

## Integrating Local Crop-Based Research into Pharmacy Education: A Faculty Perspective from Neemuch District

Dr. Vaibhav Verma<sup>1\*</sup>

<sup>1</sup>Professor, Gyanodaya  
Institute of Pharmacy,  
Gyanodaya University,  
Neemuch

### ORCID ID:

<https://orcid.org/0009-0000-3773-0697>



### Abstract:

The integration of locally available medicinal and agricultural resources into pharmacy education represents a transformative approach toward contextualized and applied learning. Neemuch district of Madhya Pradesh, known for its unique agro-climatic conditions and rich cultivation of crops such as opium (*Papaver somniferum*), soybean (*Glycine max*), garlic (*Allium sativum*), safedmusli (*Chlorophytumborivilianum*), and a diverse range of medicinal plants traded through its herbal mandi, offers significant yet underutilized potential for academic and research integration.

This study explores the scope of incorporating local crop-based research into pharmacy curricula from a faculty perspective, emphasizing its role in enhancing practical learning, research innovation, and regional relevance. Existing literature highlights the importance of experiential and community-based education in improving student engagement and research outcomes (Kolb, 1984; WHO, 2013). However, there remains a gap in systematically linking local agricultural biodiversity with pharmaceutical education, particularly in semi-urban and rural academic settings.

The paper examines how locally cultivated crops can serve as primary resources for phytochemical studies, pharmacological screening, formulation development, and clinical relevance. For instance, opium cultivation provides opportunities for studying alkaloid chemistry and regulatory frameworks, while soybean and garlic offer avenues for nutraceutical and antimicrobial research (Gupta et al., 2018; Banerjee et al., 2003). Similarly, safedmusli and other herbal commodities available in Neemuch's herbal markets present potential for ethnopharmacological investigations and value-added product development.

From a faculty perspective, integrating such locally relevant research themes can bridge the gap between theoretical knowledge and real-world application, foster innovation, and contribute to regional economic and healthcare development. The study also discusses challenges such as lack of structured frameworks, limited industry-academia collaboration, and regulatory constraints.

Overall, this paper advocates for a localized, resource-driven model of pharmacy education that aligns academic training with regional strengths, thereby enhancing research capacity, employability, and sustainable development.

### Keywords

Pharmacy education; Local crop-based research; Neemuch district; Opium research; Soybean pharmacology; Garlic therapeutics; Safed musli; Herbal mandi; Experiential learning; Ethnopharmacology; Regional innovation

**Corresponding Author:** Dr. Vaibhav Verma<sup>†</sup>, Professor, Gyanodaya Institute of Pharmacy, Gyanodaya University, Neemuch

**Copyright:** © 2026 The Authors. Published by Vision Publisher. This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0/>).

# 1. INTRODUCTION

The evolving landscape of pharmacy education increasingly emphasizes the need for context-driven, experiential, and research-oriented learning approaches. Traditional pedagogical models, largely centered on theoretical instruction, often fail to fully equip students with practical competencies required for addressing real-world healthcare and pharmaceutical challenges. Contemporary educational frameworks advocate for experiential learning, where knowledge is constructed through direct engagement with local resources and real-life applications (Kolb, 1984). In parallel, global health education bodies have highlighted the importance of aligning academic training with regional healthcare needs and available resources to enhance both relevance and impact (World Health Organization, 2013).

In this context, the integration of locally available agricultural and medicinal resources into pharmacy education presents a promising yet underexplored opportunity. Neemuch district of Madhya Pradesh represents a unique case, characterized by its agro-economic significance and diverse crop profile. The region is internationally recognized for licensed opium (*Papaver somniferum*) cultivation under strict regulatory frameworks, making it a critical site for studying alkaloid chemistry, regulatory compliance, and pharmaceutical applications (Government of India, Central Bureau of Narcotics). In addition, Neemuch is a major producer of soybean (*Glycine max*), garlic (*Allium sativum*), and medicinal plants such as safedmusli (*Chlorophytumborivilianum*), all of which hold substantial pharmacological and nutraceutical value (Ministry of Agriculture & Farmers Welfare, 2022; National Medicinal Plants Board, 2021).

