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**Research Article**

# Enhancing quality and sustainability in student startups: The role of university incubators and entrepreneurship education - realities and perspectives

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**ABSTRACT**

This study examines the role of university incubators in Algeria in enhancing the quality and sustainability of student startups under the pioneering 1275 "one degree, one startup" bylaw. While the global literature on incubators is vast, this paper's originality lies in its specific focus on developing a contextualized Key Performance Indicator (KPI) framework for a unique policy environment in a resource-rich, developing economy. Through a systematic literature review, this research synthesizes existing knowledge on incubator effectiveness to identify seven critical KPIs and proposes a research agenda for developing metrics to empirically measure their impact on startup performance and sustainability. A key methodological limitation is its theoretical foundation; the findings and proposed agenda are derived from synthesis rather than primary empirical data, underscoring the need for future empirical validation. The analysis contends that tailored entrepreneurial education and mentorship within this specific framework are crucial for driving sustainable student ventures.

**Keywords:** Startups, University Incubators, Sustainable Development, Innovation, Entrepreneurship

## 1. Introduction

Hydrocarbon rentierism has characterized the Algerian economy since its nationalization in 1971 (Álvarez, 2010). This reliance on gas and oil rent to finance public expenditure has put a brake on any efforts for economic diversification. However, mitigating this dependency has become imperative to ensure economic growth and sustainability. It can only be achieved through investment in diverse aspects of economic development that rely on knowledge, science, and technology (Gitelman et al., 2023). Converting to a knowledge-based economy, where information is considered a catalyst for growth and a strategic advantage in the global competition for a competitive edge, has become the roadmap for the Algerian government to ensure the attainment of national economic objectives, particularly in terms of growth and sustainability. In this respect, there has been an emphasis on start-ups to drive the wheel of change.

This persistent rentier model has not only constrained economic diversification but also stifled the development of a robust private sector and a culture of innovation-led entrepreneurship. Recognizing this imperative for a structural shift, the Algerian government has initiated a strategic pivot towards fostering a knowledge-based economy. This transition is explicitly operationalized through policies aimed at stimulating entrepreneurial activity from the ground up, with the higher education sector identified as a critical lever for change.

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The latest Algerian commercial guide, published by the US International Trade Administration, highlights the government's initiatives to encourage the creation of technology start-ups through the establishment of the Delegate Ministry of Knowledge Economy and Start-ups, which was promoted to the Ministry of Knowledge Economy, Start-ups, and Microenterprises in 2022. In addition to this, a strategic alliance with the Ministry of Higher Education and Scientific Research translating to the establishment of the 1275 bylaw "one degree, one start-up," can be considered as a strategy to boost the rate of technology start-up creation drawing from scientific research and academic mentorship and support within the university incubators.

University incubators play a pivotal role in the government's pursuit of economic diversification and sustainable development. The expected outcomes of these incubators within institutions of higher education include contributions to technology transfer and commercialization through the creation of spinoffs, as well as the development of the local or regional economic fabric (Abetti & Rancourt, 2006). Although they may not have access to important financial resources, university incubators provide support mechanisms for innovation and entrepreneurship to start-ups through managerial, legal, and marketing advisory services, as well as training (Aernoudt, 2004).

In this paper, we argue that students' access to entrepreneurial education and mentorship, as well as their undertaking of an entrepreneurial venture through business creation under the 1275 bylaw within the university incubator, enhances the overall performance and sustainability of the business.

The study aims to align the Algerian government's policy of encouraging and promoting the entrepreneurial spirit in higher education, as outlined in the 1275 bylaw, which allows final-year bachelor's and master's students to join the university incubator and start a business, with the situational analysis of students' start-up success and sustainability. Even though entrepreneurship education and incubator programs have boosted student's awareness of entrepreneurship and encouraged student-led startups to emerge from within the university, the long-term impact and sustainability of these startups remain unclear. The research aims to explore the role of university incubators in supporting entrepreneurship, specifically under the 1275 bylaw, and their impact on the success and sustainability of student-led startups. Moreover, it contributes to the body of knowledge regarding the role that the university currently plays in the country's economic and technological development.

