

HEALTH, SCIENCE, TECHNOLOGY, LOCAL WISDOM, AND  
SHIP TO SUPPORT GLOBAL SUSTAINABLE DEVELOPMENT



# BOOK OF ABSTRACT

## THE 2ND NHM INTERNATIONAL CONFERENCE

Integrating Health, Science, Technology, Local Wisdom, and Entrepreneurship  
to Support Global Sustainable Development

Bangkalan, 10-11 February 2026

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## The 2nd NHM International Conference (NIC)

*Integrating Health, Science, Technology, Local Wisdom, and Entrepreneurship  
to Support Global Sustainable Development*

### **Organized by**

Noor Huda Mustofa University - Indonesia

### **In collabaoration with**

Ciputra University – Indonesia

MAHSA University – Malaysia

University College MAIWP International - Malaysia

Praboromarajchanok Institute (PBRI) - Thailand

**Integritas Auditorium  
Noor Huda Mustofa University  
2026**

## About The 2nd Nhm International Conference (NIC) 2026

The 2nd NHM International Conference (NIC) 2026 is an international academic forum organized by Universitas Noor Huda Mustofa as a strategic initiative to strengthen research capacity, scientific dissemination, and global academic collaboration. In response to rapid global developments in science and technology, higher education institutions are required to produce adaptive, innovative, and multidisciplinary graduates capable of addressing complex global challenges.

This conference serves as a platform for researchers, academics, students, and practitioners to exchange knowledge, present research findings, and build sustainable academic networks at both national and international levels.

The theme of NIC 2026 is:

*Integrating Health, Science, Technology, Local Wisdom, and Entrepreneurship to Support Global Sustainable Development.* This theme highlights the importance of collaboration across disciplines to create innovative and sustainable solutions that combine scientific advancement with local values and entrepreneurial approaches.

The conference encompasses a wide range of interdisciplinary fields, including Nursing, Midwifery, Health Science, Public Health, Health Information and Technology, Entrepreneurship and Digital Business. Supporting innovation and sustainable economic development through technology-based business initiatives.

Through these diverse fields, NIC 2026 aims to promote interdisciplinary collaboration, enhance research quality and publication output, and contribute meaningfully to global sustainable development by integrating scientific advancement with local wisdom and entrepreneurial innovation.

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**The 2nd Nhm International Conference (NIC) 2025**

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Sari Agustini, S.Pd.



I would also like to congratulate the 78 students who participated in our International Essay Competition. Your ideas, creativity, and critical thinking show that young scholars play an important role in shaping the future.

My heartfelt appreciation goes to the Organizing Committee and all supporting teams. Your professionalism, your commitment, and your hard work behind the scenes have made this conference a reality. Thank you very much.

Noor Huda Mustofa University remains committed to becoming a globally connected university. We believe in collaboration over competition, knowledge with character, and innovation with social responsibility. Through conferences like this, we aim to contribute to global sustainable development in a meaningful way.

I sincerely hope that this conference will be inspiring, productive, and beneficial for all of us. May today's discussions generate new ideas, stronger partnerships, and impactful research.

Thank you very much

Wassalamu'alaikum warahmatullahi wabarakatuh.



collaboration at both national and international levels.  
Wassalamu'alaikum Warahmatullahi Wabarakatuh.

Thank you.

Bangkalan, February 10<sup>th</sup> 2026  
Chair of the Organizing Committee,  
*(Signature)*

Sitti Sulaihah, S.Kep.,Ns.,M.Kep.

**Detailed Agenda**  
**Program Schedule**  
**The 2nd NHM International Conference (NIC) 2026**

<b>Tuesday, 10 February 2026</b>	
<b>Time</b>	<b>Agenda</b>
<b>07:00 – 08:15 AM</b>	Registration
<b>08:15 – 09:15 AM</b>	Opening Ceremony
	Madurese Traditional Folk Dance Performance
	Singing of the National Anthem of the Republic of Indonesia, “Indonesia Raya”
	Welcome Address by the Chair of the Organizing Committee
	Opening Remarks by the Rector of UNHM
<b>09:15 – 09:30 AM</b>	Coffee Break
<b>Scientific/ Plenary Session</b>	
<b>09:30 – 10:45 AM</b>	Plenary Session 1 : Damelina B. Tambunan, Ph.D., CLC, CPM <i>Byound Healing: Why the Future of Healthcare Demands Entrepreneurial Leadership</i>
<b>10:45 AM – 12:00 PM</b>	Plenary Session 2 : Prof. Dr. Zakkiyatus Zainiyah M.Keb <i>sFLT1 Gene Expression In Pregnant Women At Risk Of Preeclampsia In The Madura Population: A Case-Control</i>
<b>12:00 – 01:00 PM</b>	Break
<b>01:00 – 02:00 PM</b>	Plenary Session 3 : Prof Dr. Samsiah Binti Mat <i>Digital Health &amp; Sustainable Systems: From Service Delivery to System Leadership</i>
<b>02:00 – 03:00 PM</b>	Plenary Session 4 : Dr. Nurul Hana Zainal Baharin <i>Perspective In Medical Biotechnology</i>
<b>03:00 – 03:15 PM</b>	offee Break
<b>03:15 – 04:30 PM</b>	Plenary Session 5 : Asisten Profesor Dr. Thanee Glomjai <i>Primary Health Care with Thai Local Wisdom: Bridging Tradition and Modernity</i>
<b>04.30 – 05.00 PM</b>	End of Plenary Session
<b>Wednesday, 11 February 2026</b>	
<b>08.00 – 08.30 AM</b>	Registration
<b>08.30 AM – 12.00 PM</b>	Parallel Session : Paper/ Oral Presentation
<b>01.00 – 02.00 PM</b>	Closing Ceremony

## Oral Presentation Schedule

No.	Time	Name	Title
<b>Room 1</b>			
<b>Reviewer : Prof. Dr. M. Hasinuddin, S.Kep., Ns., M.Kep</b>			
1	09.00 - 09.15	Erlin Kiriwanno	The Role Of Adolescent Posyandu In The Detection And Prevention Of Anemia: A Health Belief Model Approach
2	09.15-09.30	Andi Eka Pranata	Quality Of Life And Associated Factors Among Tuberculosis Patients With Comorbid Diabetes Mellitus
3	09.30-09.45	Hartono	Interventions To Reduce Stigma And Psychosocial Burden Among Adult Stroke Survivors: A Systematic Review
4	09.45-10.00	Dinda Deanitha Putri	Vulnerable Work In The Informal Sector: A Qualitative Study Of Contract Employees
5	10.00-10.15	Dita Puspita Sari	Relationship Between Maternal Characteristics And Urine Protein Examination Results In Pregnant Women
6	10.15-10.30	Faisal Amir	Improving Of Self-Care Deficit Through Community As Partner In Efforts To Fulfillment Personal Hygiene Of People With Mental Disorders Patients
<b>Room 2</b>			
<b>Reviewer : Dr. Ulva Noviana, S.Kep.,Ns., M.Kep</b>			
1	09.00 - 09.15	Yuli Irnidayanti	Comparative Physicochemical And Antioxidant Analyses Of Chitosan-TPP Nanocarriers Encapsulating Mangosteen Peel Extract And $\alpha$ -Mangosteen
2	09.15-09.30	Yasmin Fauziah	Voxel-Based Dosimetry Study with Model Selection for Tumor Dose Quantification in Patients with Hepatocellular Carcinoma (HCC) Treated Using $^{177}\text{Lu}$ -DOTATATE
3	09.30-09.45	Didik Priyandoko	Physicochemical Characterization And Cytotoxic Evaluation Of Julang-Jaling (Archidendron Bubalinum) Nanoparticles Against MCF-7 Cells
4	09.45-10.00	Hyan Oktodia Basuki	The Effect Of Tai Chi Exercise On Insomnia Among Elderly At Margo Mukti Nursing Home Rembang
5	10.00-10.15	Cerelia Iftina Nugroho	APPI-SCORE: Model Skoring Inovatif Untuk Prediksi Komplikasi Pasca-Apendektomi Di Rumah Sakit Heart & Surgery Bangkalan
6	10.15-10.30	Kurnia Eka Putri	Comparison Of Acupuncture And Moxibustion Therapies At ST 36, ST 40, SP 6, And RN 12 In Reducing Cholesterol Levels In Patients With Hypercholesterolemia: A Randomized Controlled Trial
7	10.30-10.45	Anindya Hapsari	Midwives and Diagnosis Delay on Endometriosis: A Narrative Review

<b>Room 3</b>			
<b>Reviewer : Prof. Dr. Bdn. Zakkiyatus Zainiyah, M.Keb</b>			
<b>1</b>	09.00 - 09.15	Nur Kamariyah	My Fun Village: A Stigma-Free Village For Leprosy Elimination And Early Detection
<b>2</b>	09.15-09.30	Nur Amalia Apri Kusdarwati	DOTS (Directly Observed Treatment Shortcourses) Team In Tuberculosis Prevention Therapy Achievements In Families Of TB Patients
<b>3</b>	09.30-09.45	Abdurahman Ismail Moh. Honin	Branding Guidelines: Sharia-Compliant Services And Environment To Enhance Patient Loyalty Through Self-Belief Moderation At Heart And Surgery Specialized Hospital
<b>4</b>	09.45-10.00	Endang Murdaningrum	Early Detection Of TB Sufferers With The KAPAK TBC Program At Banyuates Public Health Center, Sampang
<b>5</b>	10.00-10.15	Khadijah	The Impact Of JENG IVA CANTIKS Program On IVA Inspection Coverage At Kamal Primary Health Center
<b>6</b>	10.15-10.30	Rivaldi Indra Nugraha	Development Of An E-Medical Record Information System For Pregnant Women With Preeclampsia Risk Independent Practice Of Midwives In Bangkalan Regency
<b>7</b>	10.30-10.45	Alis Nur Diana	The Relationship Between Husband's Support And Mother's Anxiety Levels During Premenopausal Period
<b>Room 4</b>			
<b>Reviewer : Dr. Novi Anggraeni, S.SiT, MPH</b>			
<b>1</b>	09.00 - 09.15	Nur Fadilatul Alifah	The Effect Of Curcuma Extract Emulsion As An Amara On Ghrelin-Leptin Hormone Profiles And Increased Feed Consumption In Male White Mice (Mus Musculus)
<b>2</b>	09.15-09.30	Indah Nur Susanti	Increasing Treatment Coverage And Access To Services For Hypertension Patients Through The Innovation Of The Kopiku Store At Pengarengan Public Health Cente
<b>3</b>	09.30-09.45	Feni Yunia Achmad	Mobile Visual Inspection (IVA) And Clinical Breast Examination (SADANIS) At The Integrated Health Post (POSBINDU)
<b>4</b>	09.45-10.00	Andita Savitri Aulani	SIAPMASEH Aplication Development to Improve Patient Satisfaction With Outpatients Service
<b>5</b>	10.00-10.15	Zaitun Ermawati	The Preeclampsia-Free Village Initiative Through Early Detection Among Pregnant Women In The Service Area Of The Kokop Community Health Center
<b>6</b>	10.15-10.30	Titin Yuliani	The Young Mango Method On Family Behavior In Efforts To Prevent And Transmit Pulmonary TB

7	10.30-10.45	Dian Eka Januriwasti	A Study Of Pregnant Women's Knowledge, Perception, And Family Support In The Maternal Ultrasound Program
8	10.45-11.00	Itafiqoh Sjukur	"Kape Pagi" (Post Tooth Extraction Instruction Card) <i>Flashcard</i> Media Health Promotion Efforts at Galis Public Health Center
<b>Room 5</b>			
<b>Reviewer</b>		<b>: Dr. M. Suhron, S.Kep., Ns., M.Kep</b>	
1	09.00-09.15	Hamimatus Zainiyah	Effectiveness Of Walking And Prenatal Yoga On Stress Regulation, Cortisol Levels, And Blood Pressure In High-Risk Pregnancies For Preeclampsia Prevention
2	09.15-09.30	Siti Rochimatul Lailiyah	Analysis Of Pure Honey As An Alternative To Reduce The Frequency Of Diarrhea In Toddlers
3	09.30-09.45	Mohammad Lutfi	The Effectiveness Of A Role-Play Simulation Of Basic Life Support On The Knowledge Level Of Coastal Communities In Handling Drowning Victims (A Study In The Coastal Area Of Talangoh Village, Tanjung Bumi District, Bangkalan)
4	09.45-10.00	M. Shofwan Haris	The Effectiveness Of Moringa ( <i>Moringa Oleifera</i> ) Leaf Extract On Insulin Resistance In Mice ( <i>Mus Musculus</i> ) Obesity Model
5	10.00-10.15	Vivin Wiji Astutik	The Effect Of Complete Food Preparation Training On Mothers' Knowledge About Providing Complete Food To Infants Aged 6-9 Months At The Konang Public Health Center
6	10.15-10.30	Enggal Sari Maduratna	The Influence Of Leadership Style On Employee Performance At Bangkalan Community Health Center
7	10.30-10.45	Rulisiana Widodo	Identification Of A Minimum Family History Dataset In Electronic Medical Records As A Basis For Early Detection Of Genetic Diseases

**Keynote Speaker**

**sFLT1 Gene Expression In Pregnant Women At Risk Of Preeclampsia In The Madura Population: A Case-Control**

**Prof. Dr. Bdn. Zakkiyatus Zainiyah, M.Keb**

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**Abstract**

Preeclampsia is a pregnancy disorder characterised by hypertension and other health problems. Furthermore, preeclampsia contributes to maternal and infant morbidity and mortality. The biomarker sFLT1 is believed to be a major cause of maternal vascular disorders through its antagonistic effects on VEGF and PlGF. This study aimed to analyse sFLT1 gene expression in pregnant women at risk of preeclampsia in the Madurese population.

A case-control study design. A sample size of 45 pregnant women was divided into two groups (Group 1, High Risk for PE, and Group 2, Moderate Risk for PE). Thus, 30 cases were at risk for preeclampsia and 15 healthy pregnant women. Pregnant women at moderate and high risk for preeclampsia were enrolled in the community or attending a midwife's practice. The study criteria included gestational age <20 weeks, two or more risk factors for preeclampsia, patient demographic data screened for preeclampsia, and sFLT1 gene expression examination using Real-time RT-PCR with an RNA Blood Mini Kit. Statistical analysis used the Kruskal-Wallis test and multiple analyses.

The expression of the sFlt1 gene in the preeclampsia risk group was upregulated compared to the control group, with a relative expression of 1. The risk of preeclampsia was above 1, with a mean value of 26.09 in group 1 and 19.46 in group 2. Multiple comparison statistical tests revealed that the risk of preeclampsia in group 1 was higher than that of the control

The preeclampsia risk group has the potential to develop preeclampsia after 20 weeks of gestation. This study needs to be confirmed with a larger sample size in different populations, and to consider gestational age >20 weeks and the severity of preeclampsia.

**Keywords 3-5 words:**

**Expression; Gene; sFLT1; Preeclampsia; Madura**

**Keynote Speaker**

**Beyond Healing: Why the Future of Healthcare Demands  
Entrepreneurial Leadership**

**Damelina Basauli Tambunan**

Ciputra University, Indonesia  
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**Abstract**

The main purpose of this presentation is to explore the importance of entrepreneurial leadership in the future specifically in Healthcare Industry. The future of healthcare requires more than clinical excellence; it demands entrepreneurial leadership capable of transforming complex challenges into sustainable solutions. The idea emphasizes the critical integration of entrepreneurial characteristics within healthcare systems. As global health challenges become increasingly dynamic, driven by technological disruption, demographic shifts, and rising patient expectations; therefore healthcare professionals must evolve from traditional service providers into proactive value creators. The discussion highlights three core entrepreneurial characteristics essential in healthcare: opportunity creation, innovation-driven problem solving, and calculated risk taking. Technology serves as a key enabler, with telemedicine, artificial intelligence diagnostics, wearable devices, and health analytics reshaping service delivery and patient engagement. However, technological advancement alone is insufficient without strong leadership and adaptive mindset transformation. The presentation also explores the importance of local wisdom in designing contextually relevant healthcare innovations. By applying tools such as the Value Proposition Canvas, healthcare leaders can systematically identify patient needs, pain points, and value creation opportunities. Various health entrepreneurship models are introduced to illustrate scalable and sustainable approaches to healthcare innovation. Ultimately, the central message underscores a fundamental mindset shift from perceiving healthcare purely as a service industry to embracing it as a platform for value creation and long-term impact. Healthcare professionals are positioned not merely as caregivers but as architects of sustainable, innovative ecosystems that improve societal well-being. Entrepreneurship, therefore, is not optional in healthcare's future, it is essential.