The presence of a well-established herbal mandi in Neemuch further strengthens its potential as a regional hub for medicinal plant trade and ethnopharmacological exploration. These local resources provide a rich foundation for integrating crop-based research into pharmacy curricula, enabling students to engage in phytochemical analysis, pharmacological screening, formulation development, and clinical relevance studies. Such an approach not only enhances practical learning but also fosters innovation by encouraging students to explore locally relevant research problems. As will be elaborated in Section 3, crops like garlic and safedmusli offer significant opportunities for antimicrobial, adaptogenic, and nutraceutical research, aligning academic learning with contemporary pharmaceutical needs.

Despite this potential, current pharmacy education systems largely remain detached from local agricultural and medicinal ecosystems. Existing literature has emphasized the importance of interdisciplinary and community-based education in improving student engagement and research outcomes (Frenk et al., 2010). However, there is limited structured integration of region-specific resources into pharmacy curricula, particularly in semi-urban and rural academic settings such as Neemuch. This disconnect results in underutilization of local resources and missed opportunities for region-driven innovation.

Furthermore, the growing demand for industry-relevant skills and research competencies in pharmacy education necessitates a shift toward applied and context-specific learning models. Integrating local crop-based research can bridge the gap between theoretical knowledge and practical application, while also contributing to regional economic and healthcare development. From a faculty perspective, such integration can enhance teaching effectiveness, promote collaborative research, and create opportunities for academia–industry linkages. These aspects will be critically discussed in Section 5.

Therefore, this study aims to explore the integration of local crop-based research into pharmacy education, with a specific focus on Neemuch district. It seeks to examine how regionally available crops can be utilized as educational and research resources, evaluate their pharmaceutical relevance, and analyze the role of faculty in implementing such models. By adopting a localized and resource-driven approach, this study contributes to the development of a more contextualized, innovative, and impactful pharmacy education system.

## 2. Overview of Neemuch Crops and Their Pharmaceutical Relevance

Neemuch district, located in the Malwa region of Madhya Pradesh, is characterized by its unique agro-climatic conditions that support the cultivation of both commercial and medicinally significant crops. As introduced in Section

1, the region's agricultural diversity provides a strong foundation for integrating local resources into pharmacy education. Crops such as opium, soybean, garlic, and safedmusli, along with a wide variety of medicinal plants traded through Neemuch'sherbal mandi, possess substantial pharmaceutical relevance that remains underutilized in academic curricula.

Among these, opium (*Papaver somniferum*) holds a distinctive position due to its regulated cultivation and high pharmaceutical value. India is one of the few countries authorized for legal opium production under strict government supervision, and Neemuch serves as an important hub for this activity. Opium is a primary source of alkaloids such as morphine, codeine, and thebaine, which are essential for the development of analgesics and antitussive agents (UNODC, 2023). The presence of such a crop offers a unique opportunity for pharmacy students to understand alkaloid extraction, regulatory frameworks, and ethical considerations in controlled substance handling. As will be further discussed in Section 4, incorporating such real-world regulatory and pharmacological aspects into education can significantly enhance applied learning.

Soybean (*Glycine max*), another major crop in Neemuch, is widely recognized for its nutraceutical and pharmaceutical potential. Rich in isoflavones, proteins, and essential fatty acids, soybean has been extensively studied for its role in reducing cardiovascular risk, managing hormonal disorders, and supporting metabolic health (Messina, 2016). From a pharmaceutical perspective, soybean-derived compounds can be utilized in formulation development, functional foods, and preventive healthcare products. Integrating soybean-based research into pharmacy education can enable students to explore the interface between nutrition and pharmacology, which is increasingly relevant in modern healthcare systems.

Garlic (*Allium sativum*) is another crop of significant medicinal importance cultivated in the region. It is well documented for its antimicrobial, antihypertensive, and cardioprotective properties, primarily attributed to sulfur-containing compounds such as allicin (Banerjee and Maulik, 2002). The pharmacological versatility of garlic makes it an ideal candidate for student-led research in areas such as antimicrobial resistance, herbal formulations, and alternative medicine. As highlighted in Section 3, such crop-based studies can be directly integrated into laboratory experiments and research projects, providing hands-on learning opportunities.

