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Research Ethics of Natural Medicinal Plants in The Perspective of CIOMS-WHO 2016

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ABSTRACT

This study identified 15 factors representing project management, planning, coordination, labor, materials, equipment, weather, design changes, and regulatory or permitting issues as criteria for analyzing the severity of delays across three building construction projects in West Nusa Tenggara Province. The criteria were established through a literature review and adjusted to actual project conditions, ensuring that the analytical model was grounded in the empirical context rather than being purely theoretical. The AHP results identified four highest-priority factors: C2, weak project control by the contractor (0.168); C14, design changes initiated by the owner or consultant (0.122); C1, inadequate schedule planning (0.106); and C7, delays in material delivery (0.090). Together, these four factors accounted for approximately 48.6% of the total weight. The Consistency Index (CI) of 0.0205 and Consistency Ratio (CR) of 0.0130 indicated that the pairwise comparison matrix met the consistency requirement, allowing the resulting weights to be used in the subsequent SAW analysis.The SAW method generated preference values of 0.969 for Mandalika Hospital, 0.913 for the Islamic Center, and 0.802 for Mataram University Hospital. Under the benefit-criterion approach applied in this study, a higher preference value represented a higher relative level of delay. Accordingly, Mandalika Hospital ranked first, followed by the Islamic Center and Mataram University Hospital. These results reflected the aggregated contribution of all 15 criteria rather than the influence of a single factor. The integration of AHP and SAW was evident in the use of AHP-derived criterion weights within the SAW preference calculations, while the extent to which each project was affected by the weighted criteria determined its final preference score. Mandalika Hospital received substantial contributions from several high-priority factors simultaneously, which was consistent with field evidence of progress deviations, schedule extensions, labor shortages, weak project control, insufficient field management, and coordination problems. Consequently, the SAW ranking provided quantitative support for the conclusion that Mandalika Hospital experienced the highest cumulative relative delay among the three case-study projects.

INTRODUCTION

Traditional, complementary, and alternative medicine (TCAM) has become a substantial component of health-seeking behavior worldwide, with national studies reporting prevalence rates ranging from 24% to 71.3% across different countries. The World Health Organization formally recognized this reality by adopting the Global Traditional Medicine

Strategy 2025–2034 at the Seventy-eighth World Health Assembly in May 2025, positioning traditional medicine as a strategic priority within the organization's broader transformation agenda. This global institutional recognition reflects a significant shift: traditional medicine is no longer viewed merely as a cultural legacy or alternative option but increasingly as an important component of resilient, people-centered, and sustainable health systems, particularly in the contexts of primary health care, noncommunicable diseases, aging populations, and planetary health (Monera-Penduka et al., 2017).

In Indonesia, this global trend is reflected in national data documenting the widespread use of traditional medicine. The National Socioeconomic Survey (SUSENAS) recorded an increase in traditional medicine use from 45.17% in 2010 to 49.53% in 2011, while Riskesdas data reported a prevalence of 44.3% in 2018. Among older adults in Indonesia, utilization of traditional health services (Yankestrad) reached 37.0%, while self-medication with traditional medicines reached 17.3%, indicating that traditional medicine constitutes an integral rather than marginal component of the Indonesian health care landscape. Collectively, these figures demonstrate that research on the safety, efficacy, quality, and ethical dimensions of natural medicinal products derived from medicinal plants (Obat Bahan Alam, OBA) represents an important public health concern rather than a narrow academic field.

The expanding use of medicinal plant-based OBA has been accompanied by growth in related clinical research; however, this field presents ethical complexities that differ in important respects from those encountered in conventional pharmaceutical development. The 2016 International Ethical Guidelines for Health-related Research Involving Humans, issued by the Council for International Organizations of Medical Sciences (CIOMS) in collaboration with the World Health Organization (WHO), provide a comprehensive framework that has become an influential international ethical standard for health-related research involving humans, particularly in relation to informed consent, participant protection, social value, and research ethics oversight. Nevertheless, applying these guidelines to traditional and herbal medicine research requires careful contextualization. Recent analyses of ethical review in investigator-initiated clinical trials involving traditional Chinese medicine have highlighted distinctive considerations related to theoretical foundations, syndrome differentiation, prescription composition, dosage forms, and dosing regimens, all of which may present specific challenges for research ethics committees. Although conventional medicine and traditional medicine are governed by the same fundamental ethical principles, ethical review of traditional medicine research must also account for the distinctive characteristics of the relevant medical tradition. This tension between universal ethical principles and context-specific research practices constitutes a central concern of the present study (Un et al., 2008).

