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Indonesia's National Health Insurance: Service Expansion, Financing Performance, and Sustainability Challenges

Rizki Lestari

BPJS Corporate University, Indonesia

qee.suhardi@gmail.com *✉

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ABSTRACT

Background: Indonesia's National Health Insurance (JKN), administered by BPJS Kesehatan, has expanded to cover more than 279 million people, representing approximately 98% of the population. Despite this achievement, increasing healthcare utilization and financial pressures raise concerns about the program's long-term sustainability.
Research Gap: Existing studies have examined various aspects of JKN implementation; however, an integrated assessment of healthcare facility expansion, service utilization, benefit expenditure, and contribution performance across the program's development remains necessary.
Novelty: This study integrates four operational dimensions of JKN into a descriptive framework, providing a comprehensive overview of service expansion and financing performance during 2014-2025.
Methods: A structured narrative literature synthesis was combined with descriptive analysis of secondary operational data from BPJS Kesehatan. The analysis examined healthcare facilities, service utilization, benefit expenditure, and contribution performance. Fifty-eight publications were included in the narrative synthesis.
Results: By 2025, advanced referral facilities increased by 90.0% to 3,194, with private providers accounting for 65.8%, while primary healthcare facilities increased by 28.9% to 23,770. Service utilization reached 725,338,227, representing a 685.8% increase from 2014. Benefit expenditure accounted for 107.95% of contribution revenue and 108.24% of contribution receipts. During 2020–2025, contribution revenue increased by IDR 36.44 trillion (26.06%), while collection rates improved from 95.77% to 99.73%.
Conclusion: JKN's expansion has been accompanied by substantial financing pressures, highlighting the need to strengthen primary healthcare, improve expenditure management, and regularly assess financing adequacy.

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INTRODUCTION

Universal health coverage (UHC) is part of the Sustainable Development Goals and emphasizes access to essential services without financial hardship [44][45]. In health financing, risk pooling and purchasing services through a single managing institution represent one approach to expanding protection. Indonesia has implemented JKN on a large population scale, across diverse geographical settings and healthcare capacities.

Indonesia launched the National Health Insurance (JKN) program on January 1, 2014, demonstrating the government's commitment to health-related social protection for all Indonesians [4][5]. The program is administered by BPJS Kesehatan, a public legal entity accountable to the President of the Republic of Indonesia [1][8]. JKN integrated earlier health insurance arrangements, including Jamsostek, Askes, Jamkesmas, and Jamkesda, into a unified system, representing one of Indonesia's largest health-system reforms [28][58].

In 2025, JKN membership reportedly exceeded 279 million people, approximately 98% of Indonesia's population. This indicates the program's administrative coverage but is insufficient to assess effective access or financial protection. International comparisons must also distinguish single-payer financing, public provision, and social health insurance [46][52][54].

From a financing perspective, JKN faces substantial challenges, with claim ratios repeatedly exceeding 100%, indicating that benefit payments exceed contribution revenue [2][10]. In 2025, the claims ratio reached 107.95% of contribution revenue, reflecting a structural imbalance requiring policy attention [7][16]. Nevertheless, contribution collection improved from 95.77% in 2020 to 99.73% in 2025, suggesting progress in payment compliance.

In terms of infrastructure, JKN expansion has coincided with substantial growth in contracted healthcare facilities. Advanced referral facilities (FKRTL) increased by 90% from 2014, while first-level facilities (FKTP) grew by 28.9% [9][23]. This expansion illustrates the potential role of JKN in stimulating healthcare capacity while raising questions about geographical equity and service quality [19][21].

The analyzed data recorded 725,338,227 instances of service utilization in 2025, an increase of 685.8% compared with 2014. This reflects a growing volume of services financed by JKN, but changes in utilization cannot automatically be interpreted as improved access or quality without considering enrollment, health needs, and service characteristics [11][12].

This study aims to describe JKN developments during 2014–2025 using four indicators: the number of contracted healthcare facilities, service utilization, benefit expenditure, and contribution performance. Findings are discussed in light of health-financing literature and experiences in other countries as contextual evidence, not as tests of causal relationships.

METHODS

This study combines descriptive analysis of secondary BPJS Kesehatan operational data with a structured narrative synthesis of related literature. The design maps changes in program indicators and discusses their implications. It is not a full systematic review because search strategies, exclusion records, and risk-of-bias assessments were not reported in sufficient detail.