Safed musli (*Chlorophytumborivilianum*), a high-value medicinal plant, is known for its adaptogenic, immunomodulatory, and aphrodisiac properties. It has gained considerable attention in both traditional and modern medicine, with increasing demand in herbal and nutraceutical markets (Sharma et al., 2010). The cultivation and trade of safedmusli in Neemuch create opportunities for students to engage in ethnopharmacological research, phytochemical analysis, and value-added product development. Such activities can also contribute to the preservation and scientific validation of traditional knowledge systems.

In addition to these major crops, Neemuch's herbal mandi serves as a dynamic marketplace for a wide range of medicinal plants, including ashwagandha, kalmegh, tulsi, and other regionally available herbs. These plants offer extensive scope for pharmacognostic studies, quality control analysis, and formulation research. According to the National Medicinal Plants Board (2021), India's medicinal plant sector holds significant potential for both domestic healthcare and global trade, further emphasizing the importance of integrating such resources into academic and research frameworks.

Despite the availability of these valuable resources, their systematic incorporation into pharmacy education remains limited. The disconnect between local agricultural production and academic research restricts the potential for innovation and skill development. By leveraging the pharmaceutical relevance of Neemuch's crops, educational institutions can create a more context-specific and application-oriented learning environment. As will be explored in Section 3, these crops can be effectively integrated into curriculum design, laboratory training, and research methodologies, thereby enhancing both academic outcomes and regional impact.

### **3. Integration of Local Crop-Based Research into Pharmacy Education**

The integration of local crop-based research into pharmacy education represents a shift from traditional, theory-oriented pedagogy toward a more applied, experiential, and context-driven learning model. As discussed in Section 2, Neemuch district offers a diverse range of pharmaceutically relevant crops that can serve as practical resources for

teaching and research. Incorporating these resources into academic curricula can significantly enhance student engagement, skill development, and research competency. Educational theories strongly support such approaches, emphasizing that active and experiential learning improves knowledge retention and problem-solving abilities (Prince, 2004; Harden, 2007).

At the curriculum level, local crop-based integration can be systematically implemented across multiple pharmacy subjects. In pharmacognosy, students can study the morphological, microscopic, and phytochemical characteristics of locally available medicinal plants such as safedmusli and garlic. This can include field visits to cultivation sites and herbal mandis, allowing students to directly observe plant identification, harvesting techniques, and quality assessment practices. Such field-based learning aligns academic knowledge with real-world applications, thereby strengthening conceptual understanding.

In pharmaceutical chemistry, crops like opium provide an opportunity to study alkaloid extraction, structural characterization, and regulatory compliance. Given the strict legal framework governing opium cultivation in India, students can also gain insights into controlled substance regulations and ethical considerations in pharmaceutical practice. This integration of regulatory knowledge with scientific learning creates a comprehensive educational experience that is rarely achieved through conventional classroom teaching. As highlighted in Section 2, the presence of licensed opium cultivation in Neemuch offers a unique academic advantage in this regard.

Similarly, in pharmacology, crops such as garlic and soybean can be used for experimental studies on antimicrobial activity, cardiovascular effects, and metabolic regulation. Laboratory-based experiments can be designed to evaluate the biological activity of plant extracts, enabling students to understand drug mechanisms and therapeutic potential. Studies have shown that incorporating research-based learning into curricula enhances critical thinking and scientific inquiry among students (Prince, 2004). These experiments can be further extended into mini research projects, encouraging students to generate and analyze their own data.

In pharmaceuticals, students can work on formulation development using locally sourced materials. For example, garlic extracts can be utilized in developing antimicrobial gels or capsules, while soybean derivatives can be explored for nutraceutical formulations. Safed musli can be incorporated into herbal dosage forms such as powders, tablets, or syrups. This approach not only enhances practical skills but also introduces students to product development and innovation. As will be discussed in Section 5, such activities can also facilitate collaboration between academic institutions and local industries.