A critical dimension of this ethical complexity concerns the relationship between research and communities that hold traditional medicinal knowledge. Ethnobotanical and ethnobiological research operates at the intersection of scientific inquiry and cultural heritage, where researchers frequently engage with Indigenous Peoples and Local Communities (IPLCs) whose knowledge systems have developed across generations. The concept of epistemic injustice, articulated by Fricker (2009), captures an important ethical risk in such research: the knowledge or credibility of community members may be unfairly diminished because of their social status or identity, potentially resulting in the marginalization, invisibility, or devaluation of traditional knowledge systems. This concern has practical as well as philosophical and legal

implications. The Nagoya Protocol to the Convention on Biological Diversity establishes an access and benefit-sharing (ABS) framework based on prior informed consent, mutually agreed terms, national oversight, community participation, and compliance mechanisms. Regulations governing access to genetic resources increasingly seek to prevent biopiracy and ensure that local communities share in the benefits arising from the utilization of genetic resources, particularly those obtained in situ, while participating in relevant decision-making processes. Nevertheless, implementation gaps persist, and existing ABS frameworks do not always ensure the effective realization of community rights, including appropriate consent and benefit-sharing mechanisms. The gap between formal legal frameworks and their implementation directly affects the ethical conduct of medicinal plant research.

In the Indonesian context, these global and regional dynamics are particularly important. Indonesia possesses exceptionally rich biodiversity, while traditional medicinal knowledge embedded in practices such as jamu represents both significant cultural heritage and a potentially valuable economic resource. Molecular authentication studies of widely used Indonesian medicinal plants, such as Eurycoma longifolia (*pasak bumi*), have raised concerns regarding product authenticity. Among six commercial products labeled as E. longifolia, only one herbal tea product was considered likely to contain the authentic species, while other plant species were identified as substitutes or adulterants; Klebsiella pneumoniae was also detected on the outer wooden cup of one product. Such findings underscore the importance of rigorous authentication and quality-control mechanisms while also raising ethical concerns regarding the validity and integrity of research involving inadequately verified medicinal products. Furthermore, biopiracy—the unauthorized appropriation, patenting, or commercial exploitation of biological resources or associated traditional knowledge without appropriate consent or benefit-sharing—remains a significant concern, as illustrated by well-known controversies involving turmeric, neem, and basmati in India and Hoodia and the San people in southern Africa. The cosmetics industry has also been identified as an area requiring scrutiny because patent claims may involve plant species associated with extensive traditional knowledge without clear evidence of prior informed consent or equitable benefit-sharing with knowledge holders. For Indonesia, where medicinal plant knowledge has substantial cultural and commercial value, these concerns indicate a structural vulnerability that requires stronger ethical research governance.

The existing scholarly literature on CIOMS 2016 and the ethics of traditional and herbal medicine, although substantial, remains largely divided into separate bodies of scholarship. Research on CIOMS 2016 has generally focused on its application to biomedical and health-related research, including its increased emphasis on social value and community engagement, while also examining unresolved issues such as minimal risk and conflicts of interest. Conversely, scholarship on traditional medicine ethics has often focused on particular regional or disciplinary contexts, including ethical review of traditional Chinese medicine, African communitarian approaches to informed consent, and ethnobotanical research protocols, without systematically engaging with the CIOMS framework as an integrated whole. The intersection of these two bodies of literature—specifically, the application of CIOMS 2016 to medicinal plant-based OBA research in a biodiversity-rich, culturally diverse, and resource-constrained setting such as Indonesia—remains insufficiently examined.

This gap is particularly important because CIOMS 2016 contains explicit provisions concerning research conducted in low-resource settings, including requirements related to local social value, responsiveness to health needs and priorities, equitable ethical standards, and community engagement. The guidelines also emphasize consultation with relevant communities and appropriate planning for access to interventions or products developed through research. However, how these principles should be operationalized in medicinal plant research remains insufficiently articulated, particularly when the intervention involves a traditional formulation with a long history of empirical use and when communities simultaneously function as knowledge holders, research partners, and potential beneficiaries.

The urgency of addressing this gap is heightened by the accelerating integration of traditional medicine into formal health systems and global markets. The WHO Global Traditional Medicine Centre's 2025 annual report documented the organization's commitment to ensuring that traditional medicine is safe, effective, evidence-informed, equitable, and appropriately integrated. The WHO Traditional Medicine Global Library and the Global Traditional Medicine Strategy 2025–2034 further indicate that the international community is moving toward the development of an inclusive and comprehensive evidence base to support the integration of safe and effective traditional medicine practices into national health systems. In Indonesia, the regulatory landscape is also evolving, with increasing attention to evidence-based production and regulatory frameworks for herbal medicines that incorporate advanced technologies, omics-based authentication, and regulatory harmonization. However, these technical and regulatory developments have not been accompanied by comparable progress in the ethical governance of medicinal plant research. The absence of a clearly defined ethical framework tailored to medicinal plant research may delay ethical approval and create uncertainty for researchers and sponsors, making effective dialogue among researchers, regulators, and research ethics committees essential for the development of efficient and ethically sound research protocols. Moreover, as the commercial value of medicinal plant resources increases, the risks of exploiting traditional knowledge holders and engaging in biopiracy may also increase, reinforcing the need for robust and culturally appropriate ethical safeguards.