Literature Search Strategy

The literature search reportedly used SciSpace, Google Scholar, and PubMed. Indonesian and English search terms included "Jaminan Kesehatan Nasional," "JKN," "BPJS Kesehatan," "universal health coverage Indonesia," "single-payer health system," "largest health insurance system," and "Indonesia health financing." No publication-year restriction was applied, with emphasis on studies from 2014 to 2026 covering JKN implementation.

The search identified 91 unique publications on JKN and Indonesia's health system and 81 publications on global single-payer systems and international UHC comparisons. After selection based on relevance, methodological quality, and full-text availability, 58 publications were included in the main analysis.

Operational Data Sources

BPJS Kesehatan operational data were drawn from official presentation materials covering 2014–2025. They included (1) contracted FKTP and FKRTL facilities for 2014–2025; (2) annual healthcare utilization for 2014–2025; (3) benefit expenditure and claims ratios for 2025; and (4) contribution performance for 2020–2025, including revenue, receipts, and collection rates.

Data Analysis

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Data analysis proceeded in three stages. First, quantitative descriptive analysis of BPJS Kesehatan operational data identified trends and patterns. Second, a narrative synthesis of academic literature explored mechanisms, determinants, and implications of the observed trends. Third, descriptive comparison with single-payer arrangements in other countries positioned JKN in a global context.

Analytical Framework

The analytical framework draws on key WHO dimensions for evaluating UHC: (1) population coverage (who is covered), (2) service coverage (which services are covered), (3) cost coverage (what proportion of costs is covered), and (4) financial sustainability [41][45]. It also incorporates infrastructure and system-capacity dimensions from the literature on supply-side readiness for UHC [19][39].

Methodological Limitations

The study has several limitations. First, operational data were sourced from BPJS Kesehatan presentation materials that have not undergone academic peer review, requiring cautious interpretation. Second, comparisons with global single-payer systems are descriptive rather than based on formal statistical analysis. Third, differences in indicator definitions and measurement across countries limit direct comparability. Fourth, the focus on national aggregates may conceal substantial provincial and district-level variation in JKN implementation.

RESULT

Healthcare Facility Expansion

The number of healthcare facilities contracted by BPJS Kesehatan serves as an indicator of JKN provider-network capacity. Changes between 2014 and 2025 are analyzed separately for primary and advanced referral facilities. This measure describes network expansion, not necessarily geographical equity or quality of care.

Advanced referral healthcare facilities (FKRTL), mainly hospitals, expanded within the JKN system. During 2014–2025, contracted FKRTL increased by 1,513 facilities, or 90%, reaching 3,194 in 2025. Of these, 229 were central-government facilities, 862 belonged to regional governments, and 2,103 were privately owned. Private facilities accounted for 65.8% of contracted FKRTL, demonstrating the substantial contribution of private providers to referral-service capacity [33][58].

Primary healthcare facilities (FKTP), the front line of the tiered referral system, also increased. From 2014 to 2025, contracted FKTP grew by 28.9% to 23,770. Their 2025 composition comprised 10,151 community health centers (Puskesmas; 42.7%), 6,722 primary clinics (28.3%), 4,486 individual physician practices (18.9%), 1,207 dental practices (5.1%), 577 military clinics (2.4%), 575 police clinics (2.4%), and 52 class-D primary hospitals (0.2%).

Healthcare Service Utilization

Service utilization is one operational output of JKN. However, rising visit numbers must be distinguished from improvements in effective access because utilization may also change with enrollment, population health needs, repeated visits, and service-recording practices.

In 2025, JKN recorded 725,338,227 service-use events: (1) 283,033,128 illness-related FKTP visits; (2) 280,953,496 preventive or wellness FKTP visits, including immunization, counseling, maternal and child health/family planning, home visits, and group exercise; (3) 143,096,301 hospital outpatient visits; and (4) 18,255,302 hospital inpatient cases. This represented approximately two million service-use events per day and an increase of 685.8% from roughly 92.3 million visits in 2014.

Primary care accounted for 77.7% of total service use (illness and wellness visits), while referral facilities accounted for 22.3% (hospital outpatient and inpatient services). Although the predominance of primary care appears favorable, wellness visits, which represented 38.7% of all utilization, require further assessment to establish whether they represent meaningful preventive and promotional care rather than administrative encounters.

