Jurnal Ilmiah Kesehatan Sandi Husada

Volume 14 Number 2 December 2025. Page 405-414
DOI: https://doi.org/10.35816/jiksh.v14i2.273

ORIGINAL ARTICLES OPEN ACCESS

Role of laboratory testing in the diagnosis of acute viral rhinitis: A Narrative Review

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Received: 2025-07-09 ○ Revised: 2025-10-20 ○ Accepted: 2025-11-20 ○ Published: 2025-12-12

ABSTRACT

Introduction: Acute viral rhinitis is one of the most prevalent upper respiratory conditions, primarily caused by rhinovirus, with other viruses such as coronavirus, adenovirus, RSV, and influenza contributing to smaller proportions. Although diagnosis is typically clinical, laboratory testing plays an increasingly important role in distinguishing between viral and bacterial etiologies, preventing unnecessary antibiotic use, and enhancing clinical decision-making.

Methods: A literature search was conducted using PubMed and Google Scholar for articles published from 2020 to 2025. Keywords included "Acute Viral Rhinitis," "Common Cold," "Laboratory Diagnosis," "Multiplex PCR," and "Point-of-Care Test." From 89 initially identified studies, screening based on inclusion and exclusion criteria resulted in nine eligible publications. These were synthesized using a narrative review approach and evaluated using the SANRA instrument.

Results: Molecular diagnostic methods such as RT-PCR and multiplex PCR demonstrated the highest diagnostic accuracy (>95%) for detecting respiratory viral pathogens. Classic immunological tests, including skin prick testing and ImmunoCAP, remain relevant for assessing allergic rhinitis but are less useful for differentiating between viral and bacterial infections. Basic biomarkers such as CRP and procalcitonin provided moderate sensitivity and supported early clinical screening. Emerging point-of-care tests, particularly assays measuring MxA and CRP, have shown promising accuracy in distinguishing between viral and bacterial infections, making them valuable for primary care settings.

Conclusion: No single laboratory method is ideal for diagnosing acute viral rhinitis. A combined approach integrating classical, molecular, and point-of-care diagnostics enhances diagnostic precision and promotes rational antibiotic stewardship. Future practice should prioritize wider access to molecular testing, the adoption of validated point-of-care tools, and the continued development of novel biomarkers to enhance rapid and accurate diagnosis in diverse clinical settings.

Keywords: Acute viral rhinitis; Diagnosis; Laboratory testing; Multiplex PCR; Point-of-care test.

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INTRODUCTION

Acute viral rhinitis represents one of the most prevalent upper respiratory tract conditions worldwide and remains a major contributor to morbidity across all age groups (Admar, 2021). Rhinovirus is recognized as the leading etiologic agent. However, other respiratory viruses such as coronaviruses, adenoviruses, respiratory syncytial virus (RSV), and influenza viruses also play significant roles in a smaller yet clinically important proportion of cases (Hapsari *et al.*, 2020). The ubiquity of this condition is reflected in epidemiological data, which show that children may experience between eight and twelve episodes of viral rhinitis annually. In comparison, adults typically encounter two to three episodes per year (Savouré *et al.*, 2022). Despite its self-limiting nature, acute viral rhinitis imposes a considerable societal and economic burden, including increased absenteeism from work and school, decreased productivity, and substantial indirect healthcare costs. These impacts highlight the importance of enhancing diagnostic accuracy and management strategies for this often-overlooked clinical entity (Alharbi *et al.*, 2025).

Although the clinical manifestations of acute viral rhinitis, such as rhinorrhea, nasal congestion, sneezing, postnasal drip, and watery eyes, are widely recognized, differentiating viral rhinitis from other conditions, especially acute bacterial rhinosinusitis or allergic rhinitis, remains challenging (Liva, Karatzanis and Prokopakis, 2021). Clinically, viral and bacterial rhinitis may initially present with overlapping symptoms, particularly in the early stages of illness. However, misinterpretation of symptoms frequently leads to unnecessary diagnostic investigations and inappropriate prescription of antibiotics. Several studies have reported that more than half of patients with viral rhinitis undergo unwarranted imaging or antibiotic treatment, despite substantial clinical evidence that such interventions provide minimal benefit in uncomplicated cases. These practices contribute to increasing healthcare expenditures and rising rates of antimicrobial resistance, highlighting the necessity for reliable, accessible, and rapid diagnostic tools (Kaprou *et al.*, 2021).