## 2. Literature review

### 2.1. Theoretical background

To conceptualize the key indicators of incubator performance that promote the sustainability of student start-ups, this study draws on three fundamental theoretical foundations: the ecosystem theory, the resource-based theory, and the triple helix model.

Ecosystem theory is considered a comprehensive framework that explains the interdependence of the actors and the factors that contribute to innovation, entrepreneurship, economic growth, and sustainability. Biological ecosystems initially inspire the concept to highlight the complex, symbiotic relationships among various stakeholders within a defined business environment (Boutillier et al., 2015).

The first time this metaphor was used was by Isenberg (2010) to highlight the components of a business environment favorable to entrepreneurial innovation provided by government decision-makers, decision-makers, including policy, culture, financial resources, human capital, markets, and supporting infrastructure. This multidimensional combination considers the regional characteristics and the specific nature of interactions between stakeholders, which can either promote or hinder entrepreneurial activities. Moreover, the nature of these networks explains how some geographical regions surpass others in terms of entrepreneurial innovation and growth levels (Fernandes & Ferreira, 2022).

The ecosystem theory provides a macro-level view of the entrepreneurial environment. To understand the specific mechanisms of interaction within this ecosystem, particularly in a knowledge-driven context, Etzkowitz's (2002) Triple Helix model offers a more focused lens. This model posits that the synergy between university, industry, and government is the key driver of innovation in a knowledge-based society.

University incubators are a practical manifestation of both ecosystem and Triple Helix principles, serving as physical hubs that facilitate this trilateral collaboration. Expanding on this, Beugrè's (2017) Quintuple Helix approach

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integrates two additional, critical dimensions: civil society and the natural environment. This evolution reflects a growing consensus that sustainable entrepreneurship and long-term structural sustainability require an eco-centric orientation and deep community engagement, moving beyond purely economic objectives.. This approach highlights that university incubators not only provide a framework for collaboration among the university, industry, and policymakers but also serve as agents of civil society and the natural environment, ensuring that innovative entrepreneurial activities are in harmony with communal and ecological well-being.

Researchers emphasize the synergy between stakeholders and their ability to adapt and adjust resources to address current challenges. This would only be made possible thanks to a solid network built on trust, cooperation, and knowledge sharing (Spigel & Harrison, 2018).

Ecosystem theory provides a crucial framework for examining the contributions of various stakeholders to sustainable growth, serving as a fundamental basis for understanding complex economic and entrepreneurial contexts (Isenberg, 2010).

According to the research-based view, university incubators foster business networks and support systems from both industry and government, providing financial, human, and social resources that eventually lead to startup success from a business process perspective (McAdam et al., 2006). Moreover, applying the resource-based theory of university incubators emphasizes that the specific nature of the university's entrepreneurship orientation, its entrepreneurship education programs, training and support mechanisms, and social and business networks provide the incubated startups with a competitive advantage (Todorovic & Suntornpithug, 2008).

