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A Multicentric Assessment of Integrated Antimicrobial Stewardship (IAS) Practices Across Indian Tertiary-Care Institutions: A SASPI Capacity Mapping Initiative

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ABSTRACT

Introduction: Antimicrobial Resistance (AMR) is a critical public health threat in India, worsened by overprescription, unregulated antibiotic access, and fragmented Antimicrobial Stewardship Program (AMSP) implementation. The Society of Antimicrobial Stewardship Practices India (SASPI) developed a 42-point Integrated AMS (IAS) practice statement in 2024 to standardize stewardship across institutions. This study assessed the current adoption of these practices across Indian tertiary-care hospitals.

Methods: A multicentric, cross-sectional, survey-based study was ccccccccconducted under SASPI's capacity-mapping initiative. A structured self-administered questionnaire based on the 42-point IAS statement, spanning four domains — Administrative, Diagnostic Stewardship, Infection Prevention and Control (IPC), and Antimicrobial Stewardship (AMS) — was distributed to SASPI-affiliated institutes presenting at ASPICON 2025. Implementation was rated on a 0–100% scale and categorized as High (≥75%), Moderate (50–74%), or Low (<50%).

Results: Of 150 invited institutes, 17 participated. The overall mean compliance across all 42 items was 66.32% ± 18%. Diagnostic stewardship showed the highest adherence (81.76% ± 11.93), followed by IPC (80.12% ± 13.59) and administrative practices (66.34% ± 19.96), while AMS-specific practices showed markedly low adherence (37.06% ± 28.11). Ten of twelve AMS practice points — including pre-authorization of restricted antimicrobials, OPAT policies, PK/PD documentation, and antimicrobial time-out practices — fell into the "low" implementation category. Institution-wise scores ranged from 48.02% to 97.46%, with 5 institutions scoring "high," 9 "moderate," and 3 "low."

Conclusion: This multicentric assessment reveals substantial heterogeneity in Integrated Stewardship implementation across Indian tertiary-care institutions. While diagnostic and infection-control infrastructure is relatively well-established, dedicated antimicrobial stewardship practices—particularly those requiring active prescribing oversight—remain markedly underdeveloped, highlighting a critical gap between structural readiness and functional stewardship.

INTRODUCTION

Antimicrobial Resistance (AMR) continues to remain one of the most critical global public health crises.[1] India, often designated as the “AMR capital” of the world, is disproportionately affected on account of a high infectious disease burden, overcrowding, poor sanitation, and inadequate diagnostic infrastructure. The crisis is further worsened by overprescription of

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antibiotics, widespread availability of antibiotics through community and online pharmacies, and a lack of stringent regulatory enforcement.[1-3] The rapid emergence of resistant microorganisms, coupled with a stagnant new antimicrobial drug pipeline, makes the threat of a "post-antibiotic era" a real one. Consequently, preserving the efficacy of available antibiotics through rational antibiotic use becomes an absolute necessity. While Antimicrobial Stewardship Programs (AMSP) are proven to reduce irrational antibiotic use and optimize patient outcomes, the practice of AMSP across Indian healthcare system remains rudimentary and fragmented.[1-4]

Since AMR is a complex phenomenon involving multiple stakeholders across the healthcare continuum, tackling the challenge requires highly coordinated efforts at the national level. Recognizing the need to integrate the fragmented AMSP structures and provide a standardized operational roadmap, the Society of Antimicrobial Stewardship Practices (SASPI) consortium developed a comprehensive 42-point practice statement document in 2024. This practice statement was developed through a multicentric, multiphase consensus approach with expert inputs across 31 premier tertiary care institutes of India.[5] Further, SASPI advocates the adoption of its practice statement by the institutes to standardise and operationalize their AMSP programs. The present study aimed to survey the current implementation of SASPI's 42 IAS practice statements across tertiary care hospitals in India, including descriptive statistics.