In 2025, recorded service utilization averaged approximately two million events per day, 685.8% above the 2014 level. This change matters for capacity planning and financing projections. Assessing

JKN's impact on access requires further analysis of utilization per member, medical need, and regional differences [2][7].

Benefit Expenditure and Claims Ratios

JKN financing adequacy is examined by comparing benefit expenditure with contribution revenue and receipts. These ratios indicate pressure on benefit financing during a given period but do not establish an overall financial deficit, which also depends on other revenues, expenditures, and reserves.

In 2025, the claims ratio reached 107.95% of contribution revenue and 108.24% of contribution receipts. For every IDR 100 in contribution revenue, JKN spent IDR 107.95 on healthcare claims. Such financing imbalances are not new; JKN has repeatedly experienced deficits since its early implementation [16][37].

The expenditure analysis indicates that hospital inpatient care accounts for the largest component of claims, despite far fewer inpatient cases (18.3 million) than hospital outpatient visits (143 million) and FKTP visits (563 million). Catastrophic diseases account for a large share of expenditure despite relatively low case volumes, reflecting the epidemiological shift toward noncommunicable diseases [38].

Contribution Revenue and Collection Performance

Contribution performance is assessed through changes in revenue, receipts, and collection rates during 2020–2025. These indicators describe the capacity to mobilize funds but are insufficient to determine actuarial adequacy.

JKN contribution revenue increased by IDR 36.44 trillion, or 26.06%, during 2020–2025. This growth may be associated with continuing enrollment expansion, contribution-rate adjustments, and better payment compliance across membership segments. The result reflects JKN's substantial capacity to mobilize financial resources for healthcare.

JKN contribution revenue comes from several membership groups: government-funded contribution-assistance recipients (PBI), salaried employees (PPU) in public and private formal employment, and nonsalaried or independent participants (PBPU) and nonworkers (BP). This tripartite financing structure reflects the principle of social solidarity underpinning national health insurance.

The reported collection rate increased from 95.77% in 2020 to 99.73% in 2025, a gain of 3.96 percentage points. This indicates an improvement in the ratio of collections to the underlying assessment base. Identifying the drivers requires information disaggregated by membership segment and collection policy.

The 99.73% collection rate must be interpreted in light of the numerator and denominator used in BPJS Kesehatan's operational definition. Without comparable measures, it cannot be concluded that this rate exceeds collection performance in other social health insurance systems.

Administrative Coverage and Program Scale

Comparisons with healthcare-financing arrangements in other countries provide context for JKN's coverage scale, resource mobilization, and service-purchasing governance. Differences in membership definitions, funding sources, and benefit packages limit direct comparisons.

With more than 279 million members in 2025, JKN is among the largest national health insurance arrangements by administrative enrollment. Comparisons with the United Kingdom's NHS, Taiwan's National Health Insurance, South Korea's National Health Insurance Service, and United States public programs require caution because their institutional structures, benefit boundaries, and population categories differ [49][52][54].

DISCUSSION

Provider Network Expansion and Equity

This substantial FKRTL growth is consistent with evidence that healthcare infrastructure expansion is a prerequisite for effective UHC [19][39]. Broader JKN contracting may strengthen incentives for private providers, particularly hospitals, because the prospect of payment under JKN can reduce business risks for healthcare investors [33][58].

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The geographical distribution of FKRTL is also important. Although national aggregates indicate impressive growth, the literature identifies uneven concentration, with most referral facilities located in Java and major cities. This creates considerable disparities in access between urban and rural populations and between Java and other islands [21][23].

The central role of Puskesmas within the FKTP network reflects government commitment to community-based primary healthcare [3][9]. These centers function not only as referral gatekeepers but also as hubs for health promotion and disease prevention [53]. Nevertheless, effective gatekeeping remains challenging, with persistently high non-specialist referral rates and limited capacity to manage all 144 diagnoses intended to be resolved at primary-care level.

The growth of private primary clinics and individual physician practices contracted by JKN reflects a strategy of mobilizing private capacity to expand primary-care reach. It also creates challenges for service-quality standardization and supervision because of substantial variation across types of FKTP [6][23].