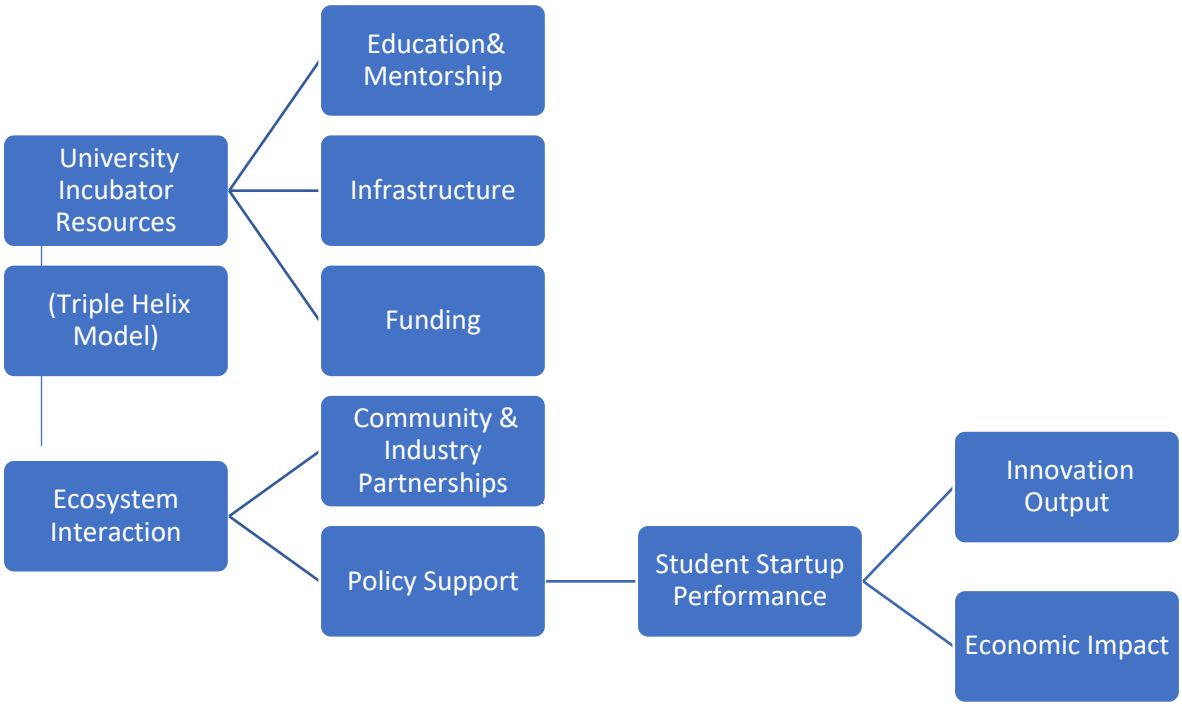


**Figure 1.** Theoretical framework

### 2.2. Parameters for Structural Sustainability in Entrepreneurial Ecosystems

Beyond the immediate success of individual startups, the long-term, structural sustainability of the entrepreneurial ecosystem itself is paramount. The literature identifies several key parameters that contribute to this resilience (Beugrè, 2017; Spigel & Harrison, 2018). These include: (1) Financial Sustainability**:** Diversified funding sources beyond government grants, including private investment, corporate partnerships, and revenue-generating services. (2) Network Density and Redundancy**:** The existence of multiple, strong connections between actors (universities, industry, government, civil society) to ensure the flow of resources and knowledge even if one node fails. (3) Institutional Support and Adaptive Policy**:** Continuous and evolving support from government and university leadership, with policies that adapt to market and technological changes. (4) Physical and Digital Infrastructure**:** Reliable access to high-quality labs, co-working spaces, high-speed internet, and fabrication facilities.

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(5) Cultural Legitimacy**:** A broad societal and academic recognition of entrepreneurship as a valuable career path, which is crucial for attracting and retaining talent.

### 2.3. The Role of University Incubators as a Platform for Collaboration within the Entrepreneurial Ecosystem

University incubators serve as critical infrastructure within the entrepreneurial ecosystem, functioning as pivotal platforms that facilitate cooperation among nascent startups, established industry players, diverse stakeholders, and government entities (Kipper et al., 2014). Recognized as innovation hubs, their effectiveness in nurturing and mentoring sustainable startups constitutes a significant driving force behind economic growth and development. By doing so, they equip local economies with enhanced competitive advantages in the increasingly demanding global marketplace (Kipper et al., 2014). Achieving this vital role necessitates the implementation of comprehensive support programs. Such programs must strategically provide essential physical infrastructure like facilities and coworking spaces, coupled with critical intangible assets including structured mentoring, specialized training services, facilitated access to diverse resources (financial, human, technological), and crucially, an environment deliberately cultivated to foster productive networking and efficient technology transfer (AL-Mubaraki et al., 2014).

Scholars emphasize the function of university incubators as conduits for knowledge and technology diffusion. Stal et al. (2016) and Abetti and Rancourt (2006) identify them as favorable channels enabling the transfer of academic research, expertise, and innovations from the university domain into the commercial business world, primarily facilitated by high-tech students and faculty members. Beyond transfer, incubators are instrumental in bolstering the sustainability and growth trajectories of startups, particularly those operating within inherently high-risk and uncertain sectors where traditional support mechanisms often fall short (McAdam et al., 2006). Furthermore, university incubators significantly enhance the legitimacy of fledgling ventures. They strengthen a startup's capacity to survive initial challenges, achieve growth, and mitigate the pervasive "liability of newness" by strategically enabling the combination of scarce resources. This is accomplished through the formation of strategic alliances and the activation of extensive stakeholder networks inherent to the incubator environment, thereby maximizing the utility derived from inherently limited inputs (Lasrado et al., 2015; Li & Chia-nan Wang, 2011).

