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Traditional Healing Practices: Opportunities for Engineering

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ABSTRACT

Traditional healing practices represent centuries of indigenous knowledge rooted in cultural, ecological, and spiritual contexts. These practices, while often marginalized, continue to serve as the primary healthcare system for over 80% of the global population. With growing concerns over the limitations of modern medicine and the need for culturally relevant, affordable healthcare solutions, engineering presents new opportunities to enhance, preserve, and integrate traditional knowledge systems into modern health frameworks. This paper examines the cultural, historical, and ethical dimensions of traditional healing while proposing engineering strategies to support sustainability, innovation, and equity. By examining case studies, technological integrations, and interdisciplinary challenges, it advocates for co-production models where engineers, healers, and communities collaboratively develop health technologies. The paper concludes that respectful, inclusive approaches to engineering traditional healing can enhance both scientific discovery and global health outcomes.

Keywords: Traditional healing, Indigenous knowledge, Biomedical engineering, Health systems integration, Ethnomedicine, Cultural sustainability, Ethical co-production.

INTRODUCTION

Traditional healing practices have effectively treated illnesses throughout history, fostering emotional connections and trust. Western scientists are now researching traditional herbal treatments to validate their efficacy and support the development of cheaper pharmaceuticals for mass production. Pharmaceutical companies and the World Health Organization seek to rationally use traditional knowledge. Despite the efficacy of modern medicine, it cannot address all ailments, and some patients question the safety of molecular therapies. Controversies surround the legitimacy of practices like aromatherapy, while the search for safe alternative therapies continues. Modern psychologists and therapists are exploring techniques used by traditional healers, such as music, discussion, and herbal concoctions. Both modern and traditional medical systems recognize the need for interdependence and the careful adoption of native therapies [1, 2].

Historical Overview of Traditional Healing

Healing traditions have been practiced for thousands of years. From the first prehistoric communities, people sought to influence their health by specific practices of cultural therapy. After and even with the invention of explanatory models of disease, anthropocentric forms of manipulating nature continued to be prevalently used. These include practices like thermal pools, steam bathing, other forms of sweating, exercise and various aspects of diet and the consumption of herbal foods, which still constitute the first line of defence against illness and disease in many cultures. Simple forms of humour-alleviating food comedies and games were introduced into the anthropological record only with settled agricultural villages. Despite varying philosophies of health and subtle incorporations of spiritual belief systems, common articulations of a desirable healthy state exist between medical systems across cultures. First and foremost is a dispassionate, well-balanced body temperature. Healing traditions across cultures appreciate a construct of body humourous balance that defines the unity of internal and external environments. This

is the wholeness of all eight facets of a person's being – thoughts, desires, motivations, behaviours, accountability, environment, resources and the body. Healing initially, and still today in many cultures, means restoring humours balance and wholeness. The recent dramatic expansion of empirical science in the West and the resultant technological/material prosperity for some nations has been accompanied by a drastic erosion in a subtle understanding of health and its enhancement. Recently unearthed enormous wealth of old traditional medical knowledge is both new and ancient to scientific understanding. This knowledge has been preserved and passed down by indigenous traditional healers in tropical forest regions throughout the world. It is an irony that many of the North and South-Indian sources of medicinal plants of many modern medical drugs have become economically and culturally moribund, in stark contraposition with their therapeutic riches. Even more so, these regions are undergoing unprecedented socio-political unraveling, bio-cultural extinction and destruction of forest cover, wildlife and forest peoples daily. These processes are accelerating in regions that are both extremely hot and rainy; indeed, 'hotspots' of biodiverse non-renewable medicinal plants. An integrated program that combines traditional healers, supportive rural healthcare providers and self-sustaining herbal enterprises can bring health improvements, cultural conservation, biodiversity preservation and economic development to resource-poor forest medicinal plant rich regions [3, 4].

Cultural Significance of Traditional Healing

Traditional healing, culturally distinct, addresses disease causes rather than just symptoms. These practices encompass holistic and localized interventions, rooted in indigenous knowledge. Preferred by populations, traditional healing emphasizes humanity's deep connection to nature and its impact on health through thermal baths, rituals, herbal foods, and exercises. Healers globally emphasize environmental respect for health. Preserving forests and their inhabitants is vital for medicinal resources and requires effective governance. Utilizing local plants in community enterprises supports conservation and enhances local economies, particularly in biodiversity-rich regions. Over 80% of the global population relies on traditional healing for primary care, with many relying solely on it. Even those who can access modern medicine frequently choose traditional methods for socio-spiritual and preventive care. Over 25% of modern drugs originate from traditional practices, which are validated by current scientific research. These historical protocols are critical for addressing primary health care needs, especially in rural areas lacking biomedical practitioners. Integrating traditional healers into national health systems can provide immediate solutions and economic benefits, including sustainable medicinal plant harvesting [5, 6].