***Keywords: entrepreneurial mindset, opportunity creation, innovation, risk taking***

## Keynote Speaker

### **Integrating Health Science, Technology, Local Wisdom, And Entrepreneurship To Support Global Sustainable Development**

**Prof Dr. Samsiah Binti Mat**

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#### **Abstract**

Global sustainable development requires integrated solutions that address complex health, social, economic, and environmental challenges. Increasingly, scholars and policymakers recognize that sustainable progress cannot rely solely on scientific or technological advancement; instead, it must combine health science, digital innovation, local wisdom, and entrepreneurship to create resilient and inclusive systems aligned with global sustainability goals.

Health science plays a foundational role in sustainable development by improving population health, strengthening disease prevention, and promoting equitable healthcare access. Strong health systems contribute directly to social stability and economic productivity, reinforcing the principle that health is both a development outcome and a driver of development. The World Health Organization emphasizes that sustainable health systems must integrate evidence-based practice with community engagement and cross-sector collaboration to achieve long-term population well-being (WHO, 2021).

Technology acts as a key enabler that enhances healthcare delivery, education, and resource efficiency. Digital health platforms, artificial intelligence, and data analytics improve decision-making, expand access to underserved populations, and optimize resource utilization. Technological innovation also supports environmental sustainability by reducing unnecessary travel, minimizing waste, and improving system efficiency. However, technology alone cannot ensure equitable outcomes; its success depends on culturally appropriate implementation and ethical governance.

Local wisdom represents an often underutilized yet powerful component of sustainability. Indigenous knowledge, cultural practices, and community-based health approaches provide context-sensitive solutions that strengthen trust, participation, and long-term adoption of health interventions. Integrating local knowledge systems with scientific evidence enhances relevance and sustainability, particularly in diverse communities where cultural values influence health behaviours and environmental stewardship. The United Nations Sustainable Development Goals (SDGs) highlight the importance of inclusive approaches that respect cultural diversity while promoting innovation (United Nations, 2015).

Entrepreneurship further accelerates sustainable development by translating knowledge and innovation into scalable solutions. Health and social entrepreneurship foster innovative service models, create employment opportunities, and promote economic resilience while addressing public health challenges. Entrepreneurial ecosystems encourage collaboration between academia, industry, and communities, transforming universities from knowledge producers into innovation hubs capable of generating sustainable societal impact. The World Bank notes that innovation-driven

entrepreneurship is essential for inclusive economic growth and sustainable system transformation (World Bank, 2020).

In conclusion, integrating health science, technology, local wisdom, and entrepreneurship offers a holistic pathway toward global sustainable development. This multidimensional approach supports health equity, economic growth, cultural relevance, and environmental responsibility simultaneously. Future progress depends on collaborative leadership that bridges disciplines, empowers communities, and ensures that innovation remains ethical, inclusive, and sustainable. By aligning scientific advancement with local context and entrepreneurial action, societies can build resilient systems capable of meeting present needs while safeguarding future generations.

## Vulnerable Work In The Informal Sector: A Qualitative Study Of Contract Employees

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### **Abstract**

**Introduction:** Job vulnerability has become a significant issue in contemporary labor conditions, particularly among contractual workers in the informal sector. Limited job security, inadequate occupational safety and health protection, and weak employment regulations place workers in a vulnerable position. This situation is commonly found in small-scale food and beverage businesses where employment relationships are informal and largely dependent on employer discretion.

**Methods:** A qualitative research design with a case study approach was employed. Data were collected through in-depth interviews, direct observation, and documentation. The study involved five informants, consisting of one key informant (the business owner) and four main informants (contractual workers). The data were analyzed using thematic analysis, encompassing data reduction, data display, and conclusion drawing to identify patterns related to job vulnerability and occupational safety and health practices.

**Results:** The study concludes that contractual workers in informal businesses remain vulnerable due to the absence of formal labor protection and occupational safety management. Strengthening occupational safety and health practices through basic training, provision of protective equipment, and clearer work procedures is essential to reduce job vulnerability and improve workers' well-being in the informal sector.

**Conclusions:** The findings indicate that contractual workers experience multiple forms of job vulnerability, including exposure to physical work hazards, long working hours, and limited access to occupational safety and health protection. Although workers demonstrate awareness of occupational safety and health issues, this awareness is not supported by formal policies, structured safety management systems, or regular safety training provided by the employer.

**Keywords 3-5 words:** job vulnerability; contractual workers; occupational safety and health

## Quality Of Life And Associated Factors Among Tuberculosis Patients With Comorbid Diabetes Mellitus

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### **Abstract**

**Introduction:** The increasing incidence of tuberculosis, accompanied by the comorbidity of diabetes mellitus, further worsens the quality of life (QoL) of patients in a region. This study focuses on analyzing factors that influence adherence to tuberculosis treatment and its impact. The relationship between medication adherence and QoL represents a breakthrough in the management of patients with TB-DM. This study aims to identify factors influencing medication adherence and QoL in TB-DM patients and visualize the role of each factor (Structural Equation Modeling).

**Methods:** The study used a cross-sectional design with a sample size of 117 TB-DM patients in Jember Regency. SEM analysis was used to examine the relationship between socioeconomic factors and medication adherence and QoL in TB-DM patients. The medication adherence instrument used the MMAS-8, while the QoL instrument used the WHOQOL-BREF.

**Results:** The results showed that income and age significantly influenced medication adherence and QoL. High income resulted in better adherence (coefficient = 0.504) and improved QoL (coefficient = 0.265). Age negatively influenced medication adherence (-0.250) and QoL (-0.338). Medication adherence positively influenced QoL (coefficient = 0.263). Other factors (education level, gender) showed a weak relationship to QoL. Family members' smoking habits positively influenced QoL, but were not significant for medication adherence. The research model showed good predictive relevance ( $Q^2 = 0.180$  for QoL and  $Q^2 = 0.172$  for medication adherence) and was able to explain a large proportion of outcome variation ( $R^2 = 0.934$  for QoL and  $R^2 = 0.802$  for medication adherence).

**Conclusions:** Income and treatment adherence are crucial for improving the QoL of TBDM patients. Research shows that service models must consider socioeconomic factors (income) and focus on improving treatment adherence to achieve better health outcomes in TBDM patients.

**Keywords 3-5 words:** Tuberculosis with Diabetes Mellitus, Quality of Life, Adherence, Social Economic Factor

## Relationship Between Maternal Characteristics And Urine Protein Examination Results In Pregnant Women

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### **Abstract**

**Introduction:** Urine protein testing is a crucial component of antenatal care (ANC) for detecting the risk of preeclampsia in pregnant women. This study aimed to analyze the association between maternal characteristics and urine protein examination results among pregnant women.

**Methods:** An analytic cross-sectional study was conducted on 97 pregnant women attending integrated ANC in February–March 2023 at Puskesmas Bangkalan. Respondents were selected using random sampling. Secondary data on maternal age risk, parity, pregnancy trimester, and urine protein examination results were obtained from medical records. Data were analyzed using the Chi-square test and Spearman's rank correlation test, with a significance level of  $p < 0.05$ .

**Results:** Statistical analysis showed no significant association between maternal age risk and urine protein examination results ( $p = 0.314$ ). Similarly, no significant relationship was found between parity and urine protein ( $p = 0.990$ ) or between pregnancy trimester and urine protein ( $p = 0.487$ ).

**Conclusion:** Positive urine protein was observed in approximately one-third of pregnant women. The occurrence of proteinuria during pregnancy is influenced by multiple factors; therefore, further studies involving broader variables and more comprehensive analytical approaches are needed to better understand the determinants of proteinuria in pregnant women.

**Keywords:** Age, Parity, Trimester, Urine protein

## Improving Of Self-Care Deficit Through Community As Partner In Efforts To Fulfillment Personal Hygiene Of People With Mental Disorders Patients

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### **Abstract**

**Introduction:** Self-care deficit is one of the main problems that arise in clients with chronic mental disorders who often experience indifference to self-care, this condition is a symptom of negative behavior and causes clients to be ostracized both in the family and society. Based on the results of a preliminary study at the Bani Amrini Mental Health Center through observation of all People with Mental Disorders (ODGJ) patients, it was found that patients experienced poor personal hygiene because there was only 1 nursing home officer who supervised 35 patients. The purpose of the study is to analyze the differences in community as partners towards the fulfillment of personal hygiene in patients with self-care deficits.

**Methods:** The design of this study was pre-experimental with a one group pre-post-test approach. The population used was People with Mental Disorders (ODGJ) at the Bani Amrini Mental Health Foundation with a sample size of 35 using the Total Sampling technique. The independent variable was community as partner and the dependent variable was the fulfillment of personal hygiene. Data sources were collected through observations of the fulfillment of personal hygiene using the Wilcoxon Signed Rank Test with a significance value ( $\alpha$ ) of 0.05.

**Results:** The test results obtained a P-value (0.000) for fulfillment personal hygiene People with Mental Disorders (ODGJ) patients before and after being given community as partner showed that there was a difference between community as a partner in improving fulfillment personal hygiene People with Mental Disorders (ODGJ) patients.

**Conclusions:** The researcher's suggestion is that it is important to implement community as partner therapy continuously to improve the fulfillment of personal hygiene for People with Mental Disorders (ODGJ) patients so that it is expected to help accelerate the recovery and healing process for People with Mental Disorders (ODGJ) patients at the Bani Amrini Mental Health Foundation.

**Keywords 3-5 words:** Community As Partner; Fulfillment of Personal Hygiene; People with Mental Disorders

## The Role Of Adolescent Posyandu In The Detection And Prevention Of Anemia: A Health Belief Model Approach

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### **Abstract**

**Introduction:** Anemia remains a serious public health problem, particularly in low- and middle-income countries. This condition occurs when the number of red blood cells or hemoglobin levels falls below normal limits. Data from the Central Maluku District Health Office indicate that the prevalence of anemia is higher among adolescent girls than among adolescent boys. This study aims to examine the role of adolescent Posyandu (community-based health posts) in the detection and prevention of anemia using the Health Belief Model approach.

**Methods:** This study employed a qualitative research method with a phenomenological approach. Informants were selected using purposive sampling. Participants consisted of four adolescent girls aged 10–19 years, one youth health cadre, two health workers, and one village government representative. Data collection techniques included interviews, documentation, and observation.

**Results:** The results showed that anemia-related problems in Central Maluku District were influenced by several factors, including: 1) perceived susceptibility to anemia (knowledge of anemia and its causes), 2) perceived severity (risks and impacts of anemia), 3) perceived benefits (consumption of iron supplementation tablets and participation in adolescent Posyandu), 4) barriers to prevention (low adolescent participation and low adherence to iron supplementation tablet consumption), and 5) the role of adolescent Posyandu (health education/counseling and health examination services).

**Conclusions:** The study concludes that adolescent Posyandu plays an important role in preventing anemia among adolescents. Through education, distribution of iron supplementation tablets, and hemoglobin testing, adolescent Posyandu serves as the frontline in promotive and preventive efforts to address adolescent anemia.

**Keywords 3-5 words:** Adolescent Posyandu, Anemia, Health Belief Model

## Interventions to Reduce Stigma and Psychosocial Burden Among Adult Stroke Survivors: A Systematic Review

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### **Abstract**

**Introduction:** Stroke is a major global health problem associated with psychosocial consequences, particularly stigma, which contributes to psychological distress, reduced social participation, maladaptive coping, and poor quality of life. It is necessary to identify effective psychosocial interventions to reduce stigma and improve psychosocial outcomes among adult stroke survivors.

**Methods:** This systematic review was conducted following PRISMA 2020 guidelines. We searched PubMed, ScienceDirect, and SpringerLink for randomized controlled trials published between 2020 and 2025. The inclusion criteria were developed according to PICO and D: Population (P): adult stroke survivors; Intervention (I): psychosocial interventions delivered by nurses or multidisciplinary teams; Comparison (C): usual care; Outcome (O): stigma and stigma related psychosocial outcomes; and Design (D): randomized controlled trials. Data were extracted and synthesized narratively.

**Results:** There were 10 studies reviewed from 515 results, including nurse-led peer support, health coaching, participation focused programmes, family focused dyadic psychoeducation, workbook based psychosocial interventions, hope based interventions, meditation, mindfulness-based stress reduction, motivational interviewing, and therapeutic conversations. Two studies reported direct reductions in stigma, while all studies consistently improved stigma related psychosocial outcomes, including self-efficacy, social participation, emotional well-being, resilience, coping, and functional independence.

**Conclusions:** Evidence directly targeting stigma reduction remains limited. However, psychosocial interventions, particularly nurse-led interventions, consistently improve stigma related psychosocial outcomes. These findings indicate that psychosocial interventions have strong potential to reduce stigma experiences and support long term psychosocial recovery among adult stroke survivors.

**Keywords 3-5 words:** Nursing interventions, Psychosocial outcomes, Self-efficacy, Stigma, Stroke survivors

## Midwives and Diagnosis Delay on Endometriosis: A Narrative Review

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### **Abstract**

**Introduction:** Endometriosis is the presence of endometrium-like tissue outside the uterine cavity, which induces a chronic inflammatory reaction. This disease is progressive, with the most common symptom was severe dysmenorrhea. Delayed diagnosis remains a problem in the management of endometriosis, as it takes between 6-10 years to be diagnosed. Midwives, who are one of the primary service providers in primary health facilities, might contribute to this problem. Thus, the purpose of this narrative review was to analyze existing research on midwives' knowledge, awareness, and attitudes regarding endometriosis and its early detection.

**Methods:** A literature search was performed using four electronic databases: PubMed, Scopus, Sage Journals, and Web of Science. This search covered quantitative, qualitative, and mixed-methods research studies. The appraisal was done using the Joanna Briggs Institute's critical tool. A total of 19 published articles were analyzed.

**Results:** Thirteen articles assessed knowledge of midwives, 5 assessed attitudes, and only 1 article assessed awareness of midwives regarding endometriosis and its early detection. The studies reveal the differences in knowledge, awareness, and attitudes regarding endometriosis among midwives from different countries. Inadequate knowledge, inadequate awareness, inadequate training, and lack of screening instruments in primary health facilities were common reasons for the delayed diagnosis of endometriosis.

**Conclusions:** Midwives' knowledge, awareness, and attitudes regarding endometriosis and its early detection were unsatisfactory. This condition may contribute to the high rate of delayed diagnosis of endometriosis. Regular in-service training is needed and resources of screening instruments should be available at the primary care level.

**Keywords:** knowledge, awareness, attitude, endometriosis, midwife

## APPI-SCORE: An Innovative Scoring Model for Predicting Post-Appendectomy Complications at Heart & Surgery Hospital Bangkalan

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### **Abstract**

**Introduction:** Post-appendectomy complications remain a significant clinical problem, as they are associated with increased morbidity and prolonged length of hospital stay. This study aimed to identify risk factors for post-appendectomy complications, evaluate the strength of their associations, and develop a risk-based scoring model to predict postoperative complications.

**Methods:** This study was an observational analytical study based on medical record data of patients with appendicitis who underwent appendectomy. The variables analyzed included clinical factors, laboratory parameters (preoperative leukocyte count), and intraoperative factors. Bivariate analysis was performed to identify factors associated with postoperative complications, followed by multivariate analysis to determine the independent risk factors with the greatest contribution. Subsequently, a predictive risk scoring model was developed and evaluated using receiver operating characteristic (ROC) curve analysis.