For students, incubators serve as a critical experiential learning platform. The effects extend beyond business creation to include significant human capital development: the acquisition of practical skills (e.g., prototyping, financial modeling), the development of an entrepreneurial mindset (resilience, opportunity recognition), and the building of valuable social capital through networks with mentors, investors, and peers (Lasrado et al., 2015; Todorovic & Suntornpithug, 2008). These student-focused outcomes are fundamental to entrepreneurial sustainability, as they create a pipeline of capable, connected, and motivated entrepreneurs who can launch and sustain future ventures.

### 2.4. The 1275 Bylaw “One Degree One Startup” Impact on University Incubators

Acknowledging the empirically demonstrated crucial role of university-led startups and spinoffs in propelling economic growth through enhanced technology and knowledge transfer, the Algerian government, specifically the Ministry of Higher Education, enacted Ministerial Resolution 1275, known as the "One Degree One Startup" bylaw (Abdelmalek & Benessalah, 2023). This landmark resolution establishes a dedicated institutional mechanism designed to actively support and incentivize startup creation and patent development specifically within the university environment, targeting students as primary entrepreneurs (Abdelmalek & Benessalah, 2023). The bylaw mandates the provision of a comprehensive training program for participating students. This program encompasses a full spectrum of accompaniment services, including intensive mentorship, alongside structured financial support mechanisms, aiming to holistically engage faculty members and the wider university community in the entrepreneurial process (Belgoum & Benessalah, 2023). Recent empirical insights derived directly from trainer experiences within analogous entrepreneurial support programs underscore the critical importance of embedding practical, hands-on learning methodologies and delivering highly tailored mentorship. These elements are identified as fundamental for effectively translating the ambitious policy framework of the 1275 bylaw into tangible, successful entrepreneurial outcomes at the student venture level (Chalabi & Belgoum, 2025). Consequently, the implementation of the 1275 bylaw has demonstrably generated a substantial and positive shift in students' awareness of entrepreneurship as a viable career path and has markedly increased their active engagement in entrepreneurial activities within the Algerian higher education context.

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## 3. Method

This study employed a systematic literature review to identify and synthesize Key Performance Indicators (KPIs) relevant to university incubators, with a specific focus on the Algerian context under the 1275 bylaw. The process involved three phases:

- Identification and Sourcing: A systematic search was conducted in academic databases (Scopus, Web of Science, Google Scholar) for peer-reviewed publications from 2000-2024. Keywords included combinations of "university incubators," "startup KPIs," "entrepreneurship education," "sustainability," and "developing economies." Seminal works (McAdam et al., 2006; Etzkowitz, 2002) provided foundational frameworks.
- Screening and Synthesis: The identified literature was screened for relevance based on inclusion criteria focusing on incubator effectiveness, entrepreneurial education, and startup sustainability, particularly in developing economies. Exclusion criteria omitted studies solely focused on corporate or non-university incubators without a educational component. The synthesis was explicitly shaped by the Algerian policy environment of the 1275 bylaw. This meant prioritizing studies and KPIs that aligned with the bylaw's goals, such as student-focused entrepreneurship, academic research commercialization, and the specific support structures (e.g., mentorship, prototyping) it mandates.
- Analysis and Agenda Development: The final phase involved a critical analysis of the gaps between the theoretical KPIs found in the literature and the practical challenges and opportunities presented by the 1275 framework. This gap analysis directly informed the proposed research agenda for developing context-specific impact metrics.

## 4. Results and Discussion

The comprehensive literature review identified seven critical Key Performance Indicators (KPIs) constituting a robust framework for evaluating the efficacy of university incubators in driving entrepreneurship, fostering innovation, promoting startup sustainability, and contributing to economic growth. Crucially, this analysis provides specific perspectives on the implementation and impact of these KPIs within the context of Algeria's pioneering 1275 "One Degree One Startup" bylaw.