Engineering Principles in Traditional Medicine

Ethical Principle (3) – Co-Production with Communities Addressing issues in AAHHP without considering local customs can lead to community anger and mistrust. It is crucial to engage with stakeholders on community investment and recognize that health care is a collaborative effort, where the community is aware of its interests and highly involved in decision-making. Ethnic divisions play a significant role in identity and the moral economies at play. Diversity modeling must continually address how difference enters discussions dominated by sameness, as well as the underlying tensions. Narratives and details can generate suspicion toward perceived authoritative knowledge and the grand visions often unfulfilled in practice. Traditional religions also present differing views on social ethics, where perfectibility is seen as conditional and elusive, particularly when it is distant from ancestral traditions. Communities seek formal participation at all levels, and the health sector, especially AAHHP, should honor indigenous knowledge rather than suppress it. Effective collaboration builds on existing community structures, fostering an environment of understanding and negotiation. Such cooperation reveals multiple histories within the community, making it complex and fraught with ethical commitments. Toleration and negotiation stem from a history of external pressures, offering hope for AAHHP. Respectable organizations can act strategically in local politics, navigating issues from denial to the use of a community's strengths against its weaknesses [7, 8].

Case Studies of Traditional Healing Methods

The ancient healers of Southern India, comprising traditional, folk, and ordained practitioners, possess extensive knowledge of over 2800 plant species used in healing. Recently, a training program for youth has been initiated, involving year-long field activities. Healers believe this will effectively train the next generation but stress the importance of protecting the forests from which their knowledge derives. In the moist deciduous forests, healers respect the spirit of plants as ancestors and maintain collaborations with outside healers. They prefer fresh plants to dried ones, leading to limited harvests. Many work closely with outside healers, providing them with identity cards to ensure proper medicine preparations and

sustainable resource use. Healers emphasize conservative resource usage, but they express concern about dwindling fresh plant availability and the endangerment of some species. Community and home gardens have been proposed to facilitate plant transfers to outside healers. Diet also plays a crucial role in healing, but consistently engaging youth in this aspect remains challenging. Healers speaking various dialects highlight the influence of celestial bodies on health and incorporate various healing philosophies, including rituals, herbal remedies, and therapeutic practices. Herbal gardens are cultivated, and traditional knowledge continues to evolve, passed down orally through generations [9, 10].

Integrating Engineering with Traditional Practices

The integration of engineering concepts with traditional practices provides opportunities to enhance sustainability, legacy, and impact. Engineering offers insights into the beauty and artistry of traditional artefacts. In some communities, engineering may not be viewed as a career, but reconceptualizing this can encourage partnerships with knowledge holders, fostering pathways to engineering education. Researchers have examined how engineering students can assist in cultural preservation as artists and designers, applying a historical perspective to ensure access and inclusion of traditional practices without appropriation. The aim is to complement, not damage, these practices, appreciating their historical significance. When traditional healers use scientific principles in their artefacts, these can be refined for broader applications, such as engineering traditional sailcraft for larger vessels. Access to external knowledge may enhance experiences and resource availability, enabling adaptation. Many traditional practices have spiritual dimensions and must be approached sensitively to avoid co-opting spirituality, which has historical implications. Engineering must recognize its limitations and foster respectful collaborations with cultural custodians, ensuring mutual benefit rather than extraction. Various approaches are possible; for example, traditional healers use soap water for wound cleaning, raising questions about manufacturing soaps with different sugar levels and sand granule sizes. These inquiries promote respect and collaboration, enhancing understanding through simulation and theory. Investigations, led by the research team, require informed consent from participants, ensuring their standards guide the application of knowledge [11, 12].