METHODOLOGY

A multicentric, cross-sectional, survey-based study was conducted by SASPI under its capacity-mapping initiative. The survey was conducted over a span of 2 months before the scheduled survey data presentation on 5th September 2025 at SASPI's annual conference, ASPICON, held at AIIMS, Mangalagiri. All SASPI-affiliated institutes (n=150) were emailed to take part and present findings at ASPICON 2025. A reminder was given 15 days after the first email, then weekly until the presentation day. Those who accepted the invitations and presented were selected for this survey. A structured self-administered questionnaire based on the SASPI's "42-Point Integrated AMS Practice Statement" was shared with the SASPI's designated members to present at the conference [Appendix 1]. Considering the online survey for public health purposes, only participant consent was obtained from each survey's institute; Institute Ethics Committee approval was deferred with respect to ICMR's Biomedical Research Guideline.

The survey questionnaire included a total of 42 questions across four domains of integrated stewardship operational framework namely: (A) Administrative (5 questions), (B) Diagnostic Stewardship (13 questions), (C) Infection Prevention and Control (12 questions), and (D) Antimicrobial Stewardship (12 questions). The participating institutes were required to provide the information as to whether the practice statement is implemented or not; and to rate the implementation status on a percentage scale (0–100%) for each of the 42 questions. On percentage scale 0% indicates no implementation and 100% indicates complete implementation of the respective practice statement. When the subjective (yes/no) response was provided without the explicit objective implementation scores citing reasons such as "under process/partial/initiated/proposal submitted" etc., a conservative estimate of 50% was taken. When the respondents gave no subjective response also, the data point was recorded as not reported.

Data were summarised and presented using descriptive statistics. Implementation responses for each practice point were further categorised according to the thresholds specified in the SASPI framework: High (≥75%), Moderate (50–74%), Low (<50%). Three separate analyses were done i.e. (a) Average domain-level implementation scores across all institutes, (b) Average (Mean+/- SD) implementation scores per practice statement across the institutes, and (c) Institute-specific average implementation scores across all practice points.

RESULTS

Of the 150 SASPI-affiliated institutions invited, 20 presented their findings at ASPICON 2025, of whom 17 consented to participate in the survey. The participating institutes included: All India Institute of Medical Sciences (AIIMS), New Delhi; Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Puducherry; Postgraduate Institute of Medical Education & Research (PGIMER), Chandigarh; Jawaharlal Nehru Medical College (JNMC), Aligarh; North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences (NEIGRIHMS), Shillong; MNR Medical College & Hospital, Telangana; Shridevi Institute of Medical Sciences And Research Hospital, Karnataka; All India Institute of Medical Sciences (AIIMS), Jodhpur; All India Institute of Medical Sciences (AIIMS), Raipur; All India Institute of Medical Sciences (AIIMS), Rishikesh; All India Institute of Medical Sciences (AIIMS), Nagpur; All India Institute of Medical Sciences (AIIMS), Bathinda; All India Institute of Medical Sciences (AIIMS), Jammu; All India Institute

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of Medical Sciences (AIIMS), Gorakhpur; All India Institute of Medical Sciences (AIIMS), Bibinagar; All India Institute of Medical Sciences (AIIMS), Guwahati; and All India Institute of Medical Sciences (AIIMS), Deoghar (Figure 1). The sites were arranged based on the year of establishment of the respective institute.



Figure 1. Geographic distribution of participating institutes across India. The map depicts the geographical locations of the 17 participating institutes across India. Blue markers indicate the location of each participating centre.

The overall mean implementation scores across all the reported 42 items among the studied institutions was 66.32% ± 18%. The domain-specific implementation of the practice statements is represented in Figure 2. Overall diagnostic stewardship practices showed the highest mean implementation (81.76% ± 11.93), followed by IPC practices (80.12% ± 13.59), administrative practices (66.34% ± 19.96), and antimicrobial stewardship practices (37.06% ± 28.11), respectively. **(Supplementary Table 1:** *CLICK HERE!*)