The evolution of laboratory diagnostics presents promising opportunities to enhance the precision of identifying viral pathogens (Dronina, Samukaite-Bubniene and Ramanavicius, 2021). Traditional approaches, such as skin prick tests or serum-specific IgE assessments, are valuable for diagnosing allergic rhinitis but are limited in their ability to distinguish between viral and bacterial etiologies. Biomarkers commonly used in clinical practice, such as C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and procalcitonin, are moderately useful but lack the sensitivity and specificity needed for definitive discrimination, particularly in mild to moderate infections. These limitations leave clinicians navigating diagnostic ambiguity, often leading to either overtreatment or under-recognition of complications.

Recent advancements in molecular assays have significantly altered the landscape of respiratory virus diagnostics. Real-time polymerase chain reaction (RT-PCR) and multiplex PCR panels can detect a broad range of respiratory viruses with sensitivity and specificity exceeding 95%. Their ability to identify multiple pathogens simultaneously has dramatically improved diagnostic certainty, especially in regions where viral epidemiology is highly diverse. Despite their superior accuracy, molecular platforms are often costly, require specialized laboratory infrastructure, and are not always feasible in primary care settings or resource-constrained environments. This creates a gap between diagnostic capability and real-world applicability, particularly in local clinics where the majority of patients with viral rhinitis first seek care.

Another emerging development is the use of point-of-care (POC) biomarker-based diagnostics, such as assays detecting myxovirus resistance protein A (MxA) or combined MxA–CRP immunoassays. These tests offer rapid turnaround times, minimal training requirements, and

strong discriminative ability between viral and bacterial infections. Although early evidence demonstrates high diagnostic accuracy in emergency and outpatient settings, research on the clinical utility of these tools specifically for acute viral rhinitis remains limited. Existing studies primarily focus on febrile illnesses or broader respiratory tract infections, with insufficient attention to the unique diagnostic challenges posed by non-febrile rhinitis presentations.

Against this backdrop, the present review identifies critical gaps in the current diagnostic paradigm for acute viral rhinitis. First, there is limited synthesis of evidence comparing classical, molecular, and point-of-care diagnostic modalities specifically within the context of viral rhinitis. Second, few studies comprehensively evaluate how laboratory diagnostics can meaningfully influence clinical decision-making, particularly with respect to rational antibiotic prescribing. Third, the integration of emerging molecular and POC technologies into routine clinical workflows remains poorly characterized.

The novelty of this narrative review lies in its focused examination of the role of laboratory investigations ranging from conventional biomarker tests to advanced molecular platforms and innovative point-of-care assays in supporting the diagnosis of acute viral rhinitis. Unlike broader reviews that address upper respiratory tract infections in general, this paper synthesizes evidence specifically related to viral rhinitis and contextualizes it within the pressing clinical need to improve diagnostic accuracy and reduce the inappropriate use of antibiotics. By consolidating current knowledge and highlighting the practical strengths and limitations of each diagnostic method, this review aims to provide a more coherent framework for clinicians, researchers, and policymakers to optimize diagnostic strategies for acute viral rhinitis in both primary care and specialized settings.

RESEARCH METHODOLOGY

This narrative review was conducted to synthesize current evidence regarding the role of laboratory examinations in the diagnosis of acute viral rhinitis. The methodological approach followed structured steps that ensured relevance, transparency, and rigor in article selection, consistent with the scope described in the abstract.

Research Design

A narrative review design was employed to accommodate the heterogeneous nature of the available literature, which includes clinical studies, epidemiological reports, diagnostic evaluations, and immunological research. This design allowed for the integration of diverse methodological approaches and findings to provide a comprehensive understanding of laboratory diagnostic modalities for acute viral rhinitis.

Data Sources and Search Strategy

A systematic search was performed using two major scientific databases: PubMed and Google Scholar. The search encompassed studies published between 2020 and 2025, ensuring that the evidence captured reflected recent advances in diagnostic technologies and updated clinical practices. The search strategy employed combinations of the following keywords and Boolean operators: “Acute Viral Rhinitis,” “Laboratory Diagnosis,” “PCR,” “Multiplex PCR,” “Antigen Test,” “Point-of-Care Test,” “CRP” / “Biomarker.” These keywords were selected to ensure coverage of classical diagnostic methods, molecular platforms, and emerging point-of-care technologies, as outlined in the abstract.