From a research perspective, integrating local crops into student projects and dissertations can significantly improve the relevance and impact of academic research. Instead of relying on generic or repetitive topics, students can focus on region-specific problems and resources, leading to more meaningful and publishable outcomes. Mukhtar et al. (2020) emphasize that contextualized and application-based learning environments improve both student motivation and academic performance. Furthermore, such research can contribute to the scientific validation of traditional knowledge and promote the development of region-specific pharmaceutical products.

Faculty play a crucial role in facilitating this integration by designing curricula, guiding research, and establishing collaborations with local stakeholders. Effective implementation requires faculty training, interdisciplinary coordination, and institutional support. Teachers must adopt innovative teaching methodologies that combine theoretical instruction with practical exposure, ensuring that students can apply their knowledge in real-world contexts. As highlighted in Section 1, aligning education with regional resources not only enhances learning outcomes but also contributes to local economic and healthcare development.

Despite its potential, the integration of local crop-based research into pharmacy education faces several challenges, including limited infrastructure, lack of standardized protocols, and regulatory constraints. Addressing these challenges requires strategic planning, policy support, and investment in research facilities. As will be explored in Section 5, institutional and policy-level interventions are essential for scaling such models and ensuring their sustainability.

In summary, integrating local crop-based research into pharmacy education offers a practical and innovative approach to bridging the gap between theory and application. By utilizing the rich agricultural and medicinal resources of

Neemuch district, academic institutions can create a dynamic learning environment that fosters research, innovation, and regional relevance. This approach not only enhances student competencies but also contributes to the broader goal of developing a sustainable and context-driven pharmaceutical education system.

#### **4. Faculty Perspective on Integrating Local Crop-Based Research (Author-wise Cross-Referenced, Critical Analysis)**

The successful integration of local crop-based research into pharmacy education largely depends on the perspectives, preparedness, and adaptability of faculty members. As discussed in Section 3, while the availability of pharmaceutically relevant crops in Neemuch provides a strong foundation for applied learning, the translation of these resources into structured academic practice requires active faculty engagement. Faculty act as the primary drivers of curriculum innovation, research guidance, and institutional collaboration, making their role central to the implementation of such context-driven educational models.

From a pedagogical standpoint, faculty members increasingly recognize the limitations of traditional lecture-based teaching methods, particularly in professional courses such as pharmacy. There is a growing awareness that students benefit more from problem-based, research-oriented, and experiential learning approaches that connect theory with real-world applications. Studies on faculty development indicate that teachers who adopt innovative teaching strategies contribute significantly to improved student learning outcomes and research productivity (Bland et al., 2005). In the context of Neemuch, this implies a shift toward incorporating locally available crops into teaching modules, laboratory exercises, and student projects.

However, despite this recognition, several practical challenges hinder the effective implementation of such approaches. One of the primary constraints is the lack of institutional infrastructure and resources required to support crop-based research. Many pharmacy colleges, particularly in semi-urban regions, face limitations in terms of laboratory facilities, funding, and access to advanced analytical instruments. This restricts the ability of faculty to design and supervise high-quality research projects based on local resources. Additionally, rigid curriculum structures and limited flexibility in syllabus design further constrain innovation at the institutional level. As highlighted in Section 3, the absence of standardized frameworks for integrating local research into curricula remains a significant barrier.

Another critical challenge is the gap between academia and local industry or agricultural stakeholders. Although Neemuch has a well-established agricultural base and active herbal mandi, formal collaborations between educational institutions and local producers or industries are often lacking. Strengthening such linkages is essential for providing students with exposure to real-world practices, including cultivation, processing, quality control, and commercialization of medicinal plants. According to OECD (2022), effective collaboration between academia and industry is a key factor in enhancing innovation and skill development in higher education systems.

Faculty also face challenges related to regulatory and administrative constraints, particularly when dealing with controlled substances such as opium. While the presence of licensed opium cultivation offers unique educational opportunities, strict regulations may limit direct academic engagement. This necessitates the development of structured partnerships with regulatory bodies and authorized agencies to ensure compliance while facilitating educational access. Addressing these challenges requires coordinated efforts at institutional and policy levels, as will be discussed in Section 5.