This study introduces a novel analytical approach by systematically examining CIOMS–WHO 2016 through the specific lens of medicinal plant-based Obat Bahan Alam (OBA) research in Indonesia rather than treating the guidelines solely as a generic framework for biomedical research. The novelty of this approach is threefold. First, it integrates principles that are often examined separately—social value and scientific validity, individual and community informed consent, risk–benefit assessment, protection of vulnerable populations, community engagement, and access and benefit-sharing—into a coherent framework tailored to the characteristics of medicinal plant research. Second, it situates this analysis within the Indonesian regulatory and cultural context by examining how international ethical standards interact with national provisions, including BPOM regulations governing clinical trials of traditional medicines, Ministry of Health regulations on traditional health services, and the role of Health Research Ethics Committees. Third, it addresses the emerging issue of epistemic injustice in traditional medicine research by moving beyond procedural compliance to examine deeper questions concerning whose knowledge is recognized, how scientific validity should be assessed when traditional formulations contain multiple bioactive constituents, and what

constitutes meaningful community engagement when traditional knowledge is collectively held. The study therefore responds to calls for research agreements and procedures that actively challenge bias and ensure that the knowledge and contributions of Indigenous Peoples and Local Communities are appropriately recognized and respected.

The purpose of this study is to systematically analyze the relevance and implementation of the 2016 CIOMS–WHO Ethical Guidelines in the context of medicinal plant-based OBA research in Indonesia using a narrative literature review. The study addresses three interrelated questions: (1) How do the core ethical principles of CIOMS 2016—social value and scientific validity, informed consent, risk–benefit assessment, protection of vulnerable populations, community engagement, fair participant selection, independent ethical review, and access and benefit-sharing—apply to the distinctive characteristics of medicinal plant-based OBA research? (2) What specific challenges arise in implementing these principles in the Indonesian context, including issues of standardization and quality control, protection against biopiracy, harmonization of national regulations with international frameworks such as the Convention on Biological Diversity and the Nagoya Protocol, and capacity building for Health Research Ethics Committees? (3) What strategies can facilitate the effective integration of CIOMS 2016 with other international ethical frameworks and national regulatory instruments to support scientifically valid, ethically responsible, and socially beneficial medicinal plant research? Through this analysis, the study aims to develop a conceptual framework that can inform researchers, research ethics committee members, and regulators in Indonesia and comparable settings.

The expected contributions of this study encompass theoretical, practical, and policy dimensions. Theoretically, it advances scholarly understanding of how universal ethical principles can be adapted to research domains characterized by collective knowledge ownership, cultural embeddedness, and complex multicomponent interventions. Practically, it provides researchers and research ethics committees with a structured framework for identifying and addressing ethical issues throughout the stages of medicinal plant research, from protocol development and community engagement to access and benefit-sharing arrangements. From a policy perspective, it identifies areas of convergence and tension among CIOMS 2016, the Convention on Biological Diversity, the Nagoya Protocol, and Indonesian national regulations, thereby providing a basis for the development of more coherent and effective ethical governance mechanisms. More broadly, the study contributes to the ongoing global dialogue on ensuring that the integration of traditional medicine into health systems respects the rights, knowledge, and interests of Indigenous Peoples and Local Communities while generating scientifically rigorous evidence to support safe and effective use. As traditional medicine remains widely used and the boundaries between traditional and conventional therapeutic systems become increasingly interconnected, the ethical conduct of medicinal plant research is not merely a matter of regulatory compliance but also a matter of justice, sustainability, and scientific integrity.

METHOD

This study employed a qualitative approach using a narrative literature review to examine the ethical principles of the 2016 International Ethical Guidelines for Health-Related Research Involving Humans issued by the Council for International Organizations of Medical Sciences

and the World Health Organization (CIOMS–WHO), as well as their relevance to research on natural medicinal products derived from medicinal plants in Indonesia.

Data were obtained from scientific publications and relevant regulatory documents, including national and international journal articles, research ethics guidelines, international policy documents, and regulations related to medicinal plant research and traditional medicine. The reviewed literature addressed research ethics, the CIOMS–WHO 2016 Guidelines, medicinal plant research, informed consent, protection of vulnerable populations, community engagement, access and benefit-sharing, protection of traditional knowledge, biopiracy, and genetic resource governance.

Relevant literature was identified, screened, and selected based on its relevance to the research objectives. The selected sources were analyzed descriptively and thematically according to key ethical principles, including social value and scientific validity, informed consent, risk–benefit assessment, protection of vulnerable populations, community engagement, fair participant selection, independent ethical review, and access and benefit-sharing related to genetic resources and traditional knowledge.

The analysis involved classifying the selected evidence into major thematic categories and interpreting the findings in relation to the specific characteristics of medicinal plant research. The CIOMS–WHO 2016 Guidelines were also compared with other international ethical and regulatory frameworks, including the Convention on Biological Diversity (CBD), the Nagoya Protocol, and the Declaration of Helsinki.

The analysis was used to identify major ethical and regulatory challenges in implementing CIOMS–WHO 2016 in medicinal plant research in Indonesia, including the standardization and quality control of medicinal plant materials, product safety, protection of traditional knowledge, biopiracy risks, community involvement, and fair and equitable access and benefit-sharing. The review provided a conceptual basis for assessing the relevance of CIOMS–WHO 2016 to scientifically valid, ethically responsible, and socially beneficial medicinal plant research.