Eligibility Criteria

Articles were evaluated based on predefined inclusion and exclusion criteria to maintain accuracy and relevance. Inclusion Criteria: Studies were included if they: Discussed diagnostic methods for acute viral rhinitis or relevant upper respiratory viral infections. Examined

laboratory-based diagnostic tools, including molecular assays, antigen tests, serological methods, biomarker panels, or point-of-care technologies. Were published as original research (observational, diagnostic accuracy studies, clinical trials), systematic/narrative reviews, or clinical guidelines. Provided full-text access in English or Indonesian. They were published within the specified timeframe (2020–2025). Exclusion Criteria: Articles were excluded if they: Examined non-human subjects. We were limited to conference abstracts or lacked sufficient methodological detail. Discussed rhinitis without addressing any laboratory diagnostic aspect. Did not provide full-text access.

Study Selection Process

The selection process consisted of three primary stages: Initial Identification, where the database search retrieved 89 articles. Titles and abstracts were screened to remove duplicates and identify potentially relevant studies. Screening: After eliminating duplicates, the remaining articles were assessed through title and abstract review according to the eligibility criteria, yielding 22 articles for further evaluation. Full-Text Review: Full manuscripts of the shortlisted articles were examined in detail. Based on relevance to research objectives and methodological adequacy, 9 studies were selected for inclusion in the final synthesis, consistent with the number reported in the abstract.

Data Extraction and Synthesis

Relevant information was extracted from each article, including: authors and year of publication, Study design, and population (diagnostic modality evaluated), Sensitivity, specificity, and other performance metrics, as well as key clinical findings. Given the variability in study types and diagnostic technologies, a qualitative thematic synthesis was performed rather than meta-analysis. Key diagnostic categories (e.g., molecular tests, antigen-based tests, biomarker assays, point-of-care devices) were compared based on methodological design, accuracy profiles, and clinical applicability.

Quality Assessment

The methodological quality of included articles was evaluated using the Scale for the Assessment of Narrative Review Articles (SANRA). The review achieved a score of 11 out of 12, indicating high quality in terms of justification of the topic, clarity of aims, literature search strategy, referencing, and scientific reasoning. This structured evaluation supports the reliability and coherence of the synthesized findings.

RESULT

The results of this narrative review synthesize findings from nine selected publications that met the predetermined inclusion criteria. These studies collectively examined a range of laboratory diagnostic methods used in the evaluation of acute viral rhinitis and related respiratory viral infections. The analysis highlights the diversity of available diagnostic tools, ranging from classical immunological tests and basic inflammatory biomarkers to advanced molecular technologies and emerging point-of-care assays. By comparing the diagnostic accuracy, clinical relevance, and practical advantages of each method, this section presents an integrated overview of how laboratory examinations contribute to improving diagnostic precision. The findings underscore that while no single diagnostic modality is universally optimal, each approach offers specific strengths depending on clinical setting, patient characteristics, and resource availability. The synthesized results provide a foundation for understanding current diagnostic capabilities and identifying potential areas for further improvement and integration into routine practice.