Technological Innovations in Healing

Traditional healing is a holistic lifestyle deeply connected to nature, viewed as a reflection of God. While humans have great intellect, they often lose balance due to the overreach of science and technology. Efforts to extend life beyond nature's typical span of 120 years focus on balancing the body, mind, and soul. Practices like early rising, bathing, exercising, and consuming herbal foods contribute to good health. Traditional healing addresses these aspects and promotes overall well-being as the true "medicine" for health care. Communities should explore this through study and natural understanding. Trained traditional healers, including shamans, priests, herbalists, and sages, dedicate their lives to mastering hidden knowledge. Various healing traditions globally utilize natural elements such as water, fire, air, earth, as well as resources from land and plants. While diverse, these practices share common goals for health perception and delivery. Herbalists employ sacred methods for creating numerous formulations. Explanations involve syllables, numbers, colors, geometrical figures, and topography, encompassing all aspects of life. Treatments are personalized, ensuring clients understand the potential effects. Traditional medicine combines the knowledge, skills, and practices rooted in different cultures for health maintenance and addressing physical and mental ailments. In modern terms, it encompasses a broad spectrum of healing practices known and recorded by pre-literate societies before the rise of advanced medical technologies. Ethnomedicine studies these medicinal cultures, linking ancient practices to biological knowledge and pharmaceutical development [13, 14].

Challenges in Merging Disciplines

Despite the opportunities for collaboration between both healing modalities, many unresolved challenges exist including differences in culture, training, curing processes, understanding of health and illness, regulations and control, motivations, access, trust, and the power to shape the health care system. It is proposed that for clearer understanding and improved collaboration, a shared knowledge base about these differences in terms of behavior, perception, and thought processes is needed. Although healers consult the sick in different locations, it is possible to determine commonalities in diagnosis and treatment. All traditional health systems possess a body of knowledge, a communal understanding of basic natural mechanisms that bring about health and illness. Large portions of the body of knowledge are written down in general medicinal texts, handbooks, and reference files. Mostly, however, the knowledge is tacit and verbalized in folk diagnoses, information on disease categories, herbal treatments, composite mixtures, and cures including rituals or sacrifices. It possesses a degree of complexity that eludes the lay

person. Pattern analysis in terms of networks of salient features can serve as an innovative transformational practice to design an empirically verifiable public knowledge base for incorporation in educational programs. Most skilled practitioners are excellent observers and assessors of health. The same treatment may bring about healing for some and death for others with the same disease. A well-organized traditional health care system relies on groups of practitioners. Types of practitioners may specialize in certain categories of health and illness, relying on a credible body of knowledge. This knowledge base may be organized in terms of criteria for type and depth of occupations and levels of education to identify and support the practitioners with regard to access to the community, control and training. The biomedical health system has many opportunities and long traditions of research and development. Health professionals are educated in a well-elaborated and widely accepted scientific paradigm and body of knowledge. Vital new insights derive from developmental and educational psychology, communication engineering, social network development, system dynamics, and controllability of systems. Most biomedical health professionals are motivated to move society towards a better state and towards more economic and social sustainability [15, 16].

Ethical Considerations in Engineering and Healing

In 1970, Paul Komesaroff wrote that healing is the practical site where the knowledge of science is applied in the service of ethics, and where ethics encounters the conditions of science. This paper focuses on how engineering is the practical site where science and technology encounter societal problems. It promotes cooperation between engineers and people engaged in or influenced by traditional healing practices to benefit rural developing areas and urban areas in developed countries. Nevertheless, engineers' direct involvement in reengineering healing processes raises ethical issues. The Codes of Ethics of professional engineering societies primarily focus on considerations of safety, health, and welfare of the public, especially when public participation in engineering-related decision making is limited. Issues of public safety, health, and welfare often are interrelated. In such cases, technical solutions can be fully formulated and thoroughly evaluated for unambiguously positive expected safety, health, and welfare effects. Such situations do offer opportunities for engineering. However, the most promising 21st century engineering opportunities of coevolving with societal systems of traditional healing practices in the developing and developed world mainly reside outside this engineering binary. The same issues of public safety, health, and welfare can also be considered as different facets, entry points, or aspects of a wider and deeper civil society concern, such as public "common good," "sustainability," or "quality of life." In ambitious state governance, public discretion, especially its expression in public participation in societal, political, and economical processes, is dynamically fed, informed, and tended by dedicated brokerage institutions that harvest, filter, and collectively present signals from focused public deliberation. Engineering practice has much to learn from this public deliberation, especially when information systems for end-users initially designed to curb personal agency are coengineered to provide public deliberation with focus, information, and connectivity paralleling those engineered for economic and political stakeholders [17, 18].

