, and professional pressures—trigger adaptive responses. Healthcare workers respond by increasing learning efforts and making work adjustments to meet institutional demands, thereby accelerating system use [52–54].

The predominance of regulatory pressure over other factors confirms that EMR adoption in Indonesia is primarily driven by institutional forces. Regulations not only mandate usage but also shape compliance norms and perceptions of facility readiness. The direct link between regulatory pressure on behavioral intention suggests that technology acceptance in the public health sector is more policy-riven than based on individual evaluations of usefulness [33].

However, regulatory pressure does not automatically lead to actual use. The gap between policy mandates and actual usage behavior highlights a common challenge in the implementation of health technologies in developing countries [55–57]. This confirms that mandatory policies, without accompanying infrastructure support, system stability, and capacity building, may result in administrative compliance rather than sustainable use. Policy effectiveness is maximized when regulatory pressure works in tandem with facility readiness, as demonstrated by its moderating role in promoting actual EMR use [58,59].

Theoretically, this study extends the analytical framework by demonstrating that, in developing countries subject to coercive health policies, external factors—particularly regulatory pressure and technostress—can overshadow individual cognitive constructs. Integrating technology acceptance models with institutional theory provides a more comprehensive understanding of how health policies influence technology acceptance and use [60,61]. Furthermore, the positive role of perceived threat supports the concept of techno-eustress, where stress triggers adaptive responses and improves performance [51,62].

From a public health policy perspective, these findings suggest that successful EMR implementation cannot rely solely on regulation. Digital transformation in primary health care requires sustained investments in infrastructure, technical support, and organizational readiness. Policies must also address the psychological impacts of regulations on health workers through training, technical assistance, and supervision to manage technostress constructively [3,63]. In this way, EMR adoption goes beyond administrative compliance to strengthen the health system and improve the quality of public health services.

RECOMENDATION

The findings of this study have significant implication for strengthening public health system and advancing health development, particularly in primary healthcare within developing countries. Based on the observed relationships between institutional pressure and practitioner behavior, three recommendations are proposed. First, in the context of primary and community health care, EMR implementation should be viewed as a tool for enhancing services rather than simply an administrative requirement. Governments and primary healthcare managers must ensure that EMRs supports service continuity, patient monitoring, and the integration of community health data. Essential prerequisites include basic infrastructure, system stability, and technical support to enable the effective functioning of EMRs in community health services.

Second, regarding health policy and management, institutional and regulatory factors serve the primary drivers of EMR adoption. Therefore, health digitalization policies should be supported by managerial mechanisms to ensure facility readiness and system sustainability. EMR regulations should be integrated with resource planning, budget allocation, and health facility performance evaluation systems to maximize their impact on the quality of public services.

Third, from the perspective of environmental and occupational health, EMR implementation policies should incorporate considerations of digital workload, the psychosocial impact of rapid adoption, and the psychosocial well-being of health workers. Promoting a supportive work environment that encourages healthy technology use is essential for the sustainability of digital transformation in the public health sector.

CONCLUSION

EMR implementation in primary health services differs significantly from conventional practices, especially under mandatory regulations. This study reveals that the interplay between institutional pressure, organizational readiness, and psychological adaptation of healthcare workers forms the foundation of EMR adoption and use. Consequently, digital health transformation should not be viewed merely as technical shift, but as a systemic evolution. To ensure that EMRs meaningfully enhance the quality of public health services, policy mandates must be harmonized with robust infrastructure support, continuous digital literacy programs, and proactive workload management to address the human dimensions of technological change.

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Authors' Contribution

Mahbub Ghozali (First Author), Conceptualization/Investigation/Formal Analysis/Original draft writing/Review and Editing (60%); Chandra Kartika Dewi (Second Author), Methodologist/Instrument Development and Validation/Clinical Insights Provider/Supervision/Review and Editing (40%).

Ethical Considerations

This study received ethical approval from the Research and Community Service Institute of UIN Sunan Kalijaga Yogyakarta (Decree Number 4013/Un.02/L3/08/2025) on August 8, 2025.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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