**Results:** Bivariate analysis demonstrated that duration of symptoms, type of appendicitis, preoperative leukocyte count, and surgical technique were significantly associated with post-appendectomy complications. Multivariate analysis identified time to surgery, type of appendicitis, and preoperative leukocyte count as the primary independent risk factors for postoperative complications. The developed scoring model showed good discriminative ability, with an area under the curve (AUC) of 0.804 and an optimal cut-off value of 7.5 to distinguish between patients with and without complications.

**Conclusions:** Inflammatory factors and delayed time to surgery are major risk factors contributing to post-appendectomy complications. The risk-based scoring model demonstrated good performance in clinical risk stratification and has potential utility as a decision-support tool in clinical practice. External validation in broader populations is required to ensure the generalizability and stability of the model's performance

**Keywords 3-5 words:** Appendicitis, post-appendectomy complications, prediction, risk score.

## Physicochemical Characterization and Cytotoxic Evaluation of Julang-Jaling (*Archidendron bubalinum*) Nanoparticles Against MCF-7 Cells

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### **Abstract**

**Introduction:** Breast cancer remains one of the leading causes of cancer-related mortality among women worldwide, and limitations associated with current therapeutic strategies, including drug resistance and systemic toxicity, highlight the need for safer and more effective alternatives. Plant-derived bioactive compounds offer promising anticancer potential; however, their clinical application is often constrained by poor physicochemical stability and bioavailability. Nanoparticle-based delivery systems represent a viable approach to overcoming these challenges. This study aimed to evaluate the physicochemical characteristics and cytotoxic activity of julang-jaling (*Archidendron bubalinum*) seed extract nanoparticles against MCF-7 breast cancer cells.

**Methods:** Targeted LC-MS analysis was performed to identify major bioactive constituents, followed by molecular docking to assess interactions with key breast cancer-related targets, namely CDK6, ER $\alpha$ , and AKT1. Nanoparticles were synthesized by ionic gelation and ultrasonication and characterized for size, surface charge, and morphology. Cytotoxic activity was evaluated using a WST-8 assay on MCF-7 cells

**Results:** LC-MS profiling identified flavonoids and phenolic acids as dominant constituents, with ferulic acid and gallic acid showing the highest relative abundance. Molecular docking revealed strong binding affinities of quercetin and kaempferol toward CDK6, ER $\alpha$ , and AKT1. The nanoparticles exhibited a polydisperse size distribution with aggregated morphology and low surface charge. In vitro assays showed a concentration-dependent cytotoxic effect on MCF-7 cells comparable to doxorubicin ( $p < 0.05$ ).

**Conclusions:** Julang-jaling nanoparticles exhibit promising physicochemical properties and significant anticancer activity, supporting their potential as a plant-based nanotherapeutic candidate for breast cancer treatment.

**Keywords:** *Archidendron bubalinum*; breast cancer; molecular docking; nanoparticles; phytochemicals

## The Effect of Tai Chi Exercise on Insomnia Among Elderly at Margo Mukti Nursing Home Rembang

Hyan Oktodia Basuki\*<sup>1</sup>, Pita Mariana <sup>2</sup>, Dyah Pitaloka<sup>3</sup>, Suhartono<sup>4</sup>,  
Hanim Nur Faizah<sup>5</sup>

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### **Abstract**

**Introduction:** Insomnia is a common sleep disorder among older adults and may negatively affect quality of life as well as physical and psychological health. One nonpharmacological approach that can be used to manage insomnia in the elderly is Tai Chi exercise. This study aimed to determine the effect of tai chi exercise on insomnia among older adults at Margo Mukti Nursing Home, Rembang.

**Methods:** This study employed a quantitative pre-experimental design using a one group pre-test post-test approach. A total of 28 elderly participants were selected through purposive sampling. Insomnia levels were measured using the Insomnia Severity Index before and after the Tai Chi intervention.

**Results:** Data were analyzed using the wilcoxon signed rank test. the results showed a significant difference in insomnia levels before and after the tai chi exercise, with a p value of 0.005. These findings indicate that tai chi exercise has a significant effect on reducing insomnia among older adults.

**Conclusions:** Tai chi exercise can be recommended as a safe and feasible nonpharmacological intervention to improve sleep quality in the elderly

**Keywords 3-5 words:** Elderly, Insomnia, Tai Chi Exercise

## Comparison Of Acupuncture And Moxibustion Therapies At ST 36, ST 40, SP 6, And RN 12 In Reducing Cholesterol Levels In Patients With Hypercholesterolemia: A Randomized Controlled Trial

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### **Abstract**

**Introduction:** Hypercholesterolemia is a major risk factor for cardiovascular disease and requires long-term management. Complementary therapies such as acupuncture and moxibustion have been widely used to reduce cholesterol levels; however, comparative evidence regarding their effectiveness remains limited. This study aimed to compare the effects of acupuncture therapy and moxibustion therapy on reducing total cholesterol levels in patients with hypercholesterolemia.

**Methods:** A randomized controlled trial was conducted in Mojosongo, Surakarta, Indonesia, from March to August 2023. Fifty patients with hypercholesterolemia were recruited using random sampling and randomly allocated into two groups (n=25 each). The acupuncture group received stimulation at Zusanli (ST 36), Fenglong (ST 40), Sanyinjiao (SP 6), and Zhongwan (RN 12), while the comparison group received moxibustion therapy. Both interventions were administered for 10 sessions, three times per week. Pre- and post-intervention total cholesterol levels were analyzed using the Wilcoxon test or Paired T-Test according to data normality.

**Results:** The results showed a statistically significant reduction in total cholesterol levels in both the acupuncture group (p<0.05) and the moxibustion group (p<0.05). Both interventions demonstrated significant effects in lowering cholesterol levels among patients with hypercholesterolemia.

**Conclusions:** Acupuncture and moxibustion therapies demonstrated comparable effectiveness in reducing total cholesterol levels in patients with hypercholesterolemia. These findings support the potential role of both modalities as complementary approaches in lipid management.

**Keywords** 3-5 **words:** *acupuncture; hypercholesterolemia; moxibustion; traditional medicine*

## Voxel-Based Dosimetry Study with Model Selection for Tumor Dose Quantification in Patients with Hepatocellular Carcinoma (HCC) Treated Using $^{177}\text{Lu}$ -DOTATATE

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### **Abstract**

**Introduction:** Hepatocellular carcinoma (HCC) is a leading cause of cancer death and needs more personalized therapies. Targeted radionuclide therapy with  $^{177}\text{Lu}$ -DOTATATE may have potential for treating HCC that expresses Somatostatin Receptor subtype 2 (SSTR2), but success depends on accurate internal dosimetry. Conventional organ- and voxel-based dosimetry using a single monoexponential model struggles to represent dose heterogeneity. This study aims to develop and assess an integrated model selection voxel-based dosimetry to improve accuracy, precision, and dose heterogeneity representation.

**Methods:** SPECT/CT serial data (four post-injection time points) from two HCC patients were processed through registration, tumor segmentation, and voxel-based dose rate-time biokinetic extraction. Biokinetic modeling used Sum of Exponentials (SOE) with monoexponential and biexponential model candidates. Model selection per voxel was based on Bayesian Information Criterion (BIC) and goodness-of-fit measure. The selected model produced voxel absorbed dose estimates. Heterogeneity analysis used Dose Volume Histogram (DVH) and dose map visualization. Method performance was compared using RD, RMSE, and MAPE.

**Results:** Model selection in voxel-based dosimetry improves fitting quality and parameter estimation stability over the monoexponential approach. The biexponential model dominates most voxels, highlighting pharmacokinetic heterogeneity in HCC tumors. This method demonstrated spatial dose heterogeneity than conventional approaches, with quantitative evaluation showing improved accuracy and precision in dose estimation, as reflected in RD, RMSE, and MAPE values.

**Conclusions:** Model selection in voxel dosimetry provides a more effective approach than conventional methods, particularly in characterizing pharmacokinetic heterogeneity and dose distribution in HCC tumors treated with  $^{177}\text{Lu}$ -DOTATATE, improving the accuracy, precision, and reliability of absorbed dose estimates.

**Keywords 3-5 words:**  $^{177}\text{Lu}$ -DOTATATE, hepatocellular carcinoma, pharmacokinetic model selection, targeted radionuclide therapy, voxel-based dosimetry.

## Comparative Physicochemical and Antioxidant Analyses of Chitosan–TPP Nanocarriers Encapsulating Mangosteen Peel Extract and $\alpha$ -Mangosteen

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### **Abstract**

**Introduction:** Environmental stressors such as UV radiation and pollutants accelerate skin aging by increasing oxidative stress and triggering inflammatory pathways, including MAPK, AP-1, and NF- $\kappa$ B. Mangosteen (*Garcinia mangostana* L.) peel extract and its major xanthone,  $\alpha$ -Mangosteen, possess strong antioxidant and anti-inflammatory activities but face limitations related to solubility, stability, and bioavailability. This study aimed to evaluate the physicochemical characteristics and antioxidant potential of mangosteen peel extract and  $\alpha$ -Mangosteen encapsulated in chitosan–tripolyphosphate (TPP) nanoparticles.

**Methods:** Nanoparticles were prepared via ionic gelation and characterized using particle size analysis (PSA) and zeta potential measurement. Antioxidant activity was assessed using DPPH, ABTS, FRAP, H<sub>2</sub>O<sub>2</sub>, and NO scavenging assays.

**Results:** The extract and  $\alpha$ -Mangosteen nanoparticles exhibited particle sizes of 444.2 nm and 622.8 nm, respectively, with moderately negative zeta potentials (–12.5 to –14.1 mV), indicating partial colloidal stability. Mangosteen extract nanoparticles demonstrated particularly strong H<sub>2</sub>O<sub>2</sub> scavenging activity (IC<sub>50</sub> = 6.32  $\mu$ g/mL), while  $\alpha$ -Mangosteen showed moderate radical-scavenging performance. The complementary antioxidant profiles of the extract and  $\alpha$ -Mangosteen suggest that chitosan–TPP nanoencapsulation enhances their stability and functional activity.

**Conclusions:** These findings highlight the potential of mangosteen-based nanoparticles as natural therapeutic candidates for managing oxidative stress-related skin damage.

**Keywords 3-5 words:**  $\alpha$ -Mangostin; Antioxidant activity; Chitosan–TPP nanoparticles; Mangosteen peel extract; Oxidative stress

## **Branding Guidelines: Sharia-Compliant Services and Environment to Enhance Patient Loyalty through Self-Belief Moderation at Heart and Surgery Specialized Hospital**

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### **Abstract**

**Introduction:** Competition among private hospitals that do not partner with the national health insurance system requires effective branding strategies to foster patient loyalty. RSKB Heart and Surgery Hospital in Bangkalan Regency has opportunities for differentiation through the implementation of sharia-based services and environments within the framework of hospital brand awareness. This study aims to analyze the effect of sharia-based services and sharia-based environments on patient loyalty and to examine the moderating role of self-belief

**Methods:** The study employed a quantitative explanatory approach with a cross-sectional design. A sample of 165 outpatient and inpatient respondents was selected using the Slovin formula. Data were collected through a five-point Likert-scale questionnaire that had been tested for validity and reliability, and were analyzed using linear regression and Moderated Regression Analysis (MRA)

**Results:** The results indicate that shariabased services have a significant effect on patient loyalty, while the sharia-based environment does not. Self-belief does not moderate the relationship between sharia-based services or environment and patient loyalty, although it improves the model's explanatory power

**Conclusions:** The findings suggest that sharia-based service aspects directly experienced through interaction, empathy, and Islamic professionalism play a more decisive role in shaping patient loyalty than physical and nonphysical environmental factors

**Keywords 3-5 words:** Hospital branding, Patient loyalty, Self-belief, Sharia-based environment, Shariabased services

## The Relationship Between Husband's Support And Mother's Anxiety Levels During Premenopausal Period

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### **Abstract**

**Introduction:** Premenopausal syndrome is experienced by many women. A preliminary study in Karang Anyar Hamlet, West Klampis Village, found that 70% of premenopausal women felt anxious about entering premenopause. Husband's support is important in reducing wives' anxiety during premenopause. The purpose of this study was to analyze the relationship between husband's support and maternal anxiety levels during premenopause in Karang Anyar Hamlet, West Klampis Village, Klampis District, Bangkalan Regency.

**Methods:** The study used a quantitative analytical approach using correlational methods. The design was cross-sectional. The independent variable was husband's support, and the dependent variable was maternal anxiety during premenopause. The study population was 45 premenopausal women, with a sample size of 31 women using simple random sampling. Data collection used the Taylor Manifest Anxiety Scale (TMAS) questionnaire and the husband's support questionnaire. The study was declared ethically sound by KEPK No. 2887/KEPK/UNIV-NHM/EC/X/2025.

**Results:** The study found that 85.7% of premenopausal mothers with good husband support experienced mild anxiety during premenopause, while half (50%) of those with less husband support experienced severe anxiety during premenopause. Data analysis using Spearman rank correlation analysis showed a significance test (Sig. (2-Tailed) of  $0.001 < 0.005$ ), concluding that there is a significant relationship between husband support and maternal anxiety during premenopause.

**Conclusions:** The conclusion is husbands need to provide full support to their wives during menopause. Midwives are expected to provide education and motivation to husbands to create a supportive environment for mothers entering menopause to reduce their anxiety.

**Keywords 3-5 words:** *Husband's Support, Premenopausal Mother's Anxiety, Premenopausal Period*

## Early Detection Of TB Sufferers with The KAPAK TBC Program At Banyuates Public Health Center, Sampang

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### **Abstract**

**Introduction:** Tuberculosis (TB) remains a health problem with low case detection rates in the Banyuates Community Health Center (Puskesmas) in Sampang. Limited early detection leads to delays in diagnosis and increases the risk of community transmission. The KAPAK TBC (Recognize, Check, Visit) innovation was developed as a strategy to empower health cadres in improving active case finding through community screening, referral for diagnostic testing, and home visits. This study aims to assess the effectiveness of KAPAK TBC in improving cadre skills, community knowledge, and case detection coverage

**Methods:** The study design was a quasi-experimental pretest-posttest on 10 cadres and 32 contact families. Interventions included cadre training, active screening, facilitation of sputum smear/TCM assistance, and home visits. Analysis used a paired t-test and Wilcoxon

**Results:** Results showed a significant increase in cadre skills ( $p = 0.000$ ) and community knowledge ( $p = 0.000$ ). TB symptoms and sputum smear results also significantly improved ( $p = 0.005$ ).

**Conclusions:** The KAPAK TBC method has proven effective in strengthening cadre capacity and improving community knowledge, and increasing TB case detection coverage through a proactive community-based approach.

**Keywords 3-5 words:** Tuberculosis, KAPAK TBC, Health Cadres, Early Detection

## The Impact of JENG IVA CANTIKS Program on IVA Inspection Coverage at Kamal Primary Health Center

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### **Abstract**

**Introduction:** Coverage of national cervical cancer screening is still low. This study aimed to examine the effect of the JENG IVA CANTIKS program on improving IVA screening coverage.

**Methods:** A quasi-experimental design was employed. The dependent variable was IVA screening coverage, and the independent variable was the JENG IVA CANTIKS program. The study population consisted of all villages within the health center's catchment area, totaling 10 villages, with the sample selected through total sampling of all 10 villages. Data were analyzed using a simple paired t-test.

**Results:** The results indicated a significance value of 0.000 ( $< 0.05$ ) in the paired sample t-test, demonstrating that the JENG IVA CANTIKS intervention had a significant effect on IVA screening coverage. However, the increase in coverage had not yet reached the national standard of 75%.

**Conclusions:** Therefore, the health center needs to strengthen the existing program by considering community behavioral assessments and cross-sectoral collaboration as a basis for establishing effective strategies to educate, motivate, and promote the importance of IVA screening.