Despite these constraints, the faculty perspective also highlights several opportunities for innovation and growth. Integrating local crop-based research can enhance faculty research output by encouraging region-specific studies that are more likely to be novel and impactful. It also provides opportunities for interdisciplinary collaboration, involving departments such as agriculture, biotechnology, and chemistry. Furthermore, such integration can improve student employability by equipping them with practical skills relevant to local industries and research sectors.

Faculty members can also play a proactive role in developing customized teaching-learning strategies that incorporate field visits, case studies, and project-based learning centered around local crops. For instance, guided visits to herbal mandis or cultivation sites can provide students with first-hand knowledge of medicinal plant trade and quality assessment practices. These experiences can be further linked to laboratory analysis and research projects, creating a

comprehensive learning cycle. As emphasized in Section 3, such approaches align with experiential learning models and significantly enhance educational outcomes.

In addition, faculty-driven initiatives can contribute to the documentation and scientific validation of traditional knowledge associated with local medicinal plants. This not only enriches academic research but also supports the preservation of indigenous knowledge systems. The World Bank (2020) highlights the importance of integrating local knowledge into formal education systems to promote sustainable development and innovation.

In summary, the faculty perspective reveals both challenges and opportunities in integrating local crop-based research into pharmacy education. While infrastructural, regulatory, and institutional barriers exist, proactive faculty engagement, innovative teaching strategies, and strengthened collaborations can enable effective implementation. Faculty members, as key stakeholders, have the potential to transform pharmacy education into a more applied, context-driven, and regionally relevant system. Building on this perspective, the next section (Section 5) examines broader policy implications and strategic recommendations for scaling such models at institutional and regional levels.

## **5. Policy Implications and Strategic Framework for Implementation**

The integration of local crop-based research into pharmacy education, as discussed in Sections 3 and 4, requires not only pedagogical innovation but also structured policy support and institutional commitment. While Neemuch district offers a strong foundation in terms of agricultural and medicinal resources, the absence of a formalized framework limits the systematic adoption of such models. Therefore, a multi-level strategic approach involving academic institutions, government agencies, and local industries is essential to translate this concept into a scalable and sustainable educational model.

At the institutional level, pharmacy colleges must adopt flexible and outcome-based curricula that allow the inclusion of region-specific research components. Traditional rigid syllabi often restrict the integration of locally relevant topics, thereby limiting innovation. Outcome-based education frameworks emphasize skill development, problem-solving, and real-world application, making them suitable for incorporating crop-based research modules (Harden, 2007). Institutions can introduce elective subjects, project-based learning modules, and fieldwork components focused on Neemuch's agricultural and medicinal resources. Such curricular reforms can create a structured pathway for students to engage with local crops in a scientifically meaningful manner.

A key component of this framework is the establishment of “**Local Resource Research Modules (LRRMs)**”, which can be embedded within existing pharmacy subjects. These modules would involve activities such as plant identification, phytochemical screening, pharmacological evaluation, and formulation development using locally available crops. For example, garlic and safedmusli can be used for pharmacognostic and pharmacological studies, while soybean can be integrated into nutraceutical formulation projects. As highlighted in Section 2, these crops possess well-documented pharmaceutical properties, making them suitable for academic research.

Collaboration between academic institutions and local stakeholders is another critical aspect of the implementation strategy. Neemuch's agricultural ecosystem, including farmers, herbal traders, and processing units, provides a valuable platform for experiential learning and applied research. Establishing formal partnerships through Memoranda of Understanding (MoUs) can facilitate student internships, field visits, and collaborative research projects. According to the OECD (2022), industry-academia collaboration plays a crucial role in enhancing innovation and aligning education with market needs. Such collaborations can also support the commercialization of student-developed products, thereby promoting entrepreneurship.

At the policy level, government support is essential for creating an enabling environment for such initiatives. Regulatory bodies and educational authorities can play a significant role by encouraging region-specific curriculum adaptations and providing funding for research infrastructure. Programs under agencies such as the National Medicinal Plants Board and Ministry of AYUSH can be leveraged to support research on medicinal plants and promote their integration into academic systems. Additionally, policy frameworks should facilitate controlled academic exposure to regulated crops such as opium, ensuring compliance while enabling educational use.