The considerable expansion of BPJS Kesehatan's provider network, with FKRTL increasing by 90% and FKTP by 28.9%, positions JKN as a single-payer arrangement that not only consolidates membership but also supports growth in healthcare capacity. For comparison, the United Kingdom's NHS operates approximately 7,000 general healthcare facilities and 1,200 NHS hospitals for a population of 67 million; JKN's network of more than 26,000 facilities for 279 million people is of a broadly comparable proportional scale [52].

From a financial-sustainability perspective, expanding the number of healthcare facilities without effective expenditure controls may exacerbate JKN financing pressures [8][37]. Nevertheless, adequate infrastructure is a prerequisite for effective service utilization and sustainable progress toward UHC [41][50].

Utilization Patterns, Access, and Primary Care

The increase is consistent with studies reporting that JKN has improved access to healthcare, especially for populations previously facing financial barriers [1][11][14]. Sihotang and Simangunsong [11] reported increased healthcare access at the municipal level, while Arfah et al. [12] examined JKN's effectiveness in improving access and service quality more broadly.

Research on performance-based capitation and primary-care utilization suggests that appropriate provider-payment mechanisms may improve the effectiveness of FKTP gatekeeping [53]. However, the high number of hospital outpatient visits (143 million) should be interpreted alongside disease patterns, primary-care capacity, and referral appropriateness; volume alone does not establish referral quality.

An important JKN achievement is expanded access to maternal and child healthcare. A propensity-score-matched study by Anindya et al. [22] found that JKN membership significantly increased the probability of skilled birth attendance, particularly among lower- and middle-income groups. JKN's contribution to family-planning services has also been documented [31].

These findings are consistent with national reports of declining maternal mortality and improved maternal-health service coverage, although substantial regional disparities persist. Wenang et al. [23] identified availability and accessibility of primary healthcare for remote, rural, and low-income populations as major challenges to inclusive UHC.

Despite aggregate growth in utilization, the literature documents disparities by geography, sociodemographic characteristics, and type of service [15][22]. Sujarwoto et al. [15], examining hidden inequalities in Indonesian UHC, identified geographical accessibility, health literacy, and perceived service quality as important determinants of underutilization.

Studies of underutilization show that near-universal administrative enrollment does not mean that all JKN members use their healthcare entitlements, particularly in remote areas and vulnerable groups. Distance to facilities, long waiting times, negative perceptions of service quality, and cultural barriers contribute to underutilization [15][21].

Experiences in Canada and Taiwan suggest that healthcare use often increases following UHC expansion [42][51]. The challenge is to balance growing demand with provider capacity, system

efficiency, and effective expenditure control [43][47]. Strengthening FKTP gatekeeping is therefore a priority for managing JKN's increasing service demand.

Benefit Expenditure and Financial Sustainability

A longitudinal study reported that active membership increased from 76.07% in December 2023 to 78.83% in December 2024, while claims pressure continued to grow with utilization [2]. The difference between the ratios based on revenue (107.95%) and receipts (108.24%) reflects a gap between assessed and actually collected contributions, suggesting remaining arrears despite improved collection rates.

The literature identifies several factors contributing to JKN financing deficits. First, contributions may be below actuarially adequate levels, especially for government-subsidized beneficiaries (PBI). Second, costly catastrophic conditions—including cardiovascular disease, cancer, kidney disease, stroke, and thalassemia—create a mismatch between claims and contributions. Third, adverse selection may occur when individuals enroll after becoming ill or stop paying while healthy [7][16][37].

Studies of JKN financing identify tariff gaps, weaknesses in claims management, and sustainability challenges requiring comprehensive reforms [10][34]. Nabiila et al. [10], evaluating JKN financing policy and strategic purchasing, concluded that sustainability and quality depend on adequate financing combined with efficient purchasing arrangements.

Research on claims patterns reveals variation by facility type and ownership. Chalkley et al. [32] identified sensitivity of hospital diagnostic coding to prices, including the potential for upcoding—recording a more severe diagnosis than warranted to obtain higher reimbursement—which may contribute to claims inflation.

JKN's financing challenges are also encountered in other healthcare-financing systems, although contexts differ [42][47][54]. The United Kingdom's NHS operates in a country spending around 10% of GDP on health, compared with approximately 3–4% in Indonesia. This fiscal-capacity difference constrains Indonesia's ability to set contributions at actuarially adequate levels [43][52].

Taiwan, frequently used as a comparison for single-payer systems, has developed expenditure controls and contribution adjustments through strict cost management, tariff negotiations, and regular actuarially informed contribution changes [51][54]. Its experience illustrates the importance of sustained political commitment to adjusting contributions as healthcare costs rise.