**Keywords:** Cervical Cancer, Coverage of VIA Screening, Public health

## DOTS (Directly Observed Treatment Shortcourses) Team in Tuberculosis Prevention Therapy Achievements in Families of TB Patients

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### **Abstract**

**Introduction:** Tuberculosis (TB) remains a global health problem, including in Indonesia, with low coverage of Tuberculosis Preventive Therapy (TPT) among household contacts. This condition is influenced by limited education, inadequate monitoring, and suboptimal assistance. This study aimed to evaluate the effectiveness of the DOTS Team Movement in improving knowledge, satisfaction, and TPT coverage among families of TB patients in the working area of Batulenger Health Center, Sampang

**Methods:** The research employed a quasi-experimental one-group pretest-posttest design involving 69 respondents and 23 contact families. The intervention included home visits, education, screening, and treatment support conducted by a multidisciplinary team.

**Results:** The results showed significant improvements in knowledge, satisfaction, and TPT coverage.

**Conclusions:** The home-visit approach and direct supervision proved effective in enhancing family understanding, motivation, and adherence, making it a potential sustainable intervention model for TB elimination in primary healthcare services.

**Keywords 3-5 words:** DOTS, Tuberculosis Preventive Therapy, TPT

## DESAKU ASIK: A Stigma-Free Village For Leprosy Elimination And Early Detection

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### **Abstract**

**Introduction:** Leprosy remains a public health problem in Indonesia and impacts medical, social, economic, and psychological aspects. High stigma often leads to delayed diagnosis, necessitating effective educational interventions. This study evaluated the effectiveness of the DESAKU ASIK Innovation Program in increasing knowledge, reducing stigma, and strengthening early detection of leprosy in Plakaran Village.

**Methods:** This study used a one-group pretest-posttest pre-experimental design to assess the effectiveness of the DESAKU ASIK Program in increasing knowledge and reducing community stigma towards leprosy in Plakaran Village.

**Results:** . The results showed a significant increase in knowledge, with an average score increasing from 23.36 to 42.20 and an N-Gain of 0.70. Stigma also decreased sharply, from an average of 41.33 to 20.49 with an N-Gain of 0.70. The program also strengthened early detection through active screening, which identified seven suspects who subsequently tested negative.

**Conclusions:** Overall, DESAKU ASIK proved highly effective as a community-based educational intervention

**Keywords 3-5 words:** leprosy, stigma, community education, DESAKU ASIK, empowerment

## Development of an E-Medical Record Information System for Pregnant Women with Preeclampsia Risk Independent Practice of Midwives in Bangkalan Regency

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### **Abstract**

**Introduction:** The high maternal mortality rate (MMR) is still a major problem in the Bangkalan Regency and even in Indonesia, one of the causes of MMR is the occurrence of preeclampsia during the pregnancy period. So far, services for pregnant women in independent midwife practices still use manual procedures by utilizing register books and KIA books. This research aims to develop an e-medical record information system for pregnant women at risk of preeclampsia at the Independent Midwife Practice of Bangkalan Regency

**Methods:** Information system development process development methods prototype. The information system testing process is carried out using testing black-box. The research subjects consisted of 5 midwives who carried out independent midwifery practice (PMB), 2 academics and 1 person from a professional organization. Qualitative data was obtained using interviews and observation as material for needs analysis user.

**Results:** The research results are processed in form flowchart information Systems, context diagram, data flow diagram, entity relationship diagram. The design is processed into the JavaScript programming language combined with the MongoDB database. From the results of this research, the information system has several features including; feature login, features for recording pregnant women, admin features, home features, features for early detection of the risk of preeclampsia, features for recording examination results for pregnant women and report features, as well as e-medical record features. Next, an evaluation of user satisfaction will be carried out End User Computing Satisfaction (EUCS). In the aspect of variable satisfaction content, accuracy, ease of use, and timeliness On average, informants answered that they were satisfied and greatly helped by the information system.

**Conclusions:** The conclusion is that the information system is very helpful for midwives' independent practice in improving health services by utilizing the function of the information system in it. Suggestions for development are that it is hoped that this e-medical record information system can be connected to higher health facilities such as community health centers and hospitals.

**Keywords 3-5 words:** *Information System, Early Detection, Preeclampsia, Pregnant Woman, EUCS*

## SIAPMASEH Application Development To Improve Patient Satisfaction With Outpatients Service

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### **Abstract**

**Introduction:** The development of the SIAPMASEH application as a digital solution to transform outpatient services. The purpose of this study was to analyze and evaluate the level of patient satisfaction with outpatient services after the implementation of the SIAPMASEH application.

**Methods:** The research method used in this study was a correlation analytic method with a Quasi-Experiment approach (One group Pre-Post Test Design), involving 54 respondents.

**Results:** The results showed an increase in satisfaction from 30 respondents to 53 respondents for the 'very satisfied' category. For the 'satisfied' category, the number decreased from 17 respondents to 1 respondent

**Conclusions:** Overall, the SIAPMASEH application proved effective in increasing outpatient service satisfaction.

**Keywords 3-5 words:** Patient Satisfaction, Outpatient Services, Service, Application

## A Study Of Pregnant Women's Knowledge, Perception, And Family Support In The Maternal Ultrasound Program Pregnancy

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### **Abstract**

**Introduction:** Ultrasound examinations during pregnancy provide accurate information about fetal development. In fact, the International Federation of Gynecology and Obstetrics (FIGO) recommends two ultrasound examinations for pregnant women in the first and second trimesters. According to the 2019 Indonesian Health Profile data, in East Java in 2023 experienced a slight increase compared to the previous year. In 2023, the coverage of obstetric complications handled was 96%, while in 2022 it was 97%, but has reached the target of 80%. With the improved detection of obstetric complications, one of which is through ultrasound examinations according to POGI recommendations, it is hoped that it will facilitate their early treatment so that planned referrals can be made to reduce the number of maternal and infant deaths. The aim of this study was to identify the knowledge, perceptions of pregnant women and family support in the ultrasound program for pregnant women at the Tongguh Community Health Center, Bangkalan Regency.

**Methods:**The research design used is descriptive, using a cross-sectional study design. The variables in this study are knowledge of pregnant women, perceptions of pregnant women, and family support in participating in the ultrasound program for pregnant women. The population in this study was all pregnant women who visited ANC at Puskesmas Tongguh Bangkalan between January and March 2025, recorded in secondary data of 53 pregnant women, and a sample size of 47 pregnant women. The sampling technique for this study was purposive sampling.

**Results:**The majority of pregnant women (35 women) had a positive perception of the prenatal ultrasound program, while a small proportion (12 women) had a negative perception of the prenatal ultrasound program. The majority of pregnant women (35 women) had a positive perception of the prenatal ultrasound program, while a small proportion (12 women) had a negative perception of the prenatal ultrasound program. The majority of families (39 women) supported the respondents' pregnancy ultrasound examinations, while a small proportion (8 women) did not support the respondents' ultrasound examinations.

**Conclusions:**Based on the results of this study, it is hoped that it will be a source of information to increase public knowledge, especially for married couples with pregnant women, as useful input to increase positive responses in compliance with the USG examination program.

**Keywords 3-5 words:** Pregnant Women's - Knowledge - Perception- Family Support-Ultrasound Program

## Mobile Visual Inspection (IVA) and Clinical Breast Examination (SADANIS) at the Integrated Health Post (POSBINDU)

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### **Abstract**

**Introduction:** ABSTRACT In Indonesia, screening using the IVA technique is only performed by 6.83% of women aged 30- 50 years. The coverage of cervical cancer screening in Indonesia is still below the target of 70% in 2023, which is only 7.02%.

**Methods:** This study aims to compare the frequency of visits by women of childbearing age for IVA and sadanis examinations before and after the innovation of the IVA and sadanis examination movement at the mobile Posbindu. The sample for this innovation was 55 through simple random sampling

**Results:** The results of data analysis using the t-test obtained sig = 0.000, this means it is smaller than  $\alpha = 0.05$

**Conclusions:** Thus, Ho is rejected and Ha is accepted. There is an increase in visits by women of childbearing age for IVA and sadanis examinations before and after the innovation of the IVA and sadanis examination movement at the mobile Posbindu.

**Keywords 3-5 words:** IVA, Sadanis, Posbindu, Mobile

## Increasing Treatment Coverage And Access To Services For Hypertension Patients Through The Innovation Of The Kopiku Store At Pengarengan Public Health Center

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### Abstract

**Introduction:** Hypertension is an increase in systolic or diastolic blood pressure, and an individual is classified as hypertensive when the systolic blood pressure (SBP) is  $\geq 140$  mmHg and/or the diastolic blood pressure (DBP) is  $\geq 90$  mmHg upon repeated measurements, while normal blood pressure is defined as SBP  $< 130$  mmHg and DBP  $< 85$  mmHg. The compliance rate of hypertensive patients receiving treatment according to standards in the 2024 SPM at UPTD Puskesmas Pangarengan remains low at 29% of the 100% target. This study aims to analyze the effect of the GERAJ KOPIKU innovation, which includes one month of treatment services, hypertension exercise sessions, education, and discussions, on treatment compliance, improvement of patients' knowledge, and controlled blood pressure status

**Methods:** A pre-experimental method with a pre-post test design was employed using purposive sampling, resulting in 46 respondents. The independent variable was the GERAJ KOPIKU intervention, while the dependent variables were treatment compliance, knowledge level, and blood pressure status. Data were collected through questionnaires and blood pressure measurements before and after the intervention

**Results:** The Wilcoxon test indicated a significant effect of GERAJ KOPIKU on treatment compliance ( $p = 0.000 < 0.05$ ), knowledge improvement ( $p = 0.000 < 0.05$ ), and controlled blood pressure status ( $p = 0.001 < 0.05$ )

**Conclusions:** Thus, GERAJ KOPIKU is proven effective in improving compliance, enhancing knowledge, and supporting blood pressure control among hypertensive patients

**Keywords 3-5 words:** Hypertension; Treatment Compliance; Knowledge; Controlled blood pressure

## **“KAPE PAGI” (Post Tooth Extraction Instruction Card) Flashcard Media Health Promotion Efforts at Galis Public Health Center**

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### **Abstract**

**Introduction:** Tooth extraction is one of the most common procedures in dentistry. Tooth extraction is a procedure that removes a tooth from its socket in the alveolar bone. Tooth extraction is performed when no further treatment can be performed to preserve the tooth, requiring it to be removed. Many people are aware of the importance of maintaining oral health, but they still don't fully understand it, and many still choose tooth extraction rather than treating damaged teeth.

**Method:** This study is a Pre-Experimental One Group Pre-test/Post-test study. This study focuses on the form and practice of health services in the form of instruction cards in health promotion efforts using flash cards. The population in this study was 24 tooth extraction patients at the Dental and Oral Clinic of Galis Community Health Center. The innovation project instrument used was a questionnaire regarding respondent knowledge and satisfaction.

**Results:** The results show that almost all respondents before being given the Morning Card Innovation (Post Tooth Extraction Instruction Card) Flashcard Media Health Promotion Efforts had a knowledge level of "less" 15 people (62.5%)

**Conclusions:** Concluded that there is a significant difference between before and after being given Morning Card (Post Tooth Extraction Instruction Card) in Flash Card media health promotion efforts.

**Keywords 3-5 words:** *Tooth extraction, Flash Card Media, Health Promotion*

## The Effect of *Curcuma* Extract Emulsion as an Amara on Ghrelin–Leptin Hormone Profiles and Increased Feed Consumption in Male White Mice (*Mus musculus*)

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### **Abstract**

**Introduction:** Temulawak (*Curcuma xanthorrhiza* Roxb.) contains curcuminoids and essential oils that aid bile and pancreatic function, thereby improving food absorption in the intestines and increasing appetite. However, the underlying biological mechanisms of the hormones that regulate hunger and satiety have not been extensively reported. This study aims to analyze the appetite-suppressing mechanism of curcuma rhizome extract emulsion by observing changes in ghrelin and leptin hormone levels in male white mice (*Mus musculus*).

**Methods:** This study was an experimental study using a post-test only control group design. The test animals were divided into five groups: negative control (distilled water), positive control (appetite stimulant syrup), and three treatment groups that received temulawak extract emulsion at different concentrations (10%, 20%, and 30%). The treatment was administered orally for 21 days. The parameters obtained included ghrelin and leptin levels in serum, which were analyzed using the ELISA method, while additional parameters included daily feed intake and weight change. The data obtained were analyzed using normality and homogeneity tests, followed by one-way ANOVA and post-hoc tests.

**Results:** This study shows that administration of temulawak extract emulsion can enhance the effects of amara, as seen from increased feed intake and body weight, and mediated by increased ghrelin levels and/or decreased leptin levels when compared to the control.

**Conclusions:** This study concluded that temulawak functions as an appetite stimulant through hormonal pathways, which has the potential to be developed as a phytopharmaceutical candidate to increase appetite through a mechanism-based approach.

**Keywords 3-5 words:** amara, temulawak, *Curcuma xanthorrhiza*, ghrelin, leptin, appetite, ELISA

## The Effect Of Mangga Muda Method On Family Behavior In Efforts To Prevent And Transmission Of Pulmonary Tb

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### **Abstract**

**Introduction:** Nearly 969,000 cases of pulmonary tuberculosis have been reported in Indonesia, placing the country second globally. Family behavioral practices play a crucial role in preventing the spread of pulmonary tuberculosis and in reducing transmission risk. This study primarily aimed to compare family behaviors related to the prevention and transmission of pulmonary tuberculosis before and after the implementation of the Mangga Muda method.

**Methods:** A quasi-experimental study with a one-group pretest–posttest design was conducted. A total of 52 families of patients diagnosed with pulmonary tuberculosis were selected using a simple random sampling technique.

**Results:** Data were analyzed using a paired t-test, with statistical significance defined as a p-value less than 0.05. The results of the Wilcoxon signed-rank test showed a significance value of 0.000, which was lower than the  $\alpha$  level of 0.05

**Conclusions:** These findings indicate a statistically significant difference in family behavioral detection scores before and after the application of the Mangga Muda method.

**Keywords 3-5 words:** *behavior, family, prevention, transmission, pulmonary TB*

## Preeclampsia-Free Village Movement Through Early Detection Of Pregnant Women In The Working Area Of The Kokop Public Health Center

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### **Abstract**

**Introduction:** WHO (World Health Organization) estimates that pre-eclampsia cases are 7 times higher in developing countries than in developed countries and the main complication that causes almost 75% of all maternal deaths is preeclampsia. The purpose of this study was to analyze the difference in the number of detected high-risk preeclampsia before and after the preeclampsia-free village action method was carried out.

**Methods:** The research method used was a Quasy Experiment with a pre-post test One Group Design approach. Subjects were selected using simple random sampling with a sample size of 38 people.

**Results:** Data analysis used the Paired T-test with a significance level of p value <0.05. The results of the statistical test of the t-test results obtained sig = 0.000, this means it is smaller than  $\alpha = 0.05$

**Conclusions:** Indicating that there was an increase or there was a statistically significant difference in the number of detected high-risk preeclampsia before and after the preeclampsia-free village action method was carried out.

**Keywords 3-5 words:** Early detection, preeclampsia, KIA book

## The Influence of Leadership Style on Employee Performance at Bangkalan Community Health Center

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### **Abstract**

**Introduction:** Employee performance is an important factor in supporting the quality of health services at the Community Health Center (Puskesmas). One of the organizational factors that allegedly affects employee performance is leadership style. This study aims to analyze the influence of various leadership styles on employee performance at the Bangkalan Health Center.

**Methods:** This study uses a quantitative approach with a *cross-sectional* design through a survey method. The research was carried out in April 2024 at the Bangkalan Health Center, Bangkalan Regency, with a total of 80 respondents selected using *purposive sampling* techniques. Data were collected using a Likert scale questionnaire and analyzed using multiple linear regression with the help of IBM SPSS software. The independent variables in this study include transformational, transactional, situational, democratic, authoritarian, *laissez-faire*, and digital leadership styles, while the dependent variables are employee performance

**Results:** The results showed that only partially authoritarian leadership styles had a significant effect on employee performance, while transformational, transactional, situational, democratic, *laissez-faire*, and digital leadership styles did not show significant influence.

**Conclusions:** These findings indicate that in the context of Puskesmas as a public health service organization, a leadership style that emphasizes clarity of direction, supervision, and compliance with operational standards plays a greater role in improving employee performance than other leadership styles. This research is expected to be considered in the management of human resources in the Health Center.