Access to Entrepreneurship Education emerged as a foundational pillar for incubator success (McAdam et al., 2006; Todorovic & Suntornpithug, 2008; Stal et al., 2016). The literature consistently demonstrates that structured education equips nascent entrepreneurs with indispensable marketing, financial, and strategic business skills. This knowledge base is paramount for mitigating the inherent "newness liability" faced by startups, thereby significantly enhancing their competitive positioning and potential for long-term sustainability and growth. For the 1275 bylaw to realize its objectives, this necessitates the deployment of comprehensive, practically oriented educational programs. Such curricula must extend beyond theory to encompass critical areas like design thinking for innovation, business model canvas development for strategic clarity, digital marketing for market reach, navigating legal procedures, and mastering business accounting fundamentals, providing students with the essential toolkit for venture creation and management.

Closely intertwined with education is the critical KPI of Mentorship and Support (Abetti & Rancourt, 2006; Lasrado et al., 2015). Evidence underscores that continuous, strategic guidance from experienced mentors is vital for enhancing startup recognition, navigating early-stage challenges, and significantly improving survival rates. This support leverages expertise in business development and innovation management, offering tailored advice crucial for refining value propositions and scaling operations. However, a significant challenge identified for the 1275 bylaw framework is its inherent emphasis on quantitative outputs (e.g., number of startups created). This focus potentially restricts the capacity for incubators to provide the deep, sustained, and personalized consulting engagements that nascent ventures, particularly those in complex or high-tech domains, fundamentally require to thrive beyond the incubation period.

Technology and Knowledge Transfer stands as a core function differentiating university incubators (Stal et al., 2016; McAdam et al., 2006; Abetti & Rancourt, 2006). These entities act as vital conduits, enabling the commercialization of academic research, patented inventions, and novel innovations developed within the university. The 1275 bylaw strategically aligns with this function by explicitly motivating students and researchers to prioritize the patenting and commercial exploitation of their research outputs. This represents a deliberate shift in academic incentives,

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encouraging the transformation of knowledge into marketable products or services rather than focusing solely on traditional academic dissemination through publications or grant applications, thereby directly linking academic endeavor to economic value creation.

The KPI of Access to Social and Business Networks, conceptually anchored in the Triple Helix model of university-industry-government interaction (Etzkowitz, 2002; Lasrado et al., 2015; McAdam et al., 2006), highlights the incubator's role as a connectivity hub. Facilitating meaningful connections between academia, industry partners, and government agencies is proven to boost startup success rates by enhancing access to essential resources, potential customers, partners, and investors. While the 1275 framework actively promotes networking through organized events, hackathons, and business meetings – providing students with invaluable real-life advice from established business leaders – a critical gap persists. The discussion reveals a pressing need for significantly heightened awareness and the accelerated development of formal venture capital (VC) and business angel initiatives within Algeria's broader entrepreneurial ecosystem. Without this maturation of the risk capital landscape, the full potential of networks fostered within incubators remains constrained.

Providing tangible Access to Human, Financial, and Infrastructure Resources is another indispensable KPI, furnishing startups with critical competitive advantages and sustainability incentives (Todorovic & Suntornpithug, 2008; Wang & Li, 2010; Lasrado et al., 2015). The 1275 bylaw facilitates this access practically, notably through provisions for prototyping support, which is crucial for product development and validation. Furthermore, a distinctive strength of the Algerian model lies in its encouragement of heterogeneous team formation, allowing collaborations of up to six students with up to three professors. This structure leverages diverse skillsets and academic expertise, offering student-led ventures a unique competitive edge by combining youthful innovation with experienced guidance.

Ultimately, the most telling measure of an incubator's success is the Sustainability of Startups it cultivates (Todorovic & Suntornpithug, 2008; Stal et al., 2016). This KPI focuses on the long-term viability and growth trajectory of ventures post-graduation. For assessing the performance of startups nurtured under the 1275 bylaw, tangible metrics become essential after a reasonable period, such as two academic years. Key indicators include the acquisition of patents protecting their innovations, the development and recognition of significant innovation projects, the attainment of the official "Startup Label" conferred by the Ministry of Knowledge Economy, and the degree of recognition and integration achieved within the wider startup and micro-enterprise communities.