Claims ratios persistently above 100% are an important warning of imbalance in JKN benefit financing. Without comprehensive financing reform—including actuarially informed contribution adjustments, diversified funding sources, and stronger cost controls—the gap between benefits and contribution revenue may continue and threaten sustainability [10][16][34]. Nevertheless, the reported collection rate of 99.73% provides a useful basis for future reforms.

Contribution Adequacy and Payment Compliance

Consistent contribution growth aligns with JKN's strategy of expanding enrollment toward universal coverage. Compared with other single-payer systems, JKN shows a positive revenue trajectory, although its per-capita contribution base remains below the level considered necessary to finance all healthcare needs without gaps [17][20].

Nevertheless, high collection rates do not automatically resolve the gap between JKN contribution revenue and benefit expenditure. The principal challenge may be the adequacy of contribution levels rather than collection efficiency alone. Actuarial studies indicate the need for periodic adjustments to account for rising healthcare costs and demographic changes [28][5].

Claims ratios above 100%—107.95% of contribution revenue and 108.24% of receipts—show that benefit expenditure exceeded contributions during the observed period. Such pressures are not unique to JKN but also affect health insurance systems in developing countries pursuing rapid UHC expansion without commensurate fiscal capacity.

In comparative perspective, high-income single-payer arrangements such as Taiwan's National Health Insurance, South Korea's National Health Insurance Service, and Canada's Medicare have also

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faced financial pressures during coverage expansion. Their responses have included premium adjustments, service-cost controls, and government subsidies [49][51][54].

The Indonesian government has sought to address JKN financing deficits through several mechanisms, including public capital support, contribution adjustments through presidential regulations, and optimization of tobacco-excise revenue-sharing funds (DBHCT) for JKN financing. These measures illustrate a whole-of-government approach to sustaining the program as a major instrument of health-related social protection.

Nonsalaried participants (PBPU), or self-paying members, have historically shown lower contribution compliance than salaried employees (PPU) and government-assisted members (PBI). Informal workers often have irregular or seasonal incomes and limited access to formal financial services, complicating continuous membership and payment.

Several innovations have been introduced to improve PBPU compliance, including digital payment channels, partnerships with microfinance institutions and cooperatives, and installment programs for members with arrears. These programs aim to improve payment compliance, but the contribution of each to the increase in aggregate collection rates from 95.77% to 99.73% during 2020–2025 remains to be evaluated.

Changes in contribution collection among nonsalaried workers are important for maintaining continuous enrollment. Evidence on the effectiveness of incentives, digital payments, and enforcement should be distinguished from aggregate trend observations before policy conclusions are drawn [17][58].

International Comparisons and Policy Implications

Historically, JKN achieved near-universal scale relatively rapidly following the 2004 National Social Security System Law and the 2014 start of BPJS Kesehatan operations. This expansion trajectory differs from the gradual historical development of single-payer systems in high-income countries; for example, the British NHS and Canada's system developed over decades [43][44].

Structurally, JKN shares several features with single-payer arrangements: BPJS Kesehatan as a central payer, a broad standardized benefit package, contracts with public and private providers, and mandatory contributions supplemented by government subsidies for vulnerable groups. Conceptually, this arrangement resembles a modified Bismarckian model adapted to a developing economy with substantial informal employment.

A major difference between JKN and single-payer systems in high-income countries is public health-financing capacity relative to GDP. The manuscript describes total health expenditure in Indonesia as below 3% of GDP, compared with approximately 8–12% in OECD countries. This creates greater budgetary pressure for JKN than for systems in countries with larger fiscal capacity [17][50].

Thailand's Universal Coverage Scheme (UCS) is frequently considered a relevant comparison because of the countries' shared Southeast Asian developing-economy context. Thailand's approach combines strong primary-care capitation, cost control at secondary and tertiary facilities, and dedicated government budgeting protected from fiscal fluctuations [55][35].

Taiwan's experience with National Health Insurance offers lessons for JKN financial sustainability. Following financing pressures in the early 2000s, Taiwan introduced reforms involving income-related premium adjustments, prospective hospital payment, and dedicated actuarial reserves. These measures helped restore financing balance while maintaining access to broad healthcare benefits [51][54].