RESULTS AND DISCUSSION

Relevance to OBA Research Medicinal Plants

The use of medicinal plant OBAs in various countries shows substantial prevalence, with usage rates ranging from 24% to 71.3% across the countries studied (Lee et al., 2022). In Indonesia, the use of medicinal plant OBAs as an alternative treatment continues to increase, both as complementary therapies and for self-medication (Utomo et al., 2022). This situation creates an urgent need for a comprehensive ethical framework in medicinal plant OBA research, which considers not only clinical aspects but also complex cultural, social, and legal dimensions.

The term "Natural Medicines" (OBA) from medicinal plants in this article includes herbal medicines, standardized medicinal plant medicines, and phytopharmaceuticals, as stipulated in Indonesian national regulations. Clarifying this terminology is important to ensure a clear scope for discussions on research ethics, consistent with the stages of scientific evidence and the level of product standardization.

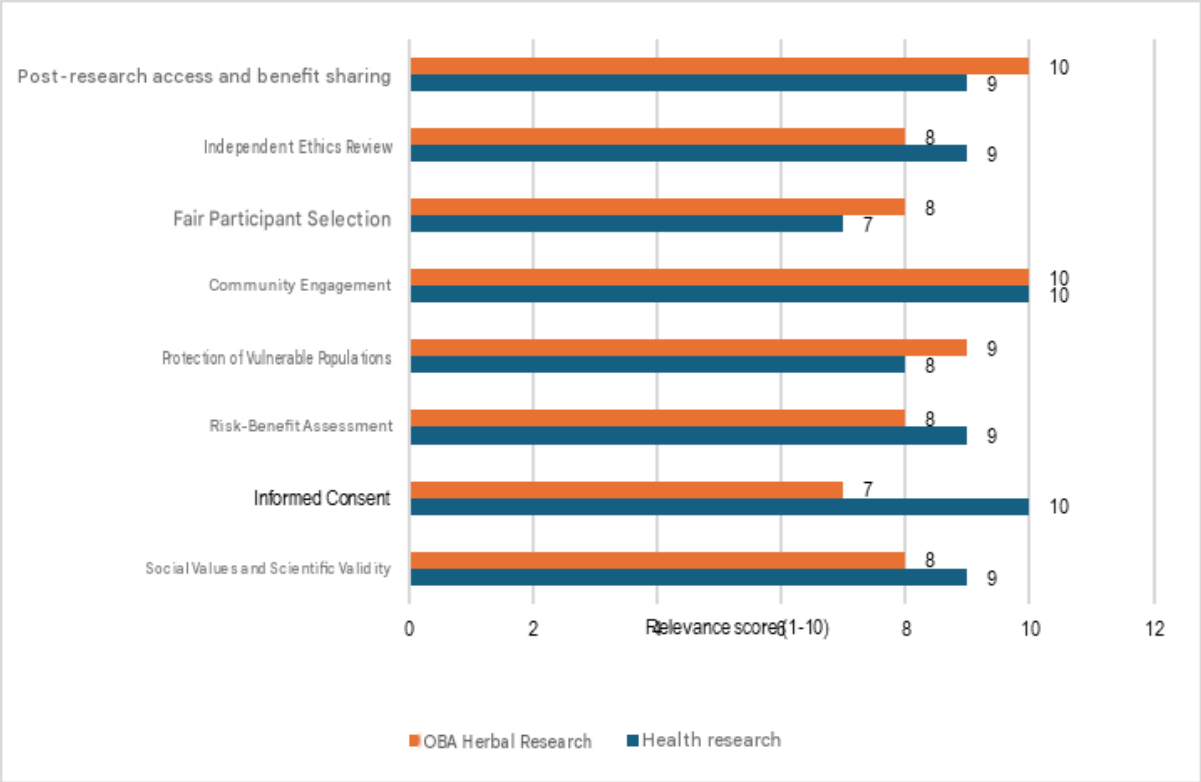

Figure 1. Relevance of the 2016 CIOMS principles to medicinal plant OBA research (Source: Analysis based on literature review)

CIOMS-WHO 2016 Core Principles in the Context of Research Ethics on Medicinal Plants

Social Values and Scientific Validity

CIOMS 2016 emphasized that research involving humans must have clear social and scientific value (Meza et al., 2018). In the context of medicinal plant OBA, this is particularly relevant given the legacy of traditional knowledge that has been used by indigenous cultures for thousands of years (Pan et al., 2013). Ethnobotanical research in regions such as Borneo has shown that medicinal plants used by indigenous communities have great potential for modern applications, with scientific evidence supporting their efficacy in treating conditions such as inflammation, infection, and chronic diseases (Mukti, 2024).

Scientific validity in medicinal plant OBA research faces unique challenges due to the complexity of medicinal plant formulations, which often consist of multiple active ingredients. As noted in research on traditional Chinese medicine, a reductionist approach may be incompatible with the premise that medicinal plant preparations are effective because they are amalgams of multiple agents addressing different aspects of a patient's imbalance (Liauw, 2021). An evidence-based production framework for medicinal plant OBA in Indonesia emphasizes the use of omics technologies and DNA-based authentication. A Quality by Design (QbD) approach is also needed to improve the consistency of quality, safety, and efficacy of medicinal plant products (Kashuri et al., 2026).