**Keywords 3-5 words:** Leadership Style, performance, employees

## Effectiveness Of Walking And Prenatal Yoga On Stress Regulation, Cortisol Levels, And Blood Pressure In High-Risk Pregnancies For Preeclampsia Prevention

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### **Abstract**

**Introduction:** Preeclampsia is a pregnancy complication closely associated with vascular dysfunction, sympathetic nervous system activation, and increased stress responses. Pregnancy-related stress and elevated cortisol levels are known to contribute to impaired blood pressure regulation that precedes the development of preeclampsia. Safe non-pharmacological interventions are therefore needed to reduce stress responses and improve hemodynamic regulation in high-risk pregnant women. This study aimed to evaluate the effectiveness of a combined walking and prenatal yoga program in reducing stress, lowering cortisol levels, and controlling blood pressure as an early preventive strategy for preeclampsia.

**Methods:** A quasi-experimental pretest–posttest control group study was conducted among high-risk pregnant women. The intervention group completed a 12-week walking and prenatal yoga program, while the control group received routine antenatal care. Stress, cortisol, and blood pressure were measured using the NuPDQ, ELISA, and a sphygmomanometer. Statistical significance was set at  $p < 0.05$ .

**Results:** The intervention group showed significant reductions in pregnancy-related stress and cortisol levels after the intervention ( $p < 0.05$ ). In addition, significant decreases in systolic blood pressure, diastolic blood pressure, and mean arterial pressure were observed compared with the control group.

**Conclusions:** Walking exercise combined with prenatal yoga effectively reduced pregnancy-related stress and cortisol levels and improved blood pressure regulation in at-risk pregnant women. This combined intervention may serve as a safe and practical non-pharmacological strategy for the early prevention of preeclampsia

**Keywords 3-5 words:** pregnancy-related stress; cortisol; walking; prenatal yoga; preeclampsia

## The Effectiveness of Moringa (*Moringa oleifera*) Leaf Extract On Insulin Resistance In Mice (*Mus musculus*) Obesity Model

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### **Abstract**

**Introduction:** Insulin resistance is a degenerative condition produced by chronic metabolic disorders in obesity. Adipose tissue in obesity secretes pro-inflammatory cytokines that cause low-grade chronic inflammation both locally and systemically, which will cause insulin resistance. The purpose of this study is to determine the effectiveness of Moringa leaf extract (*Moringa oleifera*) on insulin resistance in mice (*Mus musculus*) obesity model.

**Methods:** The research method was true experimental with only a posttest with a control group design. The test animals used were mice (*Mus musculus*), consisting of negative control, positive control, DK 150, and DK300 groups. The insulin resistance model was performed by giving a high-fat diet (HFD) and 25% fructose. Body weight weighing is done three days once, with a glucose tolerance test (GTT) in week 9 and an insulin tolerance test (ITT) in week 10.

**Results:** The phytochemical test result of Moringa (*Moringa oleifera*) leaf extract showed the presence of flavonoids. The result of the GTT test showed that the DK150 and DK300 groups were significantly different from the positive group ( $p < 0.05$ ). While the ITT test results in the DK300 group were significantly different from the positive group ( $p < 0.05$ ). The administration of Moringa leaf extract (*Moringa oleifera*) gives the effect of improving insulin sensitivity in mice, mainly in the DK300 group, which is a dose of 675 mg/ml.

**Conclusions:** The flavonoids contained in moringa leaf extract act as antioxidants, thereby enhancing the defense of pancreatic  $\beta$ -cells, which ultimately reduces insulin resistance.

**Keywords 3-5 words:** *Insulin Resistance, Moringa Leaf, High fat Diet*

## The Effectiveness of a Role-Play Simulation of Basic Life Support on the Knowledge Level of Coastal Communities in Handling Drowning Victims

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### **Abstract**

**Introduction:** The high number of drowning cases around coastal areas requires first aid, which is mostly carried out by coastal communities. This treatment is inseparable from the provision of Basic Life Support (BLS) to drowning victims by trained community members. Therefore, coastal communities must have basic knowledge of how to provide BLS to drowning victims. The purpose of this study was to determine the effectiveness of providing a Role Play Simulation on BLS on the level of knowledge of coastal communities in handling drowning victims. The number of deaths due to drowning at sea reaches 43% of the total deaths. Drowning at sea is the leading cause of death worldwide, with more than 80% of total deaths (WHO, 2022).

**Methods:** This research was conducted after an ethical feasibility test was conducted at KEPK NHM University and was declared ethically feasible with Reg No: 2703/KEPK/UNIV-NHM/EC/II/2025. The research design was two groups (experimental and control groups) pre-post test design. A total of 140 respondents (communities around the coast) were sampled in this study. The research instrument used a knowledge questionnaire and Role play Simulation observation sheet. Data analysis used the Wilcoxon test.

**Results:** The results of the study showed that the knowledge of coastal communities before the intervention had an average value of 14.47 in the control group and 13.84 in the experimental group and after the intervention had an average value of 14.39 in the control group and 15.77 in the experimental group. The results of the Wilcoxon test obtained a p-value of 0.000 (p-value  $\leq \alpha$ ).

**Conclusions:** The conclusion is that there is an influence of providing Role Play Simulation about BHD on the knowledge of coastal communities in handling drowning victims on the coast of Tlangoh Beach, Tanjung Bumi District - Bangkalan

**Keywords 3-5 words:** Simulation Role Play, Basic Life Support, Drowning Victims

## Identification of a Minimum Family History Dataset in Electronic Medical Records as a Basis for Early Detection of Genetic Diseases

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### **Abstract**

**Introduction:** Electronic Medical Records (EMR) play a crucial role in supporting healthcare services and clinical decision-making, yet family history recording remains unstructured and underutilized in healthcare practice. This situation necessitates the identification of the most essential family history data elements to ensure more focused, consistent, and applicable recording. This study aims to identify a minimum family history dataset in EMR as a basis for early detection of genetic diseases.

**Methods:** The research method used was a two-round Delphi involving 15 expert panels consisting of clinical doctors, senior medical records staff, and medical records academics.

**Results:** The results showed that in the first Delphi round, of the 15 initial elements of family history evaluated, 12 elements reached consensus, while 3 elements were excluded because they were deemed less suitable for consistent recording, and 2 additional elements emerged based on input from the expert panel. In the second Delphi round, all 14 elements evaluated reached consensus with a median value  $\geq 4$  and an IQR  $\leq 1$ . These elements included family structure, family disease history, and genetic patterns and risks that were deemed clinically important and relevant to daily healthcare practice.

**Conclusions:** This research produced 14 minimum elements of a family history dataset that can be used as a conceptual basis for the development or integration of more structured family history recording in an RME system to support early detection of genetic diseases.

**Keywords 3-5 words:** Electronic Medical Records, Family History, Minimum Dataset, Early Detection of Genetic Diseases, Delphi Method

## Analysis Of Pure Honey As An Alternative To Reduce The Frequency Of Diarrhea In Toddlers

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### **Abstract**

**Introduction:** Diarrhea is one of the leading causes of morbidity and mortality among toddlers in developing countries. Standard therapy such as oral rehydration solution (ORS) is effective in preventing dehydration; however, it has not been shown to reduce the frequency of diarrhea. Pure honey contains antibacterial and prebiotic compounds that have the potential to improve intestinal function and reduce the frequency of diarrhea. The purpose of this study was to determine the effect of pure honey administration on reducing the frequency of defecation in toddlers with diarrhea compared to ORS administration.

**Methods:** This study used a quasi-experimental design with a two-group pretest–posttest with control design. The sample consisted of 32 toddlers suffering from diarrhea, divided into two groups: the treatment group (given 5 ml of pure honey three times daily for 3 days) and the control group (given ORS). Data were collected using observation sheets and analyzed bivariately using the Wilcoxon and Mann–Whitney tests.

**Results:** The results showed that in the pure honey group, most toddlers no longer experienced diarrhea—13 toddlers (81.3%) had normal bowel movements, 3 toddlers (18.8%) had mild diarrhea, and none had severe diarrhea (0%). In the ORS group, 12 toddlers (75.0%) no longer experienced diarrhea, 4 toddlers (25.0%) had mild diarrhea, and none had severe diarrhea (0%). Statistical analysis using the Mann–Whitney test showed a p-value of 0.674 (>0.05), indicating no significant difference in defecation frequency between toddlers given pure honey and those given ORS at TPMB Sayang Ibu Lergunong Klampis Bangkalan.

**Conclusions:** The administration of pure honey is effective in reducing the frequency of diarrhea in toddlers and can be used as a natural alternative therapy to support standard treatment.

**Keywords 3-5 words:** *Pure Honey, Diarrhea, Toddlers, Defecation Frequency*

## The Effect Of Complete Food Preparation Training On Mothers' Knowledge About Providing Complete Food To Infants Aged 6-9 Months At The Konang Public Health Center

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### **Abstract**

**Introduction:** Proper complementary feeding is an essential factor in supporting optimal infant growth and development. However, many mothers still have limited knowledge regarding the appropriate timing, types, and methods of Complementary Feeding provision. This study aims to analyze the effect of MPASI-making training on mothers' knowledge about complementary feeding for infants aged 6–9 months at Konang Public Health Center.

**Methods:** This research employed a pre-experimental design with a one-group pretest-posttest approach. The sample consisted of 28 mothers with infants aged 6–9 months, selected using purposive sampling. The research instrument was a knowledge questionnaire on Complementary Feeding, while the intervention was conducted through training sessions that included counseling, demonstrations, and hands-on practice in preparing nutritious Complementary Feeding. Data were analyzed using the Wilcoxon test. This research has passed ethical feasibility test with number: 2780/KEPK/UNIV-NHM/EC/VII/2025.

**Results:** The results showed that before the training, most mothers had a low level of knowledge, totaling 20 respondents (71.4%), while after the training, most mothers' knowledge improved to a moderate level, totaling 17 respondents (60.7%). The mean knowledge score increased from 3.75 before training to 6.82 after training. Statistical analysis showed a  $p$ -value of 0.000 ( $p < 0.05$ ), indicating a significant effect of Complementary Feeding-making training on mothers' knowledge improvement.

Therefore, Complementary Feeding training is proven effective in enhancing mothers' understanding of proper complementary feeding according to infants' age. This study recommends that similar training programs be conducted continuously and integrated into *posyandu* (community health post) activities to improve public knowledge and practices on balanced nutrition.

**Keywords 3-5 words:** *Complementary Feeding, Mother's Knowledge, Training*

## ESSAY-01

# Connecting Molecules to Communities: an Integrated Research Model for Equitable Vaccines and Global Health Solutions

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### Introduction

Global health challenges have evolved rapidly in the twenty first century. Emerging infectious diseases, antimicrobial resistance, pandemics, neglected tropical diseases, and unequal access to healthcare continue to threaten millions of lives each year. The COVID-19 pandemic demonstrated that scientific progress alone is insufficient when research, production, and distribution systems operate in isolation. Vaccines were developed at unprecedented speed, yet disparities in access left many low-income countries vulnerable. This reality highlights an urgent need for a more coordinated, interdisciplinary, and integrated research framework.

Integrated research refers to the collaboration of multiple scientific disciplines, institutions, and stakeholders from molecular biology and epidemiology to data science, public policy, and community health in order to develop comprehensive solutions. In the context of vaccines and therapies, integration ensures that innovation is not only technologically advanced but also accessible, affordable, and adaptable to diverse populations. This essay argues that integrated research models combining biotechnology, digital health tools, global partnerships, and community-based implementation strategies are essential for developing effective vaccines and therapies to address global health challenges sustainably.

### Discussion and Analysis

#### 1. The Growing Complexity of Global Health Threats

Modern health threats are interconnected and complex. Infectious diseases spread rapidly due to globalization and climate change. Urbanization increases transmission risk, while antimicrobial resistance renders existing drugs ineffective. Meanwhile, non-communicable diseases such as diabetes or cardiovascular conditions often worsen outcomes of infections. These overlapping risks demand solutions that go beyond single-discipline approaches.

Traditional research often functions in silos: laboratory scientists develop vaccines, clinicians conduct trials, and policymakers manage implementation separately. This fragmentation delays responses and reduces effectiveness. For instance, promising therapies may fail because they are not affordable or culturally acceptable in target populations. Therefore, integration across scientific, social, and economic dimensions is necessary.

#### 2. Integrating Biotechnology and Precision Medicine

Biotechnology has revolutionized vaccine and therapeutic development. Technologies such as mRNA platforms, viral vectors, and recombinant proteins allow faster design and adaptation of vaccines. Precision medicine, which tailors treatment to genetic and environmental factors, also increases therapeutic effectiveness.

An integrated model would combine:

**Genomic surveillance** to detect mutations and emerging pathogens

**AI-assisted drug discovery** to shorten development timelines

**mRNA or modular platforms** that can be rapidly updated

**Personalized therapies** based on population-specific data

For example, mRNA technology used for COVID-19 vaccines can be repurposed for malaria, tuberculosis, or cancer vaccines. If combined with regional genomic data, these vaccines could be tailored to local strains, improving protection rates.

This approach shifts vaccine development from reactive to proactive predicting threats before outbreaks become global crises.

### 3. Digital Health and Data Integration

Digital technologies play a crucial role in integrated research. Big data analytics, artificial intelligence (AI), and cloud-based platforms enable real-time monitoring and decision-making.

Integrated digital systems can:

- a) Track disease outbreaks through epidemiological dashboards
- b) Monitor vaccine efficacy and side effects
- c) Optimize clinical trial recruitment
- d) Map supply chain distribution
- e) Predict shortages or high-risk areas

For example, AI models can analyze millions of data points to identify potential drug compounds faster than conventional methods. Digital health records can also improve post-vaccination surveillance, ensuring safety and building public trust.

Furthermore, mobile health (mHealth) applications allow communities in remote areas to report symptoms and receive guidance, connecting grassroots populations with global research networks. This two-way flow of information makes research more inclusive and responsive.

### 4. Global Collaboration and Equitable Access

Scientific innovation has limited impact if access remains unequal. Many low- and middle-income countries lack manufacturing facilities and depend on imports, which delays vaccine availability during emergencies. Integrated research must therefore include policy, economics, and logistics.

Key strategies include:

- a) Technology transfer agreements
- b) Regional vaccine manufacturing hubs
- c) Open-source research platforms
- d) Public private partnerships
- e) International funding mechanisms

By decentralizing production, countries can respond more quickly to local outbreaks. For instance, regional manufacturing in Africa or Southeast Asia would reduce dependence on high-income nations and ensure faster distribution.

Moreover, equitable access strengthens global security. Infectious diseases do not respect borders; protecting only certain populations leaves everyone vulnerable. Integration of research with global health diplomacy ensures that vaccines are treated as global public goods rather than commercial commodities alone.

### 5. Community-Centered Implementation

A frequent reason for vaccine or therapy failure is low acceptance within communities. Cultural beliefs, misinformation, and lack of trust can hinder uptake. Therefore, social sciences and community engagement must be integrated into research processes.

## **Community-centered strategies include:**

- a) Participatory research with local stakeholders
- b) Health education campaigns
- c) Collaboration with local leaders
- d) Feedback systems to understand concerns

When communities are involved from the early stages, they become partners rather than passive recipients. This improves adherence and ensures that solutions are culturally appropriate.

For example, integrating anthropologists and local health workers into vaccination campaigns has increased acceptance in several regions affected by polio and Ebola.

## **6. An Innovative Proposal: The Integrated Global Vaccine and Therapy Network (IGVTN)**

To operationalize these ideas, this essay proposes an innovative framework called the Integrated Global Vaccine and Therapy Network (IGVTN).

The IGVTN would consist of:

- a) Regional Research Hubs – conducting genomic surveillance and laboratory studies
- b) Digital Data Centers – sharing real-time epidemiological and clinical data
- c) Manufacturing Nodes – decentralized production facilities
- d) Community Partnership Units – managing education and outreach
- e) Policy and Funding Consortiums – coordinating international investment

These components would function as a connected ecosystem. When a new pathogen is detected, data from surveillance hubs would feed into AI platforms, accelerating vaccine design. Manufacturing nodes would begin production simultaneously, while community units prepare distribution and education. Such coordination could reduce response time from years to months or even weeks.