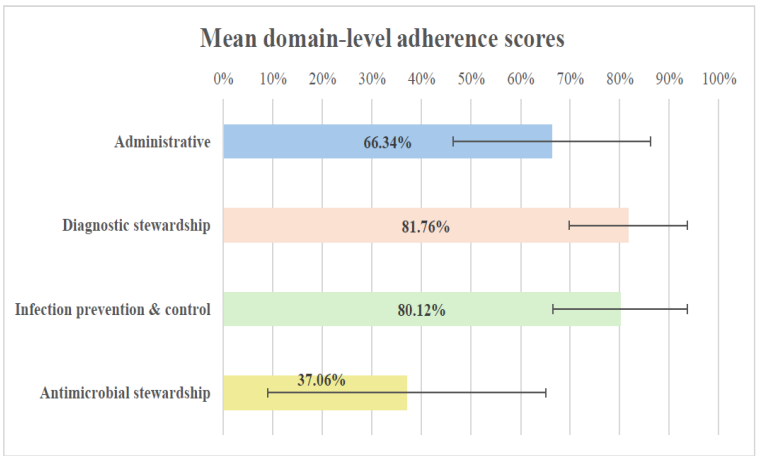

Figure 2. Domain-level implementation scores across the four domains of the SASPI 42-point IAS practice statement. Practice-points are grouped into four domains: Administrative (represented in blue), Diagnostic Stewardship (represented in orange), Infection Prevention and Control (represented in green), and Antimicrobial Stewardship (represented in yellow). Bars represent mean implementation scores (in percentage) and associated standard deviations.

Administrative Practices:

Defined accountability structures for Hospital Infection Control Committee (HICC), AMS, and diagnostic stewardship programmes scored 73%; compulsory induction programmes for postgraduate trainees, interns and nurses scored 70% and educational programmes for staff scored 68.1%. In contrast, department-wise antimicrobial policies and prescribing checkpoints had an implementation score of only 54.7%. Similarly, the establishment of an active IAS programme was moderately implemented at 65.9%.

Diagnostic Stewardship Practices:

Implementation of Clinical and Laboratory Standards Institute (CLSI)/European Committee on Antimicrobial Susceptibility Testing (EUCAST)-based antimicrobial susceptibility testing (AST) protocols was 99.4%, and digitalisation of antimicrobial resistance (AMR) data in WHONET or MS Excel was 88.2%. Practices requiring dedicated infrastructure or manpower for round-the-clock services, such as 24×7 functional laboratories with signatory authority, were 80.9%. **(Supplementary Table 2:** *CLICK HERE!*)

Infection Prevention and Control Practices:

Needle-stick injury prevention and management programme was reported by all institutions with the highest mean implementation (95%). Hospital-specific infection control policies (94.7%), functional HICC with dedicated infection control officers and nurses (92.1%), regular HICC meetings (91.8%), and monthly hand-hygiene audits (91.2%) were similarly well-established across institutions. In contrast, updated policy that specifies dealing with locally transmitted infections scored the least (56.2%). **(Supplementary Table 2**: *CLICK HERE!*)

Antimicrobial Stewardship Practices:

Within the AMS domain, only two of the 12 practice points demonstrated "moderate" implementation: antimicrobial adverse drug reaction (ADR)/serious adverse event (SAE) reporting with root-cause analysis, and corrective and preventive action (CAPA) (62.6%) and updated facility-specific ID treatment recommendations (60.6%). The remaining 10 practices

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were classified as "low" implementation. Antimicrobial 'time-out' practices (28.5%), practice documents on pharmacokinetics(PK)/pharmacodynamics (PD) of specific antimicrobial agents (23.5%), pre-authorisation of restricted antimicrobials (22.1%), and outpatient parenteral antimicrobial therapy (OPAT) policies (22.1%) were amongst the most under-implemented. **(Supplementary Table 2**: *CLICK HERE!*)