When viewed through a comparative lens with other developing economies, the KPIs for Algerian university incubators show both alignment and unique challenges. Similar to findings in other Global South contexts (Kaggwa et al., 2024; Rosado-Cubero et al., 2023), access to sustained mentorship and robust funding networks remains a universal hurdle. However, Algeria's 1275 bylaw introduces a distinct, structured mechanism for team formation (integrating students and professors) that is less common elsewhere, providing a unique potential advantage in leveraging academic expertise. Conversely, the nascent stage of the formal venture capital ecosystem in Algeria, compared to more established scenes in countries like Kenya or South Africa, highlights a critical area for policy development to complement the incubators' efforts.

Finally, university incubators contribute significantly to Regional Economic Development by acting as catalysts for local innovation ecosystems and job creation, thereby generating broader economic ripple effects throughout the region and nation (Abetti & Rancourt, 2006; Etzkowitz, 2002). Evaluating this contribution under the 1275 bylaw requires looking beyond direct startup metrics. Vital indicators include the level of awareness and understanding among key stakeholders and civil society regarding the critical role startups play in economic diversification and sustainable growth. Coupled with this, the measurable impact rate of these university-born startups – quantified through metrics like job creation, revenue generation, or market penetration – within local and regional economic activities serves as a concrete gauge of the incubators' effectiveness in fulfilling their mandate for regional and national development.

## 5. Conclusion

This paper has discussed the role of university incubators in promoting sustainable student-led startups through theoretical lenses and a synthesis of relevant KPIs. Previous literature offers insights into achieving sustainability. For instance, studies like McAdam et al. (2006) highlight that sustained post-graduation support is critical for startup

survival, a key sustainability metric. Furthermore, the connection between sustainability and structural factors is evident. The location of an incubator within a "knowledge precinct" or its architectural design promoting serendipitous interactions (e.g., open-plan layouts, communal areas) can significantly enhance network formation and knowledge spillovers, which are vital for long-term ecosystem health (Kipper et al., 2014). In the Algerian context, challenges such as disjointed collaboration and administrative bottlenecks directly impede these structural parameters, hindering the full potential of ventures and contributing to brain drain. This approach encourages final-year students to examine research questions with real business applications and to transform ideas into real ventures. These student-led startups, or more accurately, innovative ventures, benefit from human, intellectual, and financial resources in the forms of prototyping, coworking spaces, and access to human capital to start and sustain a business (Laid, 2023). Nevertheless, they encounter a series of challenges related to prototyping due to limited financial resources and insufficient infrastructure, where the required technology is sometimes unavailable within the incubator's fab labs or associated university laboratories (Benchaa et al., 2024). Other challenges relate to the disjointed ecosystem collaboration, and administrative blocks hinder the full potential of innovative ventures, leading to brain drain to other cities with a more dynamic ecosystem and sometimes to other countries. Therefore, redefining the partnership between universities, industries, and government through the Triple Helix and the quintuple Helix models is critical on the one hand to address these issues and reduce the administrative bottleneck and, on the other hand, to foster industry and government infrastructure on technology development and transfer (Beugré, 2017; Cai & Etzkowitz, 2020; Stal et al., 2016).

Ultimately, the performance of university incubators can be assessed through key indicators, including startup survival rates, job creation, technology transfer, go-to-market strategies, local and international legitimacy, and economic impact (Laid, 2023; McAdam et al., 2006). This paper calls for a mixed research approach, combining both qualitative and quantitative research, to investigate the longitudinal performance metrics from the perspectives of students, teachers, faculty members, and incubator members, ensuring they fulfill their mission efficiently.

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## ETHICAL AND SCIENTIFIC PRINCIPLES STATEMENT OF RESPONSIBILITY

The author(s) declare that ethical rules and scientific citation principles were complied with throughout the preparation process of this study.

## STATEMENT OF RESEARCHERS' CONTRIBUTION RATE TO THE ARTICLE

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The authors have no conflicts of interest to declare.

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