In OBA research on medicinal plants, scientific validity is not only determined by the design of the research methodology, but also by the consistency of raw materials, identification of plant species, standardization of marker content, stability of the preparation, and reproducibility of the extraction process.

Informed Consent and Special Procedures

Informed consent is a critical component of CIOMS 2016 that has particular implications for medicinal plant OBA research (Yip et al., 2016). In the context of medicinal plant OBA, the challenge *of informed consent* becomes more complex because it involves not only individual research participants but also communities holding traditional knowledge (Arjjumend, 2018). The Nagoya Protocol explicitly requires states to take legislative, administrative, and technical measures to recognize, respect, and support *the prior informed consent* of indigenous peoples before accessing genetic resources and related traditional knowledge.

Research suggests that in many African and Asian communities, Western-European, rights-based concepts of individual autonomy may conflict with more communitarian local cultural values and norms (Akpa-Inyang & Chima, 2021). In these contexts, collective decision-making processes often take precedence over individual autonomy and consent. CIOMS 2016 accommodates this variation by allowing for a more flexible approach in specific situations, although some critics argue that the vagueness of specific situations, allowing for incomplete disclosure, may undermine strict ethical norms (Lang, 2017).

The informed consent form for medicinal plant OBA research needs to transparently explain the product's scientific evidence status, potential benefits that are still exploratory, possible side effects, and limitations of long-term safety evidence.

Risk-Benefit Assessment

Risk-benefit assessments in medicinal plant OBA research require different considerations than conventional drugs. Although medicinal plant OBAs are often considered a more natural option, they still have the potential to cause side effects, just like synthetic drugs (Lee et al., 2022). Some medicinal plant OBAs have been reported to have direct toxic effects on the circulatory or cardiovascular systems, which can lead to harmful effects on the body, including cardiac electrophysiological dysfunction (Gavanji, 2023).

Regulation of clinical trials is crucial to ensure the safety, efficacy, and ethical conduct of drug development. However, the regulatory framework governing these trials varies significantly across countries (Sharma et al., 2025). Key recommendations include the need for specific regulations for trials of medicinal plant OBAs, which are essential to ensure safety and efficacy, as well as stronger oversight of ethical issues, particularly regarding pediatric products and orphan drugs.

Clinical research on medicinal plant OBA must still comply with the principles of Good Clinical Practice (GCP), including the availability of adequate preclinical data, standardization of test products, safety monitoring, and the use of ethically justifiable control groups.

Risk assessments in medicinal plant OBA research should also include potential interactions between medicinal plant drugs and conventional medicines, particularly in participants with chronic illnesses who use polypharmacy. Many medicinal plant products have the potential to affect enzymatic metabolism, including the CYP450 system.