Table 1. Summary of included studies

Author (Year)	Study Title / Objective	Design & Population	Key Findings	Laboratory Methods & Accuracy
(Testera-Montes *et al.*, 2021)	Review of pathophysiology, diagnosis, and management of allergic rhinitis	Narrative review of global literature	SPT, RAST, ImmunoCAP remain standard for allergic rhinitis; SPT is generally more sensitive	**SPT, RAST, ImmunoCAP**; SPT > sensitivity than ImmunoCAP
(Sabir, 2025)	Correlation between lab findings and clinical diagnosis of viral URTI in children	Observational: pediatric respiratory cases	CRP & WBC correlate significantly with clinical diagnosis, but accuracy is moderate	**CBC, CRP, PCT**; moderate sensitivity
(Inderiati, Rachmawaty and Amaniah Anhar, 2023)	Identification of ARI patients using RP2 nested multiplex PCR	Laboratory study: ARI patients in Jakarta	Multiplex nested PCR rapidly and sensitively detects multiple viral pathogens.	**RP2 Nested Multiplex PCR**; sensitivity >95%
(AlTaie *et al.*, 2024)	Immunological and molecular diagnosis of Human Bocavirus	Observational; 70 ARI patients (11–57 yrs), Mosul	IgM 53%, IgG 47%, HBoV DNA 34%; RT-PCR more accurate than ELISA	**ELISA (IgM/IgG), RT-PCR**; RT-PCR ~100% sensitivity
(Zhang *et al.*, 2020)	Evaluation of multiplex PCR for detecting respiratory viruses & Mycoplasma	Diagnostic accuracy study: outpatients with respiratory infection	Multiplex PCR rapidly identifies multiple pathogens with high accuracy	**Multiplex PCR**; sensitivity >95%
(Liva, Karatzanis, and Prokopakis, 2021)	Review of rhinitis: classification, types, pathophysiology	Narrative review	Classification of rhinitis: diagnosis varies across allergic, infectious, and non-allergic types	**SPT, IgE, nasal provocation**; SPT is more sensitive
(Piri *et al.*, 2024)	Evaluation of novel POC MxA measurement for viral infection detection	Prospective; 228 children with fever in Finland	MxA cutoff 101 µg/L → 92% sensitivity, 91% specificity for viral infection	**POC MxA assay, CRP**; Sens 92% / Spec 91%
(Zubchenko *et al.*, 2022)	Levels of AGEs in allergic rhinitis with chronic EBV infection	Observational: 25 AR patients	AR patients exhibit decreased AGE; however, immune complexes are higher during the active EBV phase.	**ELISA AGE10, PCR EBV, IgG/IgM**; accuracy not reported
(Al-Hussaniy *et al.*, 2022)	Use of PCR in diagnosis & treatment decisions for respiratory infections in Iraq	Retrospective; 134 patients of all ages	PCR detected RSV (25%), Influenza A (18%), RV/EV (10%); improved clinical decision-making	**Multiplex PCR (FilmArray)**; Sens 95–100%, Spec 99–100%

The nine studies included in this narrative review collectively demonstrate significant advancements in the laboratory-based diagnosis of acute viral rhinitis and related upper

respiratory infections. Overall, the findings highlight that no single diagnostic method is universally optimal; instead, each modality offers distinct strengths, depending on the clinical context, accessibility, and the required diagnostic accuracy. Classical immunological methods, such as skin prick tests (SPT), RAST, and ImmunoCAP, remain highly relevant for diagnosing allergic rhinitis, as demonstrated in the review by Liva, Karatzanis and Prokopakis, (2021). Although these methods do not differentiate viral from bacterial infections, SPT consistently shows superior sensitivity compared to serum-based IgE tests, reinforcing its role as a gold standard in allergy evaluation. Their persistence in clinical practice reflects the need for baseline allergen profiling, which may coexist with or mimic symptoms of viral rhinitis.

In contrast, basic inflammatory biomarkers, including CRP, leukocyte count, and procalcitonin, provide moderate diagnostic value in distinguishing viral from bacterial etiologies. The study by Sabir, (2025) indicates significant correlations between these markers and clinical presentations; however, their overall sensitivity remains limited. This supports the notion that such biomarkers are better suited for preliminary screening rather than definitive diagnosis, particularly in primary care settings.

A central theme across multiple studies is the superior performance of molecular diagnostic methods, particularly RT-PCR and multiplex PCR assays. Evidence from Inderiati, Rachmawaty and Amaniah Anhar, (2023), Zhang *et al.*, (2020), and Al-Hussaniy *et al.*, (2022) consistently shows that PCR-based techniques achieve sensitivity and specificity levels exceeding 95%. These methods enable the simultaneous detection of multiple respiratory viruses, allowing for more precise etiological identification than serological or conventional immunological tests. Their high diagnostic accuracy also has clinical implications, including reducing unnecessary antibiotic prescriptions and enhancing targeted management strategies. However, the need for laboratory infrastructure and higher costs remains a limiting factor in certain regions. The findings from AlTaie *et al.*, (2024) further emphasize the superiority of molecular methods over immunological assays for specific pathogens, such as Human Bocavirus. Although ELISA remains useful for evaluating antibody responses, RT-PCR continues to outperform in terms of accuracy and detection of active infections. This distinction highlights the complementary nature of immunological and molecular tests, depending on whether clinicians aim to detect acute infection or evaluate previous exposure.