Future Trends in Traditional Healing and Engineering

Ten key trends in traditional healing and engineering include: (1) Proliferation of diverse healing practices as globalization fosters alternative techniques and the blending of different systems. This may lead to unexpected changes influenced by Western medicine. (2) Global rediscovery of traditional healing as societies face pandemics and antibiotic-resistant diseases, increasing interest in ancient wisdom alongside attempts to control access to such knowledge. (3) Integration of technology enhances traditional healing through bio-engineering, AI, and virtual reality, creating scientific patents and intellectual property around traditional nutrients and compounds. (4) Traditional knowledge may evolve within modern economies, fostering institutionalized practices that formally document knowledge, giving way to exploitation by entrepreneurs. (5) Professionalization akin to Western medicine may arise, with traditional healers seeking accreditation and licensing to practice. (6) Advancements in technology enable laboratory study of ancient healing practices to produce compounds linked to these traditions, potentially creating a repository of healing materials. (7) Continued discrimination against traditional practices may persist, with prejudice based on sophistication and ethnicity. (8) Increased interest in healing practices and their political implications alongside scholarly discussions may spark an examination of healing traditions. (9) Distrust in formal medicine may grow, driven by conflict exposure and disillusionment with elite healing despite ongoing demand for Western medications. (10) Merging healing practices with biomedical approaches may produce innovative health solutions and wellness discourses that resonate with broader communities, prompting research into traditional vernacular traditions [19, 20].

Research Methodologies for Studying Traditional Healing

Four case studies illustrate how different interventions have led to greater attention to the continued relevance and mitigation of these threats. Research on contextual changes was directed to the issuing of additional peer-reviewed publications that identify target repairs to the maintenance of social infrastructures and the gathering of commercial VHA. Case studies reveal how traditional design practices produced illustrations that persuade broader audiences of the need to protect vocal heritage. Each case study is a locality on the edge of deep change, questioning the adaptability of heritage traditions under threat. Coping with the changes requires pluralistic and transitional modalities of situated practice that, ideally, are fostered by networks among artistic and scholarly practitioners—proactive communities of practice, with conscientiously redefining installations of questionable signs of commitment to maintain these lucrative enterprises. The questions of the case study are illustrated with presentation slides, video excerpts, and stills from exercises. Comparative and interdisciplinary investigation approach offer heteronormative roles for art-form-interventionists and the types of performance involved, from more ecumenical, curatorial coverage and documentation to sometimes intrusive co-creation. Research highlights marginalization and colonization as the essence of performed oppression. Protests against oppressive rule are indicative of the active existence of local traditions. Changes require distinguishing between textual evolution and changes in the instances of verbal performance. Disengagement arguments are concluded to be revisionist. Reintroduced performances are reply but renounce imitation and expansionism, instead anchoring on traversals distinctively situating reissut heritagization in the midst of sweeping changes. Cross-case analysis is foresighted to more than upholding modes of local oral traditions, providing insulations against mass applications of audio and visual media. A history of strategy attachments is produced, tracing how instrumental modes of performance as forms of knowledge inquiry have been repudiated one after and in favor of mass impersonations, and secondly relinquished translation's mediating roles to allow avenues for qualitative participation [21, 22].

Community Involvement in Healing Practices

Many traditional practices significantly reduce healthcare costs by emphasizing preventive strategies. Health is viewed not only through a biomedical lens but also encompasses social, psychological, behavioral, and spiritual well-being. This broader view highlights the importance of lifestyle choices and social equity in preventing illness and improving health. Various cultural aspects can reduce chronic conditions through enhanced environments and the promotion of traditional physical activity and diet. For instance, native gardens boost exercise and encourage healthier eating for coronary heart disease prevention. Community appreciation of traditional healing practices can help tackle hypertension in Native American populations, while programs enhancing indigenous understanding of climate change impacts on diabetes effectively increase health resilience. Traditional care systems offer unique healing methods that cater to marginalized groups. Health involves maintaining balance and harmony across generations, often reflecting indigenous ideas that extend beyond conventional medicine. The modern worldview often leads to unsustainable disconnection from nature, ancestors, and community, which are essential for well-being. Traditional health practices are integral to cultural and biodiversity conservation. They are adaptable, holistic, culturally inspired, environmentally supportive, and community-focused. Future research in this field can explore various avenues, including indigenous knowledge sharing, protecting cultural practices, and integrating traditional and biomedical healthcare approaches [23, 24].