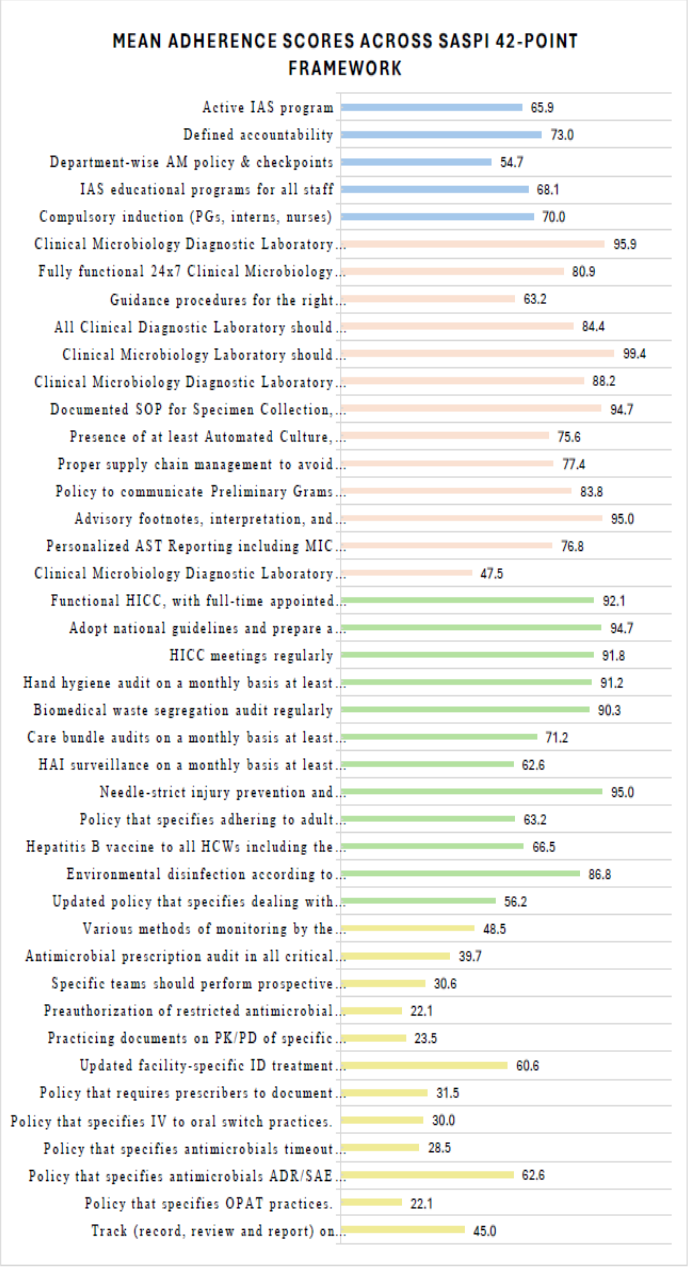

Figure 3. Mean implementation scores across the 42-point SASPI IAS practice statement (full statement access[5]). The figure depicts the mean implementation score (in percentage) for each practice point across the participating tertiary-care institutions. Practice points are grouped into four domains: Administrative (5 practice-points; represented in blue), Diagnostic Stewardship (13 practice-points; represented in orange), Infection Prevention and Control (12 practice-points; represented in green), and Antimicrobial Stewardship (12 practice-points; represented in yellow). Implementation was assessed on a 0–100% scale.

Institution-wise Implementation: Mean implementation scores across the 42 practice points ranged from 48.02% to 97.46% across the 17 participating institutions. The overall mean implementation scores of individual institutions varied considerably, with five institutions demonstrating scores ≥75% (75.0–97.46%), nine institutions having scores between 50% and <75% (53.0–74.0%), and three institutions having scores <50% (48.02–49.51%). The corresponding institution-wise domain-specific scores are provided in **Supplementary Table 3:** *CLICK HERE!*

DISCUSSION

This multi-centric study provides a cross-sectional assessment of IAS capacity across 17 tertiary-care institutions in India using the 42-point IAS practice framework developed under SASPI. The principal finding was a marked variation in implementation across the four domains of IAS, with comparatively stronger performance in diagnostic stewardship and IPC, intermediate implementation of administrative practices, and substantially lower implementation of dedicated AMS practices.[5,6]

Domain-Level Analysis: The overall domain-level analysis demonstrated that IPC and diagnostic stewardship had the "high" implementation, whereas administrative practices showed "moderate" implementation. The AMS domain had a markedly low implementation score with a wide standard deviation indicating considerable variability in stewardship capacity between institutions and "low" implementation of IAS practices. (Supplementary Table 1) At the individual practice-point level, 18 of the 42 practices were classified as "high" implementation, 13 as "moderate" implementation, and 11 as "low" implementation (Supplementary Table 2).