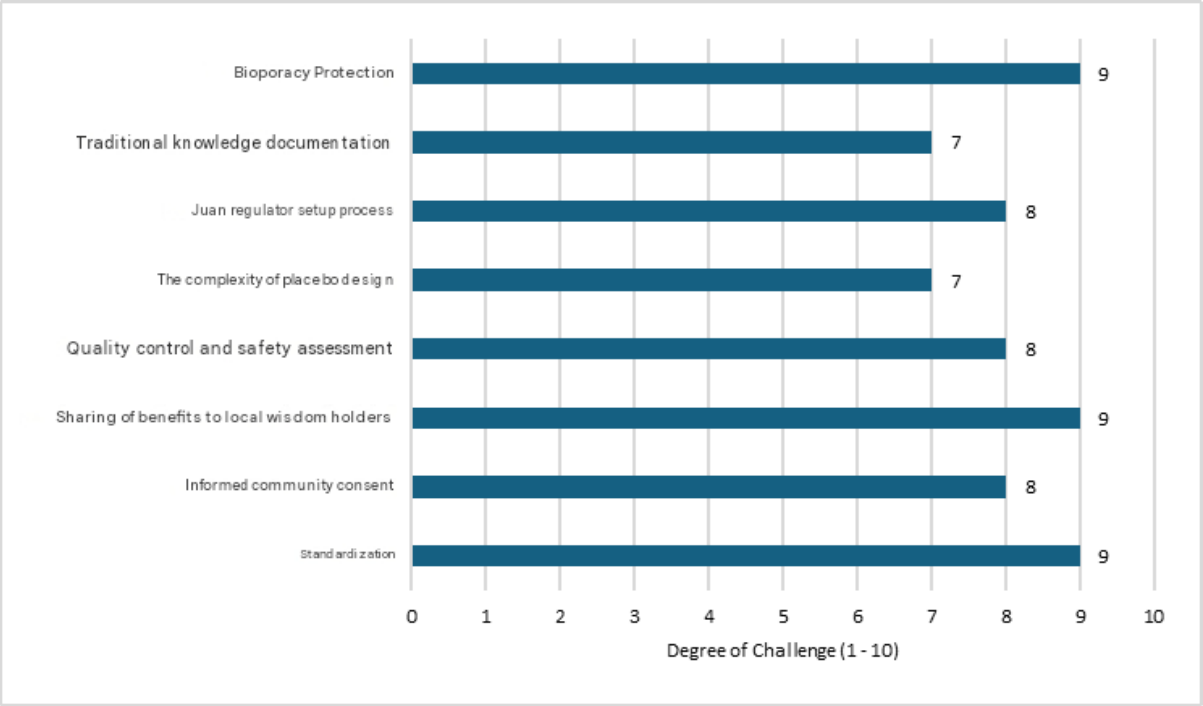

Figure 2. Ethical challenges of research in clinical trials of medicinal plant drugs in the context of CIOMS 2016
(Source: Analysis based on literature review)

Protection of Vulnerable Populations and Community Engagement

Identification and Protection of Vulnerable Populations

The 2016 CIOMS-WHO focused on protecting vulnerable populations, including indigenous communities that hold traditional knowledge of medicinal plants (Gordon, 2020). The concept of vulnerability in research ethics emerges from various sources, and two distinct approaches to describing the features that make someone vulnerable are categorical and contextual. The categorical approach considers a specific group or population as vulnerable, while the contextual approach allows for a more nuanced understanding of the nature and extent of vulnerability.

Documenting indigenous knowledge faces various obstacles, including the risk of biopiracy, lack of support from authorities, and limited initiative among indigenous communities themselves (Adam et al., 2022). The Dusun and Bajau communities in Sabah, Malaysia, for example, acknowledge that their traditional knowledge is gradually disappearing and express positive attitudes toward documentation, although they also express concerns about the potential misuse of such knowledge.

Community Involvement in the Research Process

The 2016 CIOMS-WHO study emphasized the importance of community engagement in various phases of research projects (Meza et al., 2018). In the context of medicinal plant OBA research, community engagement becomes even more critical because traditional knowledge is often collective and closely linked to a community's cultural identity (Awoke & Cosendey,

2025). Ethnomedical practices have become an integral part of the health and cultural identity of indigenous communities worldwide, encompassing holistic approaches that incorporate medicinal plants, rituals, and traditional healing methods.

Research in Ghana shows that successful collaboration between community mental health workers and traditional healers can be built through respectful interpersonal relationships, systemic support, and access to resources (Kpobi et al., 2023). While these relationships facilitate collaboration, resource constraints, mistrust, and ethical dilemmas must be addressed to build stronger partnerships. These findings highlight the importance of dedicated institutional and logistical support to ensure integration within a pluralistic health system.

Fair Sharing of Benefits

Equitable benefit sharing is a fundamental principle in research involving genetic resources and traditional knowledge (Morrison et al., 2021). The Convention on Biological Diversity (CBD) and the Nagoya Protocol have established an Access and Benefit Sharing (ABS) mechanism that mandates the fair and equitable sharing of benefits from the use of genetic resources (Singh, 2019). However, the practical implementation of ABS faces various challenges, including a lack of institutional capacity and fragmented law enforcement.

Biopiracy cases such as the patenting of turmeric, neem, and basmati in India demonstrate structural weaknesses in domestic and international intellectual property rights frameworks (Sreeja & John, 2026). These challenges require stronger legislative and diplomatic responses. South Africa's experience with Hoodia and San illustrates how patenting without observing basic indicators such as geographical indication, indigenous knowledge, novelty, benefit sharing, and prior informed consent can harm indigenous communities (Amusan, 2016).

Research that utilizes the ethnomedicinal knowledge of indigenous communities must not stop at simply collecting biological data, but must also ensure intellectual recognition, protection of cultural rights, and community involvement in the utilization of research results.

Specific Challenges in Implementing CIOMS-WHO 2016 for Medicinal Plant OBA in Indonesia

National Regulatory Framework

Indonesia has developed various regulatory instruments to address challenges in OBA research and development (Kashuri et al., 2026). The proposed evidence-based production framework for OBA regulation in Indonesia emphasizes advanced technology, omics-based authentication, and regulatory harmonization. The ASEAN/WHO initiatives allow for "loose harmonization" while maintaining traditional diversity, an approach that aligns with Indonesia's cultural diversity.

Halal certification for medicinal plant products is also a crucial consideration in Indonesia, a predominantly Muslim country (Sihombing & Nugraha, 2025). The growing global demand for halal-certified products, particularly medicinal plant products, is driven by increasing health awareness and the demand for ethical and natural products. The lengthy and complex certification process increases the need for higher costs due to the high level of compatibility required, particularly with Islamic standards.

Discussion of the implementation of research ethics of medicinal plant OBA in Indonesia needs to be explicitly linked to national regulations, including the BPOM Regulation on clinical trials of traditional medicines, the Minister of Health Regulation on traditional health services, and provisions regarding the Health Research Ethics Committee and Good Clinical Trial Practices (CUKB/GCP).