Policy Implications for Integrating Practices

There is a need for public education on the legality of traditional medicine and healing practices (TMH). Over 70% of the population utilizes TMH for their healthcare, yet awareness of the laws surrounding it remains limited, leading to conflicts within public discourse. This mistrust contributes to some TMH clients being denied treatment and traditional healers facing police harassment. Public campaigns to raise awareness about these laws could remedy the situation, encouraging clients to use TMH without hindrance. There is also a need for systematic investigation into TMH's nature and policy implications. Integrating traditional practices into mainstream health requires all stakeholders to be involved in defining and understanding these methods. Current power imbalances favor biomedical practitioners, potentially skewing the implementation if it is defined without traditional knowledge. Addressing these disparities is crucial for negotiating biomedical views of health. Formal collaboration and patient co-referral between biomedical and traditional systems are necessary. Existing rudimentary collaborations should be formalized to enhance partnerships, share knowledge, and address power imbalances.

Collaborative biomedical practitioners can promote hygienic practices among traditional healers while being receptive to learning about TMH to better understand patients' cultural beliefs. Traditional healers operating clinics must gain national recognition and support for research that generates financial benefits. Patients should receive formal referrals to TMH facilities from healthcare establishments when appropriate [25, 26].

Training and Education in Traditional Healing

Many people perceive indigenous health knowledge as spiritual; however, it is actually holistic. Colonialism has marginalized this understanding, with most modern training occurring in Western-style universities, where indigenous healing is often dismissed as merely "herbal." Indigenous healers undergo training with specialized spiritualists, starting with awareness and gradually moving to deeper experiences that go beyond mere physicality. This process leads to a spiritual zone that connects individuals to a broader collective existence spiritual, emotional, cultural, and physical. The training begins informally, involving close observation of the trainer's actions. Apprentices eventually prepare herbal remedies while being guided on their preparation. As apprentices gain skills, they face more challenging cases, with tasks kept secret as "genus knowledge," fostering trust between the healer and apprentice. Completion of the apprenticeship occurs when the apprentice is fully reliant on the trainer. It is challenging for trainers to continue with overconfident trainees, especially when training knowledge is seen as sensitive. Only a few trainers possess the authority to educate others at advanced stages. Elder governance shapes the knowledge-sharing process, ensuring practitioners avoid reputation damage by seeking clients in neighboring villages. Remedies are derived from a selection of 450 plants across 22 families, emphasizing the importance of direct contact with certain leaves. Notably, no one genuinely identifies as indigenous in using this term, despite a long history of knowledge transmission. A universal healthcare classification has been sought for a century, leading countries like China, Korea, India, and Vietnam to create rigorous training programs for traditional medicine that emphasize holistic prevention and care. Botswana boasts the oldest official arrangements on the continent, integrating tribal chief healing into the healthcare delivery system. In 2018, an estimated 19,400 illegal practitioners participated in a market of 30 million. Recently, medical students have been advocating for the inclusion of indigenous healing principles in medical school curricula to promote collaboration between traditional and modern medicine, aiming to improve training outcomes across both fields [27, 28].

Assessment of Traditional Healing Efficacy

The rapid loss of traditional healing practices and resources jeopardizes communities globally. Investigations reveal remnants of these practices in North America, Hawaii, and southern India, reflecting modern health concepts. However, discrepancies raise questions on definitions of health and healing. Over 60 traditional healers were interviewed for a research project exploring their roles in holistic health systems. Their responses were analyzed for key themes, although the interviews focused more on input than outcomes. Nevertheless, healing outcomes emerged as a significant topic during analysis, with local cultural beliefs about therapies often existing alongside discussions. These outcomes demonstrate the importance and effectiveness of cultural healing, pointing to the need for further research in various communities. Traditional healing remains a valuable and sustainable health care approach in countries rich in culture and biodiversity, such as the Himalayas and Andes. It is intertwined with sustainable development, food security, and biodiversity conservation, and is a key focus of Future Earth research. Collaboration among traditional healers, health workers, and scientists through the study of indigenous languages could enhance recognition of healing practices. Prioritizing this agenda requires an emphasis on education and outreach [29, 30].

CONCLUSION

Traditional healing practices, deeply embedded in cultural and ecological systems, offer a wealth of health knowledge that continues to support millions globally. As modern health systems grapple with the rise of chronic diseases, resistant infections, and healthcare inequity, engineering can play a transformative role in preserving and enhancing these time-tested methods. However, integration must go beyond technological application it requires ethical collaboration, respect for indigenous sovereignty, and genuine co-creation with knowledge holders. Engineering solutions, when grounded in community-driven priorities, can support sustainable medicinal plant use, develop culturally appropriate technologies, and create pathways for knowledge exchange that respect spiritual and social contexts. The future of global health lies in embracing hybrid models where traditional wisdom and modern science not only coexist but enrich one another. Investing in this interdisciplinary convergence promises more inclusive, adaptive, and resilient health care systems.

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