Another important advancement revealed in the included studies is the emergence of point-of-care (POC) diagnostic technologies, particularly those based on biomarkers. The prospective study by Piri *et al.*, (2024) provides strong evidence that MxA-based POC tests can reliably differentiate viral from bacterial infections, achieving 92% sensitivity and 91% specificity. These findings are reinforced by earlier work. Such rapid, bedside diagnostics are especially valuable in emergency and outpatient settings, where timely decision-making can reduce inappropriate antibiotic use and improve patient flow. In addition, the study by Zubchenko *et al.*, (2022) introduces lesser-known biomarkers such as advanced glycation end products (AGEs) in the context of allergic rhinitis and chronic EBV infection. Although not directly related to acute viral rhinitis, these findings expand our understanding of potential immunological pathways and point toward future opportunities for biomarker development.

Collectively, the results highlight three key insights: Molecular methods (PCR, multiplex PCR) remain the most accurate for identifying viral pathogens. POC tests, particularly those based on MxA, provide a practical alternative when rapid decision-making is required and laboratory resources are limited. Conventional immunological tests and basic biomarkers continue to hold diagnostic value, particularly in differentiating allergic conditions or providing initial clinical

screening. Together, these findings underscore the need for a multimodal diagnostic approach tailored to the specific clinical setting, available resources, and the desired level of diagnostic precision. The integration of molecular and POC technologies into routine practice holds promise for reducing diagnostic uncertainty, improving antimicrobial stewardship, and optimizing patient outcomes in cases of acute viral rhinitis.

DISCUSSION

This narrative review highlights significant advancements and persistent challenges in the laboratory diagnosis of acute viral rhinitis. Although the condition is often considered benign and self-limiting, accurate diagnosis remains clinically important due to its high prevalence, overlap with other upper respiratory conditions, and the widespread issue of unnecessary antibiotic prescribing. The findings from the nine included studies demonstrate that laboratory diagnostics play an increasingly valuable role in enhancing diagnostic precision, differentiating between viral and bacterial etiologies, and informing evidence-based clinical decision-making.

One of the key insights from this review is the continued relevance of classical immunological methods, such as skin prick tests (SPT), RAST, and ImmunoCAP (Han *et al.*, 2025). Although these tests do not directly diagnose viral rhinitis, they remain essential for identifying allergic rhinitis, a condition that frequently mimics or coexists with viral presentations (Siddiqui *et al.*, 2022). SPT demonstrates superior sensitivity compared to serum-specific IgE assays, reinforcing its status as the preferred diagnostic tool for allergic etiologies. Differentiating allergic from viral rhinitis remains a critical first step, as confusion between the two often leads to misclassification and inappropriate treatment (Kate *et al.*, 2024). However, this review also highlights the limitations of these immunological methods: they contribute little to distinguishing between viral and bacterial infections and therefore offer limited utility in the diagnostic process of acute viral rhinitis itself (Fokkens *et al.*, 2020).

In contrast, basic inflammatory biomarkers such as CRP, leukocyte count, and procalcitonin (PCT) show moderate performance in differentiating viral from bacterial etiologies (Li, Min and Zhang, 2021). CRP and leukocytosis correlate with clinical indicators of viral upper respiratory tract infection, although such markers lack the precision required for definitive diagnosis (Ma *et al.*, 2023). Their value lies in their accessibility, low cost, and utility in primary care settings where complex testing may not be available (Engel and Krumeich, 2020). Nevertheless, the moderate sensitivity and specificity of these markers limit their ability to reliably guide clinical decisions, especially when ruling out bacterial infection with high certainty is necessary. Consequently, reliance on these markers alone may contribute to diagnostic uncertainty and perpetuate the inappropriate use of antibiotics (Tarrant and Krockow, 2022).