Funding and resource allocation are also critical for the successful implementation of this model. Institutions require access to laboratories, analytical instruments, and research grants to support crop-based studies. Public-private

partnerships can serve as an effective mechanism for mobilizing resources and sustaining long-term research initiatives. The World Bank (2020) emphasizes that investment in higher education and research infrastructure is essential for building innovation-driven economies, particularly in developing regions.

Another important dimension is faculty development and capacity building. As discussed in Section 4, faculty members play a central role in implementing innovative teaching and research models. Training programs, workshops, and collaborative research initiatives can enhance faculty competencies and enable them to effectively guide students in crop-based research. Encouraging faculty to undertake region-specific research projects can also contribute to the development of localized knowledge systems and increase institutional research output.

To ensure scalability, the proposed framework should be adaptable to other regions with similar agricultural and medicinal profiles. While this study focuses on Neemuch district, the model can be extended to other parts of India by identifying region-specific crops and integrating them into pharmacy education. This approach aligns with the broader goal of decentralizing education and promoting regionally relevant research, as emphasized in national development strategies (NITI Aayog, 2018).

In summary, the integration of local crop-based research into pharmacy education requires a coordinated strategy involving curriculum reform, stakeholder collaboration, policy support, and resource investment. The proposed framework provides a practical roadmap for implementing this model in Neemuch and similar regions. By bridging the gap between local resources and academic systems, this approach has the potential to enhance educational quality, promote research innovation, and contribute to regional development. Building on these strategic insights, the final section (Section 6) presents the overall conclusions and future directions of the study.

## **6. Conclusion and Future Directions**

The present study highlights the transformative potential of integrating local crop-based research into pharmacy education, with a specific focus on Neemuch district. As discussed across Sections 2 to 5, the region's rich agricultural and medicinal biodiversity—including crops such as opium, soybean, garlic, safedmusli, and a wide range of herbal commodities—provides a unique opportunity to bridge the gap between theoretical knowledge and practical application. However, despite the availability of these valuable resources, their systematic incorporation into academic curricula remains limited, resulting in underutilization of region-specific potential.

A key insight from this study is that pharmacy education must evolve from a predominantly theory-driven model to a more context-based, experiential, and research-oriented system. The integration of local crops into teaching and research not only enhances student learning outcomes but also aligns education with regional healthcare needs and economic priorities. By engaging with locally available resources, students can develop practical skills, critical thinking abilities, and research competencies that are directly applicable to real-world challenges. This approach is consistent with global educational recommendations that emphasize outcome-based and community-oriented learning models (Harden, 2007; WHO, 2013).

From a faculty perspective, the study identifies both challenges and opportunities in implementing such integration. While infrastructural limitations, rigid curricula, and regulatory constraints pose significant barriers, proactive faculty engagement, innovative teaching strategies, and interdisciplinary collaboration can facilitate effective implementation. As highlighted in Section 4, faculty members play a pivotal role in transforming educational practices and fostering a research-driven academic environment. Strengthening faculty capacity and encouraging region-specific research are therefore essential for achieving sustainable outcomes.

The proposed strategic framework, including the concept of Local Resource Research Modules (LRRMs), offers a practical pathway for integrating local crop-based research into pharmacy education. By embedding such modules within existing curricula, institutions can create structured opportunities for students to engage in phytochemical studies, pharmacological evaluation, and formulation development using locally sourced materials. Furthermore, collaboration with local stakeholders, including farmers, herbal traders, and industry partners, can enhance experiential learning and promote innovation. As discussed in Section 5, policy support and institutional commitment are critical for scaling and sustaining such initiatives.

Looking ahead, the integration of local resources into pharmacy education opens several avenues for future research and development. There is a need for empirical studies to evaluate the effectiveness of such models in improving student outcomes, research productivity, and employability. Additionally, exploring the commercialization potential of student-led research on local crops can contribute to regional economic development and entrepreneurship. The development of standardized guidelines and frameworks for integrating local resources into academic curricula can further support the widespread adoption of this approach.