Diagnostic stewardship emerged as one of the strongest components of the IAS framework, with an overall score of 81.8% indicating "high" implementation. Antimicrobial susceptibility testing protocols based on institutional, CLSI or EUCAST guidance, close proximity of the clinical microbiology laboratory to the hospital, communication of advisory information and interpretation of intrinsic resistance, and documented specimen collection, storage, transportation and processing procedures demonstrated "high" implementation. These findings suggest that conventional microbiological infrastructure and laboratory processes are relatively well established in participating tertiary-care institutions.[5]

The strong performance of diagnostic stewardship is particularly relevant within an integrated stewardship

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model. Appropriate specimen collection, timely microbiological investigation, reliable susceptibility testing, and effective interpretation of laboratory results form the basis for targeted antimicrobial therapy. The current findings suggest that many institutions already possess an important platform upon which more active antimicrobial prescribing interventions can be built.[5, 6]

However, diagnostic stewardship was not uniformly implemented. The practice concerning rapid diagnostic tests for detection of resistance mechanisms such as carbapenem resistance, Methicillin-resistant Staphylococcus aureus (MRSA) and Extended-Spectrum Beta-Lactamase (ESBLs) was amongst the lowest performing diagnostic practices. There was also considerable institutional variation in AMR data digitization and the availability of automated culture, identification and susceptibility testing systems. These findings suggest that the availability of conventional laboratory services may not be equated with comprehensive diagnostic stewardship capacity.

Similarly, IPC practices demonstrated "high" implementation. A functional HICC with designated infection-control officers and nurses was particularly well established. Hospital-specific infection-control policies, needle-stick injury prevention and surveillance, regular HICC meetings, hand-hygiene audits, and biomedical-waste segregation audits were also highly implemented. These findings indicate that institutional infection-control structures and several routine IPC activities are comparatively well established.[7]

The relative strength of IPC is important because infection prevention is intrinsically linked to antimicrobial stewardship. Prevention of healthcare-associated infections and transmission of multidrug-resistant organisms reduces the need for antimicrobial therapy and limits antibiotic selection pressure associated with unnecessary or prolonged antimicrobial exposure.[7]

Hospital-acquired infection surveillance with root-cause analysis and CAPA, care bundle audits, policies addressing locally transmitted infections, including multidrug-resistant organisms and specifying implementation of adult vaccinations by healthcare workers (HCWs) and hepatitis B vaccine for all HCWs had "moderate" implementation. These findings suggest that further strengthening of surveillance-linked interventions, vaccine implementation, and feedback mechanisms are required to translate established IPC structures into sustained reductions in infection transmission and antimicrobial use. The comparatively lower implementation also indicates that the presence of institutional infrastructures does not essentially translate into comprehensive surveillance and quality improvement systems.[7]

The administrative domain, while showing overall "moderate" implementation had considerable heterogeneity in implementation across 5 practice statements across studied institutes. The department level accountability for antimicrobial policies and its utilization audit remains the most under-implemented practice.[8]

The most important finding of this study was the substantially lower implementation of dedicated AMS practices. The overall implementation score was approximately half of the score observed for diagnostic stewardship and IPC. Ten out of twelve AMS practice points assessed had "low" implementation, with scores below 50%. The weakest implementation was observed for pre-authorization of restricted antimicrobials, OPAT policies, PK/PD practice documents, and antimicrobial time-out policies. These findings suggest that while many participating institutions have established administrative, diagnostic and infection-control structures, the mechanisms for actively influencing antimicrobial prescribing are still less developed.[6, 8]