This network is innovative because it integrates science, technology, policy, and society into a single operational structure rather than separate efforts. It is also realistic, as similar collaborations already exist but remain fragmented. The IGVTN simply formalizes and synchronizes them.

## **7. Challenges and Ethical Considerations**

Despite its benefits, integrated research faces obstacles. Funding limitations, intellectual property disputes, data privacy concerns, and political differences may hinder collaboration. Ethical oversight is essential to protect participants in clinical trials and ensure equitable benefit sharing.

To address these challenges:

- a) Transparent governance structures must be established
- b) Data security standards should be enforced
- c) Fair licensing agreements should balance innovation and accessibility
- d) International regulations should promote solidarity

Ethical integration ensures that technological advancement aligns with human rights and social justice.

## **Conclusion**

Global health challenges demand solutions that are faster, smarter, and more inclusive than ever before. Isolated research approaches are insufficient to address complex threats such as pandemics, antimicrobial resistance, and neglected diseases. Integrated research combining biotechnology, digital tools, global collaboration, and community engagement offers a comprehensive strategy to develop vaccines and therapies that are both innovative

and equitable.

By leveraging interdisciplinary cooperation and establishing frameworks like the proposed Integrated Global Vaccine and Therapy Network, humanity can transition from reactive crisis management to proactive prevention. Ultimately, the success of vaccines and therapies should not be measured only by scientific breakthroughs but by their ability to reach and protect every population. Integrated research, therefore, is not merely a scientific necessity but a moral imperative for achieving global health security.

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## ESSAY-02

### When Data Learns to Care

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#### Introduction

Imagine this. You walk into a crowded clinic on a Monday morning and the line of patients seems endless. Nurses shuffle through thick stacks of paper, doctors try to recall previous records from memory, and everyone waits longer than they should. Now imagine another scene happening at the same time. Like a virus spreads quietly across a city faster than the paperwork can move. By the time the symptoms rise, the hospitals are already overwhelmed. As a first-semester student who just started learning about how healthcare really works, I was struck by how strange this contrast feels. We live in a world where diseases evolve fast, yet our health management systems often remain slow, manual, and unprepared. It made me realize that the biggest challenge in global health is not a lack of data, but our inability to transform that massive amount of data into quick, life-saving decisions.

When I first entered the world of health sciences as a new university student, I quickly realized that healthcare is not as simple as treating diseases or giving medicine. Behind every diagnosis and every decision, there is an invisible system that carries millions of data points. In my first semester, I saw how many hospitals and clinics around me still rely heavily on manual paperwork and handwritten records. They store mountains of folders, patient files, and printed lab results. Everything feels slow, especially when compared to how quickly modern health crises spread. Pandemics move fast, new variants appear unpredictably, and chronic diseases are rising everywhere. It became clear to me that the way we manage health information has not fully adapted to the speed and complexity of today's challenges.

This contrast between traditional manual systems and modern global health threats creates a serious gap. The problem is no longer the absence of data. In fact, the world produces more health data today than at any other time in history. What we lack is the ability to convert this enormous amount of information into quick and accurate decisions. According to one of the journals I read, health systems often drown in data that is fragmented, inconsistent, or unused. Healthcare workers have to deal with administrative tasks that take away their time from patients. Hospitals struggle to predict patient surges. Governments fail to detect outbreaks early. The result is a system that reacts late instead of preparing early.

Seeing this, I strongly believe that integrating Artificial Intelligence and Big Data into health systems is no longer optional. It is the only realistic solution to build a health system that is not just reactive but predictive. AI is not simply a tool that helps. It is a catalyst that transforms the entire way we diagnose, manage, and control diseases. The future of global health depends on how well we use technology to understand patterns hidden in data and turn them into actions that can save lives.

#### Discussion

##### Revolutionizing Diagnosis and Disease Management

One of the clearest impacts of AI can be seen in medical diagnosis. Traditional diagnostic

methods depend heavily on the expertise and focus of healthcare workers. But human eyes can get tired, and human judgment can vary. AI changes this by learning from enormous sets of medical images and clinical data. Research from the journals shows that AI systems can analyze X-ray, MRI, and CT-scan images with accuracy that can match or even surpass trained radiologists (Patil & Shankar, 2023). These systems can detect abnormalities such as tumors, lung infections, or fractures much earlier than manual observation (Panahi, 2025).

For example, in one journal focusing on AI in public health, researchers developed a model that identifies early lung abnormalities related to infectious diseases. AI can detect subtle patterns that human observers might easily miss. This early detection gives patients a much better chance of receiving timely treatment (Panahi, 2025). It also helps prevent overcrowding in hospitals by reducing unnecessary follow-up tests.

However, in my opinion the most meaningful part of AI in diagnosis is how it frees healthcare workers from administrative burdens. Nurses and doctors spend a large portion of their time filling out forms, tracking lab results, or updating patient histories. AI can automate these repetitive tasks (Patil & Shankar, 2023). A study from the journals explains how clinical decision support systems use machine learning to update patient data in real time. When AI handles the routine tasks, healthcare workers can devote more time to what really matters: listening to patients, understanding their fears, and giving them compassionate care. In this sense, AI does not replace human touch. It protects and strengthens it (Minerva & Giubilini, 2023).

AI can also support doctors by providing instant recommendations based on current medical guidelines. For instance, AI tools can alert physicians if a treatment plan does not align with the best available evidence or if a patient's condition shows signs of sudden deterioration (Chinta et al., 2025). This is especially important in emergency departments where every minute counts. AI becomes a second pair of eyes that constantly monitors data and helps prevent fatal mistakes.

### **Predictive Analytics and Disease Control**

AI becomes even more powerful when combined with large-scale public health data. Instead of responding after a crisis begins, AI allows us to predict potential outbreaks before they happen (Panahi, 2025). One of the journals I reviewed describes how machine learning models can analyze environmental data, mobility patterns, climate information, and health records to detect early signs of disease spread. These predictive models were used during COVID-19 to estimate case surges and guide government policies (Chinta et al., 2025).

AI can track patterns such as sudden increases in flu-like symptoms in a certain region. If this data is combined with travel information, the system can estimate the likelihood of the disease spreading to nearby cities or countries. This kind of prediction gives health authorities time to prepare hospital beds, medical supplies, and vaccination campaigns. Without AI, these decisions are often made too late.

Data also plays a crucial role in vaccine distribution. In the past, distributing vaccines was often inefficient because decisions were based on incomplete information. AI solves this by analyzing population density, transportation routes, and disease prevalence to create an optimized distribution network. One journal highlights how AI systems can recommend the most efficient supply chain routes to prevent wastage and ensure vaccines reach the most vulnerable populations first. This makes health systems more equitable because everyone gets access to resources based on actual need, not guesswork.

AI can also help control chronic diseases like diabetes and hypertension. Wearable devices collect continuous data about heart rate, blood glucose, activity level, and sleep patterns. AI uses these data streams to warn patients of potential risks (Minerva & Giubilini,

2023). For example, if the model detects unusual glucose fluctuations, it can alert the patient through their smartphone. This continuous monitoring reduces hospital visits and improves long-term quality of life (Panahi, 2025).

### **Improving Hospital Management and Service Efficiency**

Hospitals are the heart of health systems. But many hospitals struggle with long waiting times, overcrowded emergency rooms, and poor resource distribution. AI introduces a new level of efficiency by analyzing patient flow, bed occupancy, and staff availability in real time (Patil & Shankar, 2023). According to one journal, AI-based hospital management systems can accurately predict patient admissions for the next few hours or even the next day.

These predictions help hospitals allocate resources such as ventilators, beds, and medical staff more effectively. For example, if AI predicts a surge in emergency visits during the weekend, hospital managers can arrange additional staff or prepare more treatment rooms. This prevents delays in care and lowers stress for both patients and healthcare workers.

AI can also manage patient queues by assigning priority levels based on the severity of symptoms. Instead of waiting hours for triage, patients with urgent needs can be identified faster. This is important in emergency medicine, where fast treatment can save lives.

Another important function is automated inventory control. Hospitals often face shortages of essential medicines or equipment because they cannot track stock accurately. AI systems can monitor inventory levels and predict when supplies will run out (Patil & Shankar, 2023). One journal highlights how predictive algorithms can even recommend the best time to reorder medications to reduce cost and prevent waste.

These improvements may sound technical, but their impact is deeply human. Shorter waiting times reduce patient stress. Better resource allocation means fewer preventable deaths. Efficient hospitals allow healthcare workers to operate in a safer and more organized environment.

### **Ethical Challenges and Data Security**

Even though AI brings many benefits, it also carries risks that we cannot ignore. Health data is extremely sensitive. If it is misused or exposed, it can harm patients financially, socially, and psychologically. One of the journals discusses how AI models must be trained using secure, anonymized data to protect patient privacy.

There is also the challenge of algorithmic bias. If AI systems are trained on data that only represent certain populations, the predictions may not be accurate for others (Chinta et al., 2025). For example, an AI model trained only on data from high-income countries may not work well in low-income communities. This can worsen health inequalities. It is important for developers to include diverse data sets and continuously test the fairness of their algorithms (Chinta et al., 2025).

Another ethical issue is digital inequality. Not all regions have equal access to AI technologies. Rural areas, for example, may lack internet access or trained personnel to operate digital tools (Panahi, 2025). This could create a gap between regions that benefit from AI and those that do not. To prevent this, governments and global organizations must ensure that AI systems are accessible and affordable for all (Chinta et al., 2025)

Despite these challenges, the journals suggest that strong regulation and transparent data governance can help AI grow responsibly. What matters most is that human values remain at the center of technological innovation.

## Conclusion

After learning about the power of AI and Big Data from various studies and journals, I believe that they are not just tools but engines that will transform the entire global health system. They allow us to shift from slow manual processes to intelligent systems that predict risks, prevent crises, and support healthcare workers. AI helps detect diseases earlier, manage hospitals more efficiently, and control outbreaks before they become disasters.

However, technology alone is not enough. The true strength of AI comes from how we use it together as humans. Health workers, policymakers, researchers, and communities must collaborate to ensure that AI serves everyone fairly. Technology gives us the speed and accuracy we need, but compassion and ethical responsibility give health systems their soul.

By embracing AI and Big Data with a human-centered approach, we are building a future where healthcare is not only more advanced but also more just. This is the vision of a global health system that cares, predicts, protects, and responds with wisdom and empathy. But at the same time, we have to use AI wisely. And as a first-semester student just beginning my journey, I am hopeful that I can be part of that future.

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## ESSAY-03

# Healthcare Management Transformation Through Predictive Analytics and Machine Learning

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### Introduction

Predictive analytics is a method of using past data to forecast what will happen in the future. Like a weather forecaster who looks at cloud patterns to predict rain, predictive analytics examines health data patterns to estimate disease risks or care needs. Machine learning is a branch of artificial intelligence that enables computers to learn from data without being specifically programmed. Imagine teaching a child to recognize cats, you don't need to explain technical details, just show many pictures of cats, and the child will recognize the pattern themselves. Machine learning works the same way, only with far greater speed and capacity.

One of machine learning's greatest contributions to healthcare is its ability to diagnose diseases with high accuracy. In this era, AI algorithms can read X-rays, CT scans, and MRI with precision comparable and even surpassing specialist doctors. A real example is in cancer detection. A study showed that AI algorithms can detect breast cancer from mammograms with higher accuracy than human radiologists (McKinney et al., 2020).

Predictive algorithms analyze various data such as travel patterns, population density, mobility rates, and even social media information to estimate where and how fast diseases will spread. Platforms like BlueDot successfully provided early warnings about COVID-19 before the World Health Organization (WHO) issued official announcements.

AI systems can predict how many patients will arrive at the emergency unit on a given day, so hospitals can better arrange staff numbers. Algorithms can also optimize surgical schedules, predict medical procedure durations, and allocate recovery rooms efficiently.

Moreover, machine learning can identify patients at high risk for readmission after hospital discharge. With this information, medical teams can provide extra attention and more intensive follow-up to these patients, reducing readmission rates that harm both patients and the healthcare system (Rajkomar et al., 2018).

Every person has a different body condition, and medicine that works for one person may not work well for another. Machine learning paves the way for truly personalized treatment through medical history, and other individual factors. For instance, AI systems can assist in chronic disease management such as diabetes. AI-based applications can predict patients' blood sugar levels based on eating patterns, physical activity, and insulin doses, then provide customized recommendations to keep sugar levels stable.

### Discussions

Moving forward, we can expect deeper integration between AI and healthcare systems. Some applications that can be used are:

**Virtual assistants for healthcare workers:** AI-based medical chatbots that can perform initial triage, answer patient's questions, and provide health education 24/7. This can help

patient to get health services faster without have to queue.

**Integrated wearable devices:** Smart watches and other health devices that continuously monitor body conditions and provide alerts when detecting anomalies inside the body. So, we can anticipate problem that occur in the body.

However, we have to know that technology is a tool, not an instant solution. The success of using digital technology in healthcare depends on how we use it wisely.

Even though the potential is huge, implementing machine learning in healthcare is not without challenges. First is the issue of data quality. Algorithms are only as good as the data they use. If the input data is incomplete or inaccurate, the predictions will also be problematic.

Second is the issue of privacy and data security. Health data is highly sensitive and must be strictly protected. AI use requires access to large amounts of data, raising concerns about how that data is stored, used, and protected from misuse.

### Conclusion

Predictive algorithms and machine learning have truly become life-savers in modern healthcare systems. From diagnosing diseases earlier, predicting outbreaks, optimizing hospital management, to personalizing treatment, this technology can help us in the healthcare system.

However, it's important to remember that AI is not a replacement for human medical personnel. This technology is a tool that strengthens the capabilities of doctors, nurses, and other healthcare professionals. The combination of human clinical expertise and machine computational intelligence creates a powerful synergy to deliver the best healthcare services.

To realize the full potential of this technology, we need investment in digital infrastructure, human resource training, and most importantly, commitment to ensuring that AI benefits can be felt by everyone, not just those living in developed countries or large cities. Healthcare transformation through AI and predictive analytics is no longer a distant future. It is today's reality that continues to evolve. Our task is to ensure that these life-saving algorithms truly save as many lives as possible throughout the world.

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## ESSAY-04

# SYNAPSE: Synchronized AI-Platform For Nanoscale Synthesis And Equitable-Distribution

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## Introduction

In the current post-pandemic era, the global health landscape is undergoing a serious change: the rapid rise of zoonotic diseases and the emergence of "superbugs" that are becoming more resistant to available medications. Although the COVID-19 pandemic sped up vaccine production, the global health system remains dangerously reactive, often waiting for an outbreak to happen before starting the lengthy process of drug discovery. This "reactive gap" arises because traditional research works in isolation, where laboratory work, clinical testing, and manufacturing are disconnected. Integrated research combines artificial intelligence (AI) for predictive mapping, modular biotechnology, and decentralized production. Advanced machine learning algorithms are employed to analyze genetic data and forecast viral mutations, taking into account factors such as replication rates, host-pathogen interactions, and environmental influences (Al-amran et al., 2023). This approach is crucial for global health because it shifts medical responses from reactive and fragmented efforts to proactive, coordinated defense systems. This essay will discuss how AI-driven genomic surveillance can predict viral mutations, how mRNA-based modular platforms enable quick therapeutic designs, and how decentralized "bioreactor hubs" can provide fair access to medicine in resource-limited settings.

## Discussion

The essence of this scientific innovation is the shift from "observed research" to "predictive synthesis," using AI to map viral evolution before outbreaks happen. In traditional research, developing therapies often takes time due to the slow process of isolating a virus and mapping its proteins through trial and error. By integrating deep-learning models, researchers can carry out *in silico* (computational) screening of billions of molecular compounds against predicted viral structures. This enables the creation of "Broadly Neutralizing Antibodies" (bNAbs) that attack conserved regions of a viral family rather than a single strain (Koh et al., 2025). This mechanism acts as a "digital twin" of the laboratory, where the safest and most effective options are identified digitally before any physical lab work begins.