Experiences in Germany's health insurance system (Krankenversicherung) and South Korea's NHIS suggest that consolidating fragmented insurance funds may improve healthcare resource allocation. JKN similarly integrated formerly separate arrangements—Askes, Jamsostek, Jamkesmas, and Jamkesda—into a unified system, following a trajectory associated in the literature with improved equity and efficiency [57][56].

From an equity perspective, JKN has helped reduce previously pronounced access gaps between richer and poorer groups, urban and rural populations, and formal and informal workers. Studies report greater use of formal healthcare among low-income households, reduced risk of catastrophic health expenditure, and expanded access to preventive care, with potential long-term health benefits [28][4].

JKN demonstrates that administrative coverage can be expanded to a very large population through enrollment arrangements, risk pooling, and fiscal support. However, enrollment alone is not a sufficient measure of UHC success; effective access, quality, equity, and financial protection must be assessed separately.

Growing service utilization requires corresponding adjustments in facility capacity and financing management. Available aggregate data do not establish whether capacity and demand expanded in balance across regions and types of service.

JKN financing combines contributions from multiple membership segments with government funding for selected groups. Sustainability assessments must distinguish contribution adequacy, members' ability to pay, health risks, and the level of public subsidy.

Improved collection rates indicate stronger contribution mobilization. However, these descriptive data cannot determine whether the change resulted from data integration, incentives, collection mechanisms, or shifts in membership composition.

CONCLUSION

Operational data indicate expansion of the JKN provider network and increased service utilization during 2014–2025. In 2025, reported enrollment exceeded 279 million. These measures describe the program's operational scale but do not directly establish equitable access or improved service quality.

Contracted advanced referral facilities increased by 1,513 to 3,194 in 2025, while primary healthcare facilities reached 23,770. Private providers accounted for 65.8% of the referral network. Further evaluation is needed to assess geographical distribution and whether capacity matches members' needs.

Service utilization reached 725,338,227 in 2025, an increase of 685.8% from 2014. This reflects greater recorded service volume, but per-member and service-specific analyses are needed to clarify implications for effective access.

In financing, benefit expenditure reached 107.95% of contribution revenue and 108.24% of contribution receipts in 2025. These ratios show that benefit costs exceeded contributions during the observed period, but assessing the program's overall financial health also requires data on reserves and other financial components.

Contribution revenue increased by IDR 36.44 trillion (26.06%) during 2020–2025, while the collection rate rose from 95.77% to 99.73%. Improved contribution mobilization does not automatically ensure sufficient financing for benefits.

Overall, the central lesson from JKN's development is the need to align enrollment expansion, provider capacity, and financing adequacy. International comparisons should be based on consistently defined indicators.

Policy priorities include periodic assessment of contribution and subsidy adequacy, stronger primary-care quality, evaluation of referral appropriateness, and evidence-based expenditure controls.

Prospective payment arrangements, monitoring of claims patterns, and improved data governance may support purchasing efficiency. Each intervention should be evaluated for its effects on care quality and participant protection.

Future studies should examine regional variation, utilization per member, the distribution of medical needs, and financing by service category. More detailed longitudinal data would help distinguish operational trends from policy impacts.

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AUTHOR CONTRIBUTION STATEMENT

Rizki Lestari contributed to the conceptual development of the study, research methodology, collection and analysis of secondary data, interpretation of findings, and preparation of the manuscript. The author also participated in critically reviewing and revising the manuscript to ensure its academic quality, accuracy, and coherence. The author has read and approved the final version of the manuscript and accepts responsibility for the integrity and accuracy of the research.

AI DISCLOSURE STATEMENT

Artificial intelligence-assisted tools were used to support language editing, English translation, and improvements in the clarity, organization, and academic presentation of the manuscript. These tools were employed solely as editorial assistance and were not intended to replace the authors' intellectual contributions, analytical judgments, or responsibility for the research findings. The authors retain full responsibility for the accuracy, originality, interpretation, and integrity of the manuscript, including the verification of references, statistical information, and conclusions. No artificial intelligence system is recognized as an author or credited with independent responsibility for the research.

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CONFLICTS OF INTEREST

The authors declare that they have no known financial or non-financial conflicts of interest that could have influenced the research, analysis, interpretation, or presentation of the findings reported in this manuscript. The authors further declare that the study was conducted independently and that no external organization exerted inappropriate influence over the research process or conclusions.

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