Challenges of Standardization and Quality Control

Standardization of medicinal plant OBAs is a major technical challenge in the research and quality assurance of medicinal plant OBA products (Un et al., 2008). The complexity of traditional Chinese medicine formulations and other medicinal plant OBAs consisting of various medicinal plants requires a special approach to quality control. Various methods have been developed, including DNA methods for drug ingredient identification, chemical markers for quality control, and the application of HPLC (*High-Performance Liquid Chromatography*) methods.

The adulteration of weight loss supplements with conventional pharmaceutical drugs such as sibutramine hydrochloride presents a safety risk that needs to be addressed (Suparmi et al., 2023). Toxicity studies in rats have shown that adulterated supplements produce the highest kidney and liver toxicity. Dietary supplements should be thoroughly screened for undeclared chemicals to protect public health and strengthen legal requirements.

Protection from *Biopiracy*

Significant risks *of biopiracy given its rich biodiversity and traditional knowledge (Antons, 2010)*. Indonesian access regulations are discussed as an example of how national development goals and royalty collection interests often dominate discussions, while key concepts remain insufficiently defined to avoid overlap and conflict. Authentic local support for conservation goals will depend on whether benefit flows can be guaranteed.

The cosmetics industry has been identified as a sector requiring greater scrutiny regarding the potential misuse of plant biodiversity and traditional knowledge (Jefferson & Robinson, 2025). Analysis of the patent landscape shows that cosmetics companies regularly claim intellectual property for the use of a wide range of plant species for which they possess extensive traditional knowledge (Haunschild et al., 2024). There is little evidence that large companies seek *prior informed consent* for the use of genetic resources or traditional knowledge, or that they share benefits with local providers.

Research on medicinal plant OBA also needs to consider the principle of biodiversity sustainability so that the exploitation of medicinal plants does not cause ecosystem damage or the scarcity of certain species.

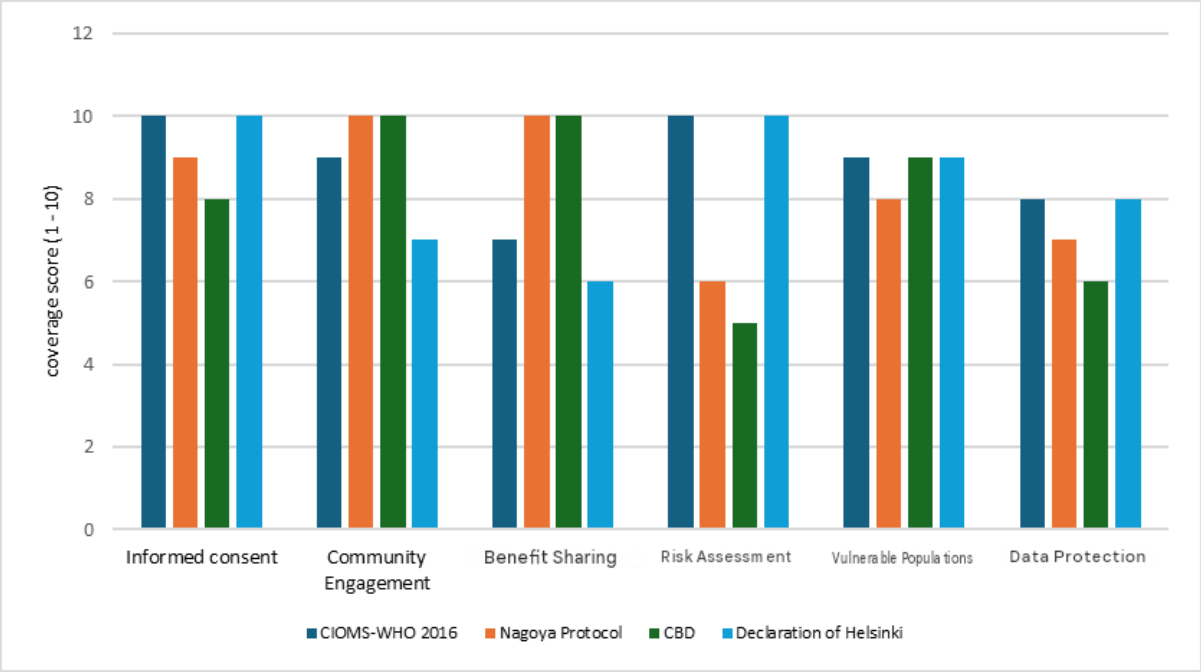

Figure 3. Comparison of international research ethics frameworks for medicinal plant OBA research
(Source: Analysis based on literature review)

Integration of CIOMS-WHO 2016 with Other International Frameworks

Harmonization with the Declaration of Helsinki and the San Code

The 2016 CIOMS-WHO guidelines were designed to align with the Declaration of Helsinki and other international ethical instruments (Seneviratne, 2023). Close collaboration with the World Medical Assembly ensures that these guidelines are aligned with the Declaration of Helsinki. Core principles include respect, integrity, justice, beneficence, and research merit, all of which apply to traditional medicine research.

A comparison with the San Code of Ethics reveals important similarities in terms of community engagement, respect for human dignity, and justice (Akpa-Inyang, 2025). The San believe that community engagement in biomedical research reduces exploitation and enhances human dignity and should be based on mutual respect, honesty, justice, fairness, and an ethic of care. This approach aligns with the 2016 CIOMS emphasis on community engagement and the protection of vulnerable populations.