Pre-authorisation systems require clearly defined restricted-antimicrobial lists, prescribing criteria, review mechanisms, and timely involvement of the AMS team. Their limited implementation may therefore reflect the need for definite protocol and dedicated stewardship personnel to facilitate coordination within the multidisciplinary AMSP team for ensuring its implementation at institute level.[9] Similarly, the limited implementation of PK/PD-guided antimicrobial practice represents another important gap. Optimisation of antimicrobial exposure according to PK/PD principles is particularly relevant for critically ill patients and for antimicrobials whose efficacy or toxicity is strongly influenced by drug exposure.[10, 11] This may suggest the need for greater involvement of clinical pharmacologists within multidisciplinary AMS teams. Notably, the "low" implementation of OPAT and antimicrobial time-out policies may indicate a gap in the operational mechanisms for monitoring, optimising, and structured reassessment of antimicrobial therapy. Reassessment of antimicrobial selection, dose, route, spectrum and duration after treatment initiation is important because antimicrobial prescribing should not be regarded as a one-time decision. Repeated optimisation is required as microbiological information becomes available and the patient's clinical status changes.[8, 9]

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Institution-Wise Analysis:

The institution-wise analysis further demonstrated substantial heterogeneity in implementation across the participating institutions. Five of the 17 institutions had overall mean scores in the "high" implementation category, whereas three institutions had scores in the "low" implementation category. The institution-specific scores are presented in Supplementary Table 3.

Importantly, institutional performance was not uniformly high or low across all four domains. Several institutions demonstrated high implementation of diagnostic stewardship and IPC despite limited implementation of AMS practices. Such institutions may be able to strengthen active AMS interventions by leveraging their existing infrastructure. In contrast, institutions with low implementation across multiple domains may first require foundational capacity building. Similar institutional variation in AMS implementation has been described in Indian tertiary-care settings. [6] These findings support consideration of institute-specific approaches that are tailored to locally identified implementation gaps. The SASPI 42-point framework provides a practical structure for such prioritisation because it allows individual institutions to identify specific deficiencies across administrative, diagnostic, IPC, and AMS components. [5] This highlights the importance of domain-specific capacity mapping rather than relying solely on a single composite institutional score.

Overall, the findings highlight the need to complement structural capacity building with greater operationalisation of stewardship practices and the potential role of the SASPI IAS framework as a benchmarking and quality-improvement tool. Application of the framework longitudinally could therefore provide an objective mechanism for institutions to monitor progress from structural readiness towards functional stewardship.[5,8]

STRENGTHS AND LIMITATIONS

This study has several strengths. It provides a multi-centric assessment of IAS implementation across 17 tertiary care institutions and evaluates 42 practice points spanning four integrated domains. The use of a structured, consensus derived SASPI framework permits systematic assessment beyond antimicrobial prescribing alone and captures the administrative, diagnostic and infection control foundations required for effective stewardship. The institution-wise assessment also demonstrates the extent of heterogeneity in implementation across study domains. This analysis could serve as a guide for targeted capacity building at institutional level.

The study had the following limitations. First, the cross-sectional design provides a snapshot of implementation and does not permit assessment of temporal trends. Second, data were collected using a structured self-administered questionnaire completed by designated institutional respondents. The survey question didn't have a "not available option" so for certain practices such as automated culture facilities, the institutes had to give a zero score. The dataset and subsequent analysis were based on information provided by a designated representative of the participating institutes. The reported implementation scores, therefore, represent institutional assessments and may be influenced by respondent perception or reporting bias. Third, the sample of 17 institutions may not be reflective of the entire spectrum of IAS practices across all the Indian tertiary care settings. Further, studies involving larger sample sizes, especially including primary and secondary care or smaller private facilities, need to be undertaken in the future.

CONCLUSION

This multi-centric assessment provides a snapshot of baseline AMSP structures and demonstrates substantial heterogeneity in the implementation of a standardized operational roadmap essential for the practice of Integrated Stewardship across Indian tertiary care institutions.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

None

ETHICS STATEMENT INCLUDING PATIENT CONSENT

Not applicable

AUTHOR'S CONTRIBUTION

NS: Conceptualization; Critical review; Approval

SM: Conceptualization; Critical review; Approval

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PKP: Conceptualization; Data resources; Critical review; Approval

NK: Data Collection; Data curation; Data analysis, Manuscript writing

SVL: Data Collection, Data curation; Manuscript writing

NM: Data Collection; Data curation; Data analysis

AI DECLARATION

No AI tool was used to generate research data, perform data analysis, interpret findings, formulate scientific conclusions, or make editorial decisions. All AI-assisted content was critically reviewed, verified, and revised by the authors. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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