To analyze the effectiveness of this integrated approach, a SWOT analysis shows a strategic advantage in speed and flexibility, even with high initial infrastructure costs. The main strengths include a significant drop in the drug discovery timeline from years to months and a modularity that allows for quick adjustments to new viral variants. The main weaknesses involve a strong reliance on high-performance computing power and specialized datasets. Additionally, this framework offers chances to tackle "neglected diseases" in developing nations through open-source genetic databases, although it must navigate threats like ethical concerns about data privacy and the potential "dual-use" of genetic information. By setting specific, time-bound SMART goals, this innovation aims to shorten the time for

Phase I clinical trial readiness for any new "Pathogen X" to under 100 days, as supported by the Coalition for Epidemic Preparedness Innovations (Christodoulou, 2023).

The practical implementation of this concept relies on "Modular Bio-Foundries," which serve as prototypes for a decentralized global manufacturing network. Unlike large, centralized pharmaceutical facilities, a bio-foundry is a compact, automated unit such as a "pharmacy in a box" that can produce mRNA-based vaccines on-site. The process involves sending a digital blueprint via the cloud to a local bioreactor, which then synthesizes the vaccine using standardized chemical precursors (Alrashidi et al., 2024). This prototype design solves the "Cold Chain" logistics issue since vaccines are produced exactly where they are needed. This approach reduces the carbon footprint and ensures that rural clinics in the Global South have the same access as urban centers in developed nations.

The sustainability of this integrated model is enhanced by its ability to tackle "Antimicrobial Resistance" (AMR), a global health threat that could lead to 10 million deaths annually by 2050 if not addressed. A sustainable research model must be circular; data collected from local clinics must feed back into the AI models to improve future drug designs. Recent data shows that integrated platforms can cut vaccine waste by 40% because production is scaled to local demand instead of being overproduced in central hubs (Buroni & Chiarelli, 2022). This continuous feedback loop makes sure the global health system evolves more quickly than the pathogens it aims to combat.

While the benefits are significant, a critical evaluation points out that the main drawback is the "Digital Divide," which could create technological dependency in developing countries. If AI algorithms and patents remain exclusively controlled by high-income nations, the decentralization risks becoming superficial. Therefore, the implementation must involve a "Technology Transfer" protocol, training local scientists to operate and manage the bio-foundries. Moreover, the reliance on digital data makes the system susceptible to cyber-attacks, necessitating strong cybersecurity measures from the start (Alam & Kumar, 2025). Despite these challenges, the risk of doing nothing is far greater than the risk of trying something new.

### Conclusion

In conclusion, moving toward an integrated research framework that combines computational intelligence, modular biotechnology, and decentralized production is no longer a choice; it is a necessity for modern global health security. This essay has shown that the traditional, fragmented method of medicine is insufficient given the rapidity of modern pathogens, and only a coordinated system can provide a proactive defense. By utilizing AI-driven structural biology, scientists can now predict and create therapies for viral threats before they occur, while modular mRNA platforms facilitate the quick production of these therapies. Additionally, the shift toward decentralized bio-foundries ensures that these scientific advances are not just retained by wealthy nations but are made available to vulnerable populations in real-time.

Based on the evidence presented, it is clear that the future of pandemic preparedness depends on the digitalization of biology. As we move forward, global health authorities need to prioritize international technology transfers to prevent the "digital divide" from obstructing the rollout of these life-saving tools (Alam & Kumar, 2025). If we successfully connect predictive data with local production, we can foresee a future where the 100-day target for vaccine readiness becomes a global standard, effectively ending the age of widespread pandemics (Christodoulou, 2023). Ultimately, through this kind of scientific innovation, we can transform our world from a state of constant vulnerability into a resilient system capable

of safeguarding all humanity.

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## ESSAY-05

### **MEDIGUARD: An Integrated Digital Health Mobile Application as A “Digital Safety Net” To Improve Verified Arv Adherence and Continuity of Hiv Care**

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#### **Introduction**

In 2024, approximately 1.3 million people worldwide were recorded as having Human Immunodeficiency Virus (HIV) infections, which is equivalent to an average of around 3,500 new cases every day (UNAIDS, 2025). HIV is a virus that attacks CD4 cells in the human immune system, thereby reducing the body's ability to fight infection and potentially progressing to Acquired Immunodeficiency Syndrome (AIDS) if not adequately treated (WHO, 2025). The addition of these cases every day shows that HIV control efforts are not yet fully optimal, so attention is still needed to the medical and behavioral factors of patients that affect the overall success of HIV treatment (WHO, 2025). One of the main factors is the success of antiretroviral therapy (ART), which, although clinically effective, is highly dependent on the level of patient adherence to consistent long-term treatment (WHO, 2026). UNAIDS data show that although access to ARV therapy is becoming more widespread, many individuals with HIV do not adhere to their treatment regimen optimally, even though international guidelines recommend an adherence rate of more than 95% to achieve viral suppression. This non-adherence contributes to treatment failure and even the risk of preventable deaths (UNAIDS, 2025).

Non-adherence to ARV therapy manifests globally with alarming consequences. Research in Tanzania shows that 35.3% of HIV patients do not adhere to ARV therapy, with the main factor hindering therapy adherence being forgetting to take medication regularly. A cross-sectional study in northeastern region of Brazil reported that 28.4% of HIV/AIDS patients were non-adherent to ARV, due to low social support and patients lack of knowledge about therapy. In Indonesia, nationally, limited access to health services and low health literacy are challenges in HIV control, so that some individuals do not immediately receive proper examination and treatment (Indonesian Ministry of Health, 2023). Additionally, stigma and discrimination against people living with HIV/AIDS (PLWHA) as well as socioeconomic factors such as transportation costs and low social support further worsen patient adherence to ARV treatment (UNAIDS Indonesia, 2024).

Non-adherence to ARV therapy is generally demonstrated through various behaviors, such as busy daily activities that cause patients to forget to take their medication, lack of knowledge, low social support, and even discontinuation of treatment because they feel healthy. Empirical data shows that non-adherence to ARV consumption is caused by various interrelated factors and is not a problem that arises suddenly. Chronologically, after someone is diagnosed with HIV and begins ARV therapy, the initial stage of treatment is generally characterized by high enthusiasm for recovery and improving quality of life. However, over time, adherence often declines due to fatigue from long-term treatment, the emergence of side effects, and the social stigma that still attaches to people living with HIV. Studies show that the need to take ARVs every day without interruption is a burden for patients, especially those of

productive age who have busy schedules and limited time (WHO, 2023).

Various conventional efforts have been implemented by the healthcare system to improve ARV therapy adherence, such as routine counseling, face-to-face education, community support, and the use of manual reminders. These interventions have been proven to improve patient adherence in the early stages of treatment, but their effectiveness tends to decline in the long term. Studies show that after several months, the adherence rates of many patients return to near baseline levels due to limited continuous monitoring, high dependence on clinic visits, and the dominant role of patient initiative and self-discipline without the support of a verified reminder system (UNAIDS, 2024). This situation was exacerbated during the COVID-19 pandemic, when mobility restrictions caused significant disruptions to face-to-face counseling services and drug distribution, exposing the fundamental weaknesses of conventional approaches that were not adaptive to crisis conditions.

Although medication reminder applications are widely available, analysis shows that the majority of applications only focus on the reminder function without other supporting features such as health education, behavioral intervention, weak motivational mechanisms, and the absence of integrated health monitoring, thereby limiting their effectiveness and appeal in improving medication adherence. (Ahmed, et al., 2018). Medication Digital Guard (MEDIGUARD) is a digital health innovation that goes beyond conventional approaches by integrating five key features, namely the Edu-Center with educational videos from trusted doctors, a verified Pill Reminder, tele-consultation services, a reward-based Carepoint feature to reinforce behavioral motivation, and a health tracker to continuously monitor patients' health conditions. This integration makes Mediguard not only an ARV adherence tool, but also a personalized, interactive, and sustainability-oriented therapy support ecosystem. Mediguard also supports the achievement of Sustainable Development Goal (SDG) 3.3, which is to end the AIDS epidemic as a public health threat by 2030. According to the Global AIDS Update Report, antiretroviral treatment has significantly reduced AIDS-related deaths since 2010. However, increasing the coverage of HIV interventions, including ARV adherence, is crucial to accelerating the reduction of deaths and infections worldwide within the framework of SDG 3.3, as millions of people still do not receive the recommended treatment and new infection rates remain high (UNAIDS, 2025).

### Contents

The Mediguard application is a digital technology-based healthcare service model that aims to improve ODHIV compliance in taking ARV through an integrated support system. This application is intended for use in areas with high ARV non-compliance rates as a collaborative approach-based „Digital Safety Net“. To support sustainable long-term treatment and improve the quality of HIV services, the app incorporates integrated features that form a comprehensive digital system to enhance the quality of HIV services. Before users can utilize the service features, they must fill out their profiles to begin customization. This initial step aims to ensure that the application is used according to the instructions.

**1. The Edu-Center** feature is designed as a video-based education center for people living with HIV, providing comprehensive information about HIV, ARV therapy, reproductive health, and healthy lifestyles. Mediguard works with trusted doctors and medical personnel, and all content is delivered in educational videos. Each video has an interactive comment section where users can ask questions about material they do not understand, and doctors will respond to these questions. At the end of the video, users are asked to fill out a short evaluation to assess their level of understanding of the material, and can earn points that are integrated

with the CarePoints system as a form of reinforcement for user motivation and engagement. The choice of video format is based on changes in information consumption patterns in the digital age, where audio-visual media is considered more effective in conveying health messages clearly and easily (Navarrete, E., et al, 2025). In addition to serving as an educational tool, this feature also supports the sustainability of the application through the proportional placement of advertisements.



**Figure 1.** Edu-Center Feature

2. **The Pill Reminder** feature is an automatic notification system designed to remind users to take their ARV medication on schedule. When the notification is pressed, users will be directed to the app and asked to activate the camera as a form of visual verification that the medication has actually been taken, either through photos or videos. This mechanism aims to improve treatment adherence in a more objective manner. Ten minutes after medication time, the system will send a follow-up notification to ask about any side effects experienced by the user with the response options “yes” or “no.” If the user selects “yes,” the system will automatically connect the user to the Tele-Consultation feature to obtain medical assistance, thereby reducing the risk of discontinuing medication due to side effects



**Figure 2.** Pill Reminder feature

3. **The Tele-Consultation** feature provides remote medical consultation services via chat with doctors or counselors who are competent in the field of HIV. This feature is designed to provide private and secure access to health services, especially for PLHIV who have limited access to direct health facilities. Through Tele-Consultation, users can obtain education, counseling, and initial treatment for medical complaints and side effects of therapy. This feature is equipped with access to a service administrator who can be contacted at any time in

an emergency. The administrator acts as a liaison between users and healthcare facilities in their area of residence. This integration is achieved through the completion of the user's initial profile data, such as domicile and information on the nearest healthcare services. In an emergency, users can directly contact the administrator to obtain guidance or assistance connected to local healthcare services.



**Figure 3.** Tele-Consultation feature

4. **The CarePoints** feature adopts a gamification approach based on a points system as a form of positive reinforcement for ARV medication adherence behavior. Users will earn points every time they successfully take their medication on time and complete the verification steps specified in the application, such as uploading photos or videos of themselves taking their medication. In addition, points can also be accumulated through user engagement in the Edu-Center feature, namely by watching educational videos and answering evaluative questions afterwards. This approach is designed to improve health understanding while strengthening users' intrinsic motivation through a sense of achievement and active involvement in the therapy process. Points collected through the CarePoints feature can be exchanged for vouchers after reaching certain targets. These vouchers are health-oriented and integrated directly into the application. They can be used to obtain light medical equipment, such as masks, hand sanitizers, or multivitamins, and exchanged directly at designated partner pharmacies. The redemption process is designed to be simple, where users only need to show the digital voucher in the app to the pharmacy to receive the specified products. By integrating a reward system that is tangible and relevant to health into daily therapy routines, Mediguard strives to reinforce positive health behaviors and increase user motivation.



**Figure 4.** CarePoints feature

5. **The Health Tracker** feature serves as a means of monitoring the user's health condition through the visualization of clinical data, such as CD4 and viral load, in the form of easy-to-understand graphs. This presentation helps users understand the relationship between

therapy adherence and concrete health developments, thereby strengthening awareness of the benefits of long-term ARV therapy. In addition, this feature supports health workers in evaluating the effectiveness of therapy on an ongoing basis.



**Figure 5.** Health Tracker feature

To objectively assess the effectiveness of this innovation, measurable application success indicators were established. The success of the Mediguard application innovation is measured through indicators that include increased user understanding of HIV and ARV therapy through educational videos, ARV consumption compliance, involvement in medical consultations, participation in educational activities on the application, and regular monitoring of clinical indicators, with a target achievement of between 75–90% of users for each program component.

The successful implementation of the Mediguard application innovation requires cross-sector collaboration to ensure integration with the healthcare system and program sustainability. The parties involved include the Ministry of Health in the integration of national HIV policies and services, healthcare facilities and medical personnel in monitoring compliance and providing ARVs, technology developers in application system development and security, and pharmacy partnerships as facilitators of CarePoints reward exchanges.

## Conclusion

Non-adherence to ARV therapy among PLHIV is a global problem that is on the rise and cannot be optimally addressed through conventional approaches. The inability to maintain long-term adherence not only worsens the clinical condition of individuals, but also hinders efforts to control HIV at the population level by increasing the risk of drug resistance and transmission. This situation underscores that ARV non-adherence is a strategic and urgent issue in the global health system, requiring more adaptive, responsive, and patient-centered innovations.

The Mediguard application innovation offers a comprehensive approach by integrating digital reminders, real-time monitoring, gamification, health education, and ongoing support into a single technology-based system. With a patient-centered design and measurable success indicators, this innovation has the potential to improve treatment adherence, reduce the risk of drug resistance, and strengthen the effectiveness and responsiveness of health services. With cross-sector support and evidence-based development, Mediguard is expected to become part of the strategic solution in HIV control and the achievement of sustainable health development goals.

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## ESSAY-06

### **EIR (Effective Integration in Research) As a Key to Equitable Global Health**

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Tahun 2026*

#### **Introduction**

Global health is a multidimensional field of study that affects health at the international level. It encompasses public health, biology, social sciences, environmental health, economics, and health policy. In the contemporary era, many new global health challenges have emerged, ranging from unequal access to health services, the threat of epidemics, non-communicable diseases, climate change, and maternal and child health.

This proves that global health still faces major challenges. The main solution to these major challenges can largely be addressed through vaccines and therapies. However, the benefits of vaccines and therapies have not been felt equally by communities in various countries. This is especially true in developing countries with the lowest incomes. In Indonesia, the number of children who did not receive their first DPT vaccine (zero-dose) was more than 1.3 million in 2023, placing Indonesia sixth in the world in terms of zero-dose rankings. Despite progress in the country, the coverage rate for several vaccines is still below the optimal target of 80%-90% for 2024-2025.

This situation reflects that there are inequalities, not only in access to health services but also in the integration of policy research and health program implementation. Therefore, effective integration in research (EIR) is key to bridging these gaps in order to achieve more equitable and equitable global health.

#### **Discussion 1**

One of the main factors contributing to global health inequality is the lack of integration in health research. This challenge is not only limited to scientific aspects, but also includes policy, social, economic, and distributional dimensions that are not sufficiently involved from the initial planning stage. As a result, many scientific innovations fail to be implemented widely and sustainably in society.

This situation is reflected in the implementation of the National Health Insurance (JKN) and Minimum Service Standards (SPM) in Indonesia. Although both have become important foundations of the national health system, their implementation has been uneven due to differences in regional system capacity, unequal distribution of resources, and weak integration between research, policy, and service implementation.

#### **Discussion 2**

This condition is not unique to Indonesia. Various low- and middle-income developing countries, such as India and Nigeria, face similar challenges, where health innovations are often not fully aligned with the capacity of local health systems. Limitations in infrastructure,

human resources, and policy integration are major obstacles to the equitable implementation of health innovations.