Synergy with *the Convention on Biological Diversity* (CBD) and the Nagoya *Protocol*

CIOMS-WHO 2016 needs to be integrated with the CBD and the Nagoya Protocol for research involving genetic resources and traditional knowledge (Arjjumend, 2018). The Nagoya *Protocol* grants rights to indigenous peoples and local communities in accordance with *the United Nations Declaration on the Rights of Indigenous Peoples* (UNDRIP). States parties are required to take legislative, administrative, and technical measures to recognize, respect, and support their *prior informed consent and effective involvement in preparing mutually agreed terms* before accessing genetic resources and related traditional knowledge.

The CBD has three main objectives: biodiversity conservation, sustainable use of indigenous biological resources, and fair and equitable benefit sharing (Amusan, 2016). The

protocol also stipulates that countries have sovereignty over biological resources found within their territories, control access, ensure community rights, and the right to fair and equitable benefit sharing arising from commercialization (Singh, 2019).

Considerations for Research on Ayahuasca and Other Traditional Medicines

The case of biomedical research on ayahuasca provides a crucial example of the challenges of epistemic injustice in traditional medicine research (Schenberg & Gerber, 2022). Indigenous peoples have used ayahuasca therapeutically for a very long time, so the epistemic authority accorded to scientific studies needs to be questioned. New regulations on ayahuasca must respect *the free, prior, and informed consent* of indigenous peoples, in accordance with ILO Indigenous and Tribal Peoples Convention No. 169.

Declaring the ayahuasca complex as national cultural heritage could prevent third-party patenting and encourage the development of traditional medicine. When involving isolated compounds derived from traditional knowledge, benefit-sharing agreements are mandatory, in accordance with the United Nations Convention on Biological Diversity. This approach could be applied to Indonesian traditional medicinal plants, which face similar risks.

CONCLUSION

The CIOMS–WHO 2016 Ethical Guidelines proved to be a relevant, comprehensive, and adaptable ethical framework for research on natural medicinal products (Obat Bahan Alam, OBA) derived from medicinal plants in Indonesia; however, their implementation could not be applied mechanically and required careful contextual adaptation. Their core principles—social value and scientific validity, informed consent, risk–benefit assessment, protection of vulnerable populations, community engagement, and access and benefit-sharing—required contextual interpretation when applied to medicinal plant research. Scientific validity was challenged by the multicomponent nature of traditional formulations, which may not be adequately addressed through purely reductionist approaches and therefore requires raw-material standardization, DNA-based authentication, marker-compound quantification, and reproducible extraction procedures. Informed consent needed to accommodate the collective decision-making structures of Indigenous communities without compromising individual autonomy, while risk–benefit assessment needed to consider potential cardiovascular toxicity and herb–drug interactions mediated by cytochrome P450 (CYP) enzymes. The protection of vulnerable populations and meaningful community engagement required contextual rather than purely categorical approaches to ensure that communities were not merely consulted but actively involved throughout the research process. Access and benefit-sharing, as established under the Convention on Biological Diversity and the Nagoya Protocol, remained among the most challenging principles to operationalize because of limited institutional capacity, fragmented enforcement, and persistent risks of biopiracy involving traditional knowledge without appropriate consent or equitable compensation. The Indonesian context introduced additional complexities, including the need for harmonization with BPOM regulations, halal requirements, and evidence-based production frameworks incorporating omics technologies and Quality by Design (QbD). Thus, CIOMS 2016 provided a robust ethical foundation, but its effective implementation in Indonesia required stronger national regulations, standardized research methodologies, enhanced capacity among Health Research Ethics Committees, and greater protection of Indigenous peoples' rights and biodiversity. Without such contextual

adaptation and institutional strengthening, the guidelines risk becoming a procedural formality rather than providing substantive protection for research participants, traditional knowledge holders, and ecosystems.

Future research should move beyond this conceptual and literature-based analysis by empirically evaluating the implementation of CIOMS 2016 principles in clinical trials, research registries, and postmarketing surveillance in Indonesia. Cross-cultural studies are needed to examine whether the flexibility provided by CIOMS 2016 for "special circumstances" strengthens or potentially weakens ethical protections in communities characterized by collective decision-making traditions. Research on the implementation of access and benefit-sharing should evaluate the effectiveness of Material Transfer Agreements (MTAs), the role of local governments, and the extent to which benefits actually reach communities that hold traditional knowledge. Implementation research is also needed to identify effective models for strengthening the capacity of Health Research Ethics Committees, including their resource requirements and institutional governance. In addition, ethical research on emerging technologies, including omics, artificial intelligence-assisted drug discovery, and digital sequence information, is necessary to ensure that frameworks governing consent, benefit-sharing, and intellectual property remain relevant. Finally, participatory research involving Indigenous community members as co-researchers would be valuable for determining whether existing ethical frameworks genuinely respect community epistemic authority and support the sustainable conservation of medicinal plant biodiversity.

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