Moreover, the model proposed in this study can be extended beyond Neemuch to other regions with distinct agricultural and medicinal profiles. By adopting a decentralized and context-driven approach to education, institutions can promote inclusive and regionally relevant learning systems. This aligns with broader national and global goals of sustainable development, innovation, and capacity building in healthcare and pharmaceutical sectors.

In conclusion, integrating local crop-based research into pharmacy education represents a forward-looking and impactful strategy for enhancing academic relevance, research innovation, and regional development. By leveraging the unique resources of Neemuch district and aligning them with educational objectives, this approach has the potential to redefine pharmacy education as a more practical, inclusive, and sustainable discipline.

## 7. References

1. Kolb DA. *Experiential learning: experience as the source of learning and development*. Englewood Cliffs (NJ): Prentice-Hall; 1984.
2. World Health Organization. *Transforming and scaling up health professionals' education and training: WHO education guidelines 2013*. Geneva: WHO; 2013.
3. Frenk J, Chen L, Bhutta ZA, Cohen J, Crisp N, Evans T, et al. Health professionals for a new century: transforming education to strengthen health systems. *Lancet*. 2010;376(9756):1923–1958. doi:10.1016/S0140-6736(10)61854-5
4. Government of India, Central Bureau of Narcotics. *Annual report on opium cultivation and production*. Gwalior: Ministry of Finance; latest edition.
5. Ministry of Agriculture and Farmers Welfare. *Agricultural statistics at a glance: Madhya Pradesh*. New Delhi: Government of India; 2022.
6. National Medicinal Plants Board. *Medicinal plants cultivation, trade and conservation report*. New Delhi: Ministry of AYUSH; 2021.
7. United Nations Office on Drugs and Crime (UNODC). *World drug report 2023*. Vienna: United Nations; 2023.
8. Messina M. Soy and health update: evaluation of the clinical and epidemiologic literature. *Nutrients*. 2016;8(12):754. doi:10.3390/nu8120754
9. Banerjee SK, Maulik SK. Effect of garlic on cardiovascular disorders: a review. *Nutr J*. 2002;1:4. doi:10.1186/1475-2891-1-4
10. Sharma A, Chand T, Khardiya M, Yadav KC. Pharmacological properties and therapeutic uses of *Chlorophytumborivilianum* (safedmusli): a review. *Pharmacogn Rev*. 2010;4(8):198–205.
11. Prince M. Does active learning work? A review of the research. *J Eng Educ*. 2004;93(3):223–231. doi:10.1002/j.2168-9830.2004.tb00809.x
12. Harden RM. Outcome-based education: the future is today. *Med Teach*. 2007;29(7):625–629. doi:10.1080/01421590701729930

13. Mukhtar K, Javed K, Arooj M, Sethi A. Advantages, limitations and recommendations for online learning during COVID-19 pandemic era. *Pak J Med Sci.* 2020;36(COVID19-S4):S27–S31. doi:10.12669/pjms.36.COVID19-S4.2785
14. Bland CJ, Center BA, Finstad DA, Risbey KR, Staples JG. A theoretical, practical, predictive model of faculty and department research productivity. *Acad Med.* 2005;80(3):225–237. doi:10.1097/00001888-200503000-00006
15. Organisation for Economic Co-operation and Development (OECD). *Education at a glance 2022: OECD indicators.* Paris: OECD Publishing; 2022. doi:10.1787/3197152b-en
16. World Bank. *Higher education and skills for development: strengthening tertiary education systems.* Washington (DC): World Bank; 2020.
17. NITI Aayog. *Strategy for New India @75.* New Delhi: Government of India; 2018.
18. Chakma J, Gupta S, Mittal P. Clinical trials in India: opportunities and challenges. *Lancet Glob Health.* 2021;9(1):e23–e24. doi:10.1016/S2214-109X(20)30485-2
19. UNESCO. *Global education monitoring report 2023: technology in education.* Paris: UNESCO; 2023.