The most consequential findings of this review relate to molecular diagnostic methods, particularly PCR and multiplex PCR assays. Across multiple studies, including those using molecular platforms, consistently demonstrate superior sensitivity and specificity, exceeding 95% for most respiratory viruses (Datta *et al.*, 2024). These assays not only provide rapid and accurate detection but also permit simultaneous identification of multiple pathogens, a major advantage given the heterogeneity of viral agents associated with rhinitis. Molecular tests have been shown to alter clinical decision-making, reducing unnecessary antibiotic prescriptions and enabling more targeted patient management. Despite these strengths, molecular methods face barriers such as high cost, need for specialized laboratory infrastructure, and limited availability in resource-constrained settings. These limitations highlight an important diagnostic gap: the mismatch between ideal diagnostic accuracy and real-world clinical feasibility.

Recent advancements in point-of-care (POC) diagnostics offer an innovative solution to this gap. Biomarker-based POC assays, especially those utilizing MxA and CRP, can reliably distinguish viral from bacterial infections within minutes. With sensitivities above 90% and high specificities, these tests have the potential to transform decision-making in primary care and emergency settings, where time and resources are limited. Their practical advantages, including rapid turnaround, minimal training requirements, and portability, position POC diagnostics as a promising bridge between clinical needs and laboratory capabilities. However, their application specifically to non-febrile viral rhinitis remains underexplored, suggesting an area for future research. Another emerging direction highlighted by this review is the investigation of novel biomarkers such as advanced glycation end products (AGEs). Although not directly related to acute viral rhinitis, these findings introduce the possibility of identifying new immunological markers that could, in the future, refine diagnostic profiling for specific patient subgroups. Such biomarkers may hold value in cases with comorbid conditions or atypical disease presentations, although further research is required before they can be integrated into routine practice.

Taken together, the findings of this review underscore the need to adopt a multimodal diagnostic approach. No single laboratory method is sufficient to address the broad diagnostic variability seen in patients with rhinitis symptoms. Classical immunological tests remain foundational for allergy-related presentations. Basic biomarkers assist in initial clinical screening, while molecular tests provide unparalleled diagnostic accuracy. POC devices offer practical and rapid decision-support tools. The integration of these modalities, tailored to clinical context and resource availability, provides the greatest potential for improving diagnostic outcomes. This review highlights the broader implications of laboratory diagnostics in combating the misuse of antibiotics. Misdiagnosis of viral rhinitis as bacterial rhinosinusitis continues to drive unnecessary antibiotic prescriptions. By enhancing diagnostic certainty, whether through PCR-based testing or rapid POC assays, clinicians can make more rational, evidence-driven treatment decisions that support antimicrobial stewardship and improve patient outcomes.

CONCLUSION

This narrative review demonstrates that laboratory diagnostics play a crucial role in improving the accuracy of acute viral rhinitis diagnosis and guiding rational clinical decision-making. While classical methods such as skin prick tests and basic biomarkers contribute to the initial assessment, molecular techniques, particularly RT-PCR and multiplex PCR, remain the most accurate tools for identifying viral pathogens with high sensitivity and specificity. Emerging point-of-care assays, especially MxA-based tests, offer promising rapid alternatives that can support timely diagnosis in primary care settings. Taken together, the evidence clearly shows that no single diagnostic method is ideal; instead, a multimodal approach tailored to the clinical context provides the most effective strategy for improving diagnostic precision and reducing unnecessary antibiotic use.

Based on the findings, it is recommended that clinical settings integrate molecular diagnostic methods when available, particularly in cases where distinguishing between viral and bacterial infections is essential for therapeutic decisions. For resource-limited environments, incorporating validated point-of-care biomarker tests can provide rapid and reliable support for frontline decision-making, thereby reducing the misuse of antibiotics. Future research should focus on evaluating these diagnostic tools specifically in non-febrile viral rhinitis, developing cost-effective molecular platforms, and exploring novel biomarkers that may further enhance the accuracy of detecting viral infections.

Acknowledgement

The authors would like to express their sincere gratitude to all individuals and institutions who contributed to the completion of this narrative review. Special appreciation is extended to Metana Puspitasari for her valuable guidance, constructive feedback, and continuous support throughout the research and writing process. The authors also acknowledge the Library of the Faculty of Medicine, Universitas Muhammadiyah Surakarta, for providing access to essential literature and academic resources. Finally, heartfelt thanks are conveyed to fellow medical students whose insightful discussions and encouragement greatly enriched the development of this manuscript.

Conflict of Interest

There are no potential conflicts of interest relevant to this article.

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