In contrast, many developed countries have demonstrated a greater capacity for their healthcare systems to adopt innovations, including in vaccination programs. Countries such as Portugal and Japan have shown that the success of vaccination is not only determined by vaccine availability, but also by strong institutional leadership, science-based communication, and a high level of public trust in public health policies. The integration of scientific research, communication strategies, and policy implementation enables immunization programs to be carried out effectively and widely accepted by the public.

The differences in the implementation of health innovations between countries show that the success of health programs is not solely determined by the availability of innovations, but rather by the level of integration between research, policy, and implementation in the health system.

### **Discussion 3**

Effective Integration in Research (EIR) is an approach that emphasizes the integration of relationships between institutions across dimensions in the context of global health. This approach not only involves institutions focused on scientific research, but also includes government agencies, academic and research institutions, international organizations, the health service implementation sector, as well as civil society and communities as parties that support research and bridge the relationship between research, policy, and practice in the field.

Within the EIR framework, government agencies act as policy directors and national health priority setters to ensure alignment with scientific findings. Academic institutions and research organizations serve to produce contextually relevant and applicable evidence, while international organizations contribute to the provision of funding, global standards, and cross-border knowledge transfer. On the implementation side, the health service sector, such as health insurance systems and primary care facilities, spearheads the application of research results in the field. Civil society and communities play an important role in building public trust, ensuring social acceptance of health innovations, and providing the necessary feedback for policy and program refinement. However, without strong coordination mechanisms, the roles of these institutions often operate separately, so that research results are not fully integrated into health policy and service implementation.

Therefore, EIR can be positioned as an institutional mechanism that coordinates cross-sector actors to bridge the gap between research, policy, and health service implementation.

### **Conclusion**

Global health challenges emphasize that scientific innovation must be accompanied by strong integration between research, policy, and implementation. Through the Effective Integration in Research (EIR) approach, cross-sector collaboration can be strengthened so that the benefits of health innovation can be felt more evenly. This approach is an important foundation in realizing a fair and sustainable global health system.

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## ESSAY-07

# AIDSS-HEALTH: Artificial Intelligence–Driven Decision Support Systems for Global Health Management

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## Introduction

Digital transformation in the healthcare sector has accelerated significantly over the past decade, particularly with the development of artificial intelligence (AI) as a key technology in data management and decision-making. The global healthcare system is currently facing multidimensional challenges, ranging from an increasing burden of chronic diseases, limited healthcare resources, to the ever-growing complexity of clinical data. These conditions require a decision-making approach that is not only fast but also evidence-based and systematic.

AI offers advanced analytical capabilities through large-scale data processing, pattern recognition, and machine learning-based predictions. Topol (2021) states that the convergence of human intelligence and artificial intelligence has the potential to create high-performance medicine, which is a more precise, efficient, and patient-oriented healthcare system. In this context, AI is not intended to replace the role of healthcare workers, but rather to strengthen the quality of clinical and managerial decision-making. standardized integration of traditional therapies within modern health systems.

One of the most relevant forms of AI implementation in healthcare management is Decision Support Systems (DSS). AI-based DSS are designed to assist decision makers by providing recommendations generated through systematic analysis of complex data. Chen et al. (2022) emphasize that AI-based DSS have developed rapidly and are now widely used in clinical decision support, particularly in diagnosis, therapy selection, and patient risk management.

However, the application of AI in healthcare systems also raises ethical, governance, and system reliability challenges. The World Health Organization (WHO, 2022) emphasizes that the use of AI in healthcare must uphold the principles of transparency, fairness, data security, and accountability, given its direct impact on patient safety. In addition, the effectiveness of AI-based DSS is highly dependent on data quality and the integration of health information systems, which remain problematic in many countries.

Based on this background, this essay aims to analyze the role of AI-based Decision Support Systems in global health management, by reviewing the benefits, challenges, and contributions of industrial engineering approaches in ensuring the efficiency and responsiveness of health systems. This analysis is expected to provide a systematic and innovative perspective on the integration of AI in health decision-making.

## OVERVIEW AND ANALYSIS

### Concepts and Mechanisms of AI-Based DSS

An AI-based Decision Support System (DSS) is an information system that combines data, analytical models, and a user interface to support decision-making in complex situations.

Unlike conventional DSS, AI-based DSS utilize machine learning and deep learning algorithms to generate adaptive recommendations based on historical and real-time data patterns (Esteva et al., 2021).

Chen et al. (2022) report that over 70% of modern clinical DSS developments have integrated AI components, particularly for risk analysis, clinical outcome prediction, and therapy personalization. These systems are capable of processing thousands of clinical variables simultaneously, thereby reducing human cognitive limitations in dealing with the complexity of health data.

### The Implications of AI-Based DSS on Clinical Decisions

Artificial intelligence-based Decision Support Systems (DSS) are integrated information systems designed to assist decision makers in dealing with complex and unstructured problems, particularly in the health sector. Unlike conventional DSS, which generally relies on static rules and deterministic analysis, AI-based DSS utilizes machine learning and deep learning algorithms to recognize patterns, study relationships between variables, and generate adaptive recommendations based on historical and real-time data (Esteva et al., 2021; Chen et al., 2022). With these capabilities, AI-based DSS can support more precise and evidence-based decision-making amid the complexity of modern clinical data.

To clarify the working mechanism of AI-based DSS in the context of healthcare management, Figure 1 presents a system flow that illustrates the integration between data, analytical processing, and the role of humans in final decision-making.

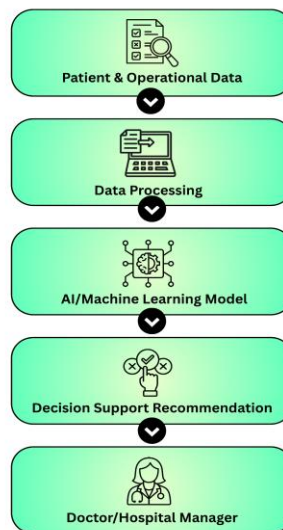


Figure 1. Workflow of AI-based Decision Support Systems in Health Management

As shown in Figure 1, the first stage in AI-based DSS is the collection of patient and operational data. Patient data includes electronic medical records, laboratory test results, medical images, medical history, and demographic data. Meanwhile, operational data includes bed availability, medical staff schedules, service unit workloads, and hospital logistics data. According to the WHO (2022), the quality and completeness of data at this stage greatly determine the reliability of DSS recommendations, as data bias or fragmentation can directly impact patient safety.

The next stage is data processing, which includes data cleaning, normalization, integration between data sources, and feature selection. This process aims to ensure that the data used by the AI model is consistent, relevant, and representative. Chen et al. (2022) emphasize that failure in the data processing stage is one of the main causes of poor clinical

DSS performance, even though the AI algorithms used are considered advanced.

After the data is processed, the system enters the core stage, namely AI modeling or machine learning. At this stage, machine learning algorithms analyze complex patterns in the data to generate predictions or recommendations, such as patient risk estimates, clinical intervention priorities, or resource requirement projections. Shameer et al. (2021) show that machine learning models in the cardiovascular field are able to identify patient risk with a higher degree of accuracy than traditional statistical approaches, confirming the superiority of data-driven approaches.

The results of AI modeling are then presented in the form of decision support system recommendations. These recommendations are not binding, but are presented as additional information to support professional judgment. Topol (2021) emphasizes that the main strength of AI-based DSS lies in its ability to provide comprehensive and rapid analysis, thereby reducing the cognitive burden on healthcare professionals when making decisions in high-pressure environments.

The final stage in the AI-based DSS workflow is decision-making by doctors or hospital managers. In accordance with the human-in-the-loop principle recommended by the WHO (2022), the final decision remains in human hands. DSS serves as a tool that improves the quality of decision-making, not as a substitute for clinical or managerial responsibilities. Thus, AI-based DSS is part of a socio-technical system that emphasizes collaboration between technology and human expertise.

### **Managerial and Operational Efficiency of the Health System**

At the managerial level, AI-based DSS contributes significantly to the efficiency of healthcare systems. Topol (2021) states that the inefficiency of global healthcare systems causes a waste of around 20–30% of total healthcare expenditure. AI-based DSS can be used for hospital capacity planning, medical staff schedule optimization, and healthcare service demand prediction.

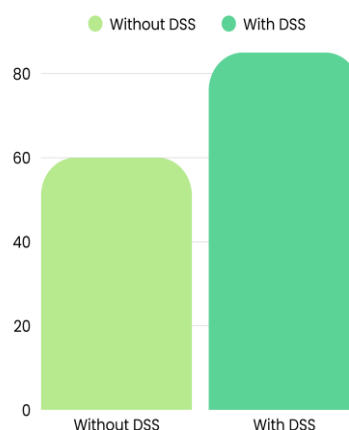


Figure 2. Comparison of Healthcare System Efficiency Before and After the Implementation of an Artificial Intelligence (AI)-Based Decision Support System (DSS)

By utilizing integrated operational and clinical data, AI-based DSS enables decision makers to quantitatively evaluate multiple policy and operational scenarios before implementation. From an industrial engineering perspective, this capability supports

evidence-based decision making through system-level analysis, trade-off evaluation, and resource optimization. DSS allows hospital managers to assess the impact of alternative scheduling policies, capacity allocation strategies, and service demand forecasts on overall system performance. Consequently, decision making shifts from intuition-driven approaches to data-driven optimization, aligning with industrial engineering principles that emphasize efficiency, effectiveness, and sustainability across the entire healthcare delivery system rather than isolated subsystems.

### **Challenges in Ethics, Data, and Governance**

Despite its significant potential, the implementation of AI-based Decision Support Systems (DSS) faces substantial challenges related to ethics, data quality, and governance. The World Health Organization (WHO, 2022) reports that approximately 60% of its member countries still suffer from fragmented health data and low system interoperability. Such conditions increase the risk of algorithmic bias, limit data representativeness, and ultimately reduce the reliability of DSS-generated recommendations.

Furthermore, WHO (2022) emphasizes that the deployment of AI in healthcare must adhere to the human-in-the-loop principle, in which human judgment remains central to the decision-making process. AI-based DSS should not function as autonomous decision makers, but rather as analytical tools that enhance the quality, speed, and consistency of healthcare professionals' considerations. Failure to maintain adequate human oversight may lead to ethical concerns, accountability issues, and reduced trust in AI-assisted systems.

### **The Role of Industrial Engineering in AI-Based DSS Integration**

From an industrial engineering perspective, AI-based DSS should be viewed as an integral component of a complex socio-technical system. Industrial engineering contributes by designing efficient process flows, analyzing workloads, optimizing resource allocation, and evaluating system performance after DSS implementation. Through a systems engineering approach, industrial engineers ensure that AI technologies are integrated in a manner that aligns people, processes, and technology, thereby minimizing disruption while maximizing operational and managerial benefits.

### **Conclusion**

AI-based Decision Support Systems offer substantial potential to enhance both clinical and managerial decision-making within global healthcare systems. Empirical evidence indicates that AI-based DSS can improve decision accuracy, operational efficiency, and system responsiveness. However, successful implementation is highly dependent on high-quality data, robust ethical governance, and human-centered system design.

The integration of AI-based DSS with industrial engineering approaches is crucial to ensuring that such technological innovations are not only technically advanced, but also effective, sustainable, and socially responsible in practice. Through a systematic and collaborative approach, AI-based DSS can serve as a key foundation for the development of more efficient, adaptive, and equitable healthcare systems worldwide.

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## ESSAY-08

# **SWAP (Smart Wound Analysis Patch): Integrated Multi-Sensor Healthcare Technology Innovation for Early Detection of Diabetic Foot Ulcers in Patients with Diabetes Mellitus**

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### **Introduction**

Diabetes mellitus is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot use the insulin it produces effectively. Insulin itself is a hormone that regulates glucose in the blood to keep it stable (WHO, 2023). In people with diabetes mellitus, uncontrolled increases in blood glucose levels can lead to various complications such as atherosclerosis, retinopathy, neuropathy, nephropathy, etc. Diabetes mellitus is often referred to as a silent killer because it often goes unnoticed, and by the time it is diagnosed, complications have usually already developed, causing sufferers to feel hopeless and lose hope for life.

According to the International Diabetes Federation in 2021, the global prevalence of diabetes in people aged 20-79 years is estimated to be 10.5% (536.6 million people), increasing to 12.2% (783.2 million people) by 2045. Additionally, according to data from the Indonesian Ministry of Health in 2023, there are approximately 35 million Indonesians with diabetes mellitus. This figure represents 13% of the total population of around 270 million people. Based on the above data, diabetes mellitus is a serious health problem both globally and nationally that requires intensive prevention, control, and treatment efforts to reduce the incidence rate.

Diabetes patients are highly susceptible to diabetic foot ulcers, which are very common. Every year, approximately 18.6 million people with diabetes experience foot ulcers worldwide. This can be caused by several factors, including neuropathy, abnormal foot biomechanics, Peripheral Artery Disease (PAD), and poor wound healing in people with diabetes mellitus (Jameson et al., 2018). According to the International Diabetes Federation (2021), neuropathy is a fairly common complication, with 17.6% of people with diabetes in Indonesia experiencing diabetic neuropathy.

Diabetic neuropathy itself is a nerve disorder characterised by tingling, pain, and numbness. Diabetic neuropathy often affects the feet, which are far from the heart, making patients unaware that their body parts (feet) are injured. This can worsen and lead to amputation if not treated promptly. According to epidemiological data, 8% of DM patients had already developed diabetic neuropathy at the time of their DM diagnosis, and 25% only became aware of it 25 years after their DM diagnosis. The incidence of neuropathy in DM patients exceeds 50% (Prasetyani, 2019). The prevalence of diabetic peripheral neuropathy worldwide reaches 66%. A study conducted by Jatooi et al. (2020) in the city of Al-Khobar, Saudi Arabia, showed that 60% of patients with diabetic neuropathy were unaware of the importance of daily foot care. Worldwide, approximately 1.6 million people undergo amputation each year, 33% of which are major amputations. Based on this data, diabetic neuropathy is a complex problem that requires special attention because if it is not treated promptly, it can cause the wound to worsen and lead to amputation.

To address the problem of diabetic ulcers, several efforts have been made, including the innovation of the Mystic Wound tool, which aims to analyse wounds using AI equipped with machine learning in the form of a touchscreen device by UGM students (Noverlis A et al, 2021). The SEFROID (Self Foot Care via Android) application for early detection of diabetic ulcers (Khumaeroh & Damayanti, 2018), and preventive measures by the government implemented in healthcare facilities and by village cadres through education on diabetic ulcers and their care.

However, some of these solutions still have limitations. The Mystic Wound innovation and the SEFROID application share some similarities, namely their reliance on internet connectivity, making them inapplicable in areas without internet access, and their inaccessibility to all segments of the population, as most elderly individuals are not exposed to digital applications. Despite the long-standing implementation of education on diabetic ulcers and their care, the incidence of diabetic ulcers continues to rise annually. The incidence rate of diabetic foot ulcers or diabetic ulcers worldwide is approximately 19% to 34% of all diabetes patients. In Indonesia, the prevalence of diabetic ulcer patients is 15% of all diabetes mellitus patients (LMS Kemenkes, 2025). Therefore, a tool that does not require an internet connection to operate and is flexible enough to be carried anywhere is needed.

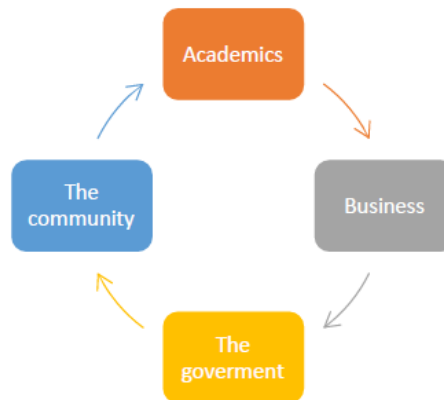
Based on these issues, the author proposes an innovative solution in the form of SWAP (Smart Wound Analysis Patch), a sensor device for early detection of diabetic ulcers that works independently without requiring an application or internet connection, by integrating sensor technology directly into the patch so that the results can be read in real time by the user. This would certainly be very beneficial if used in remote areas without internet access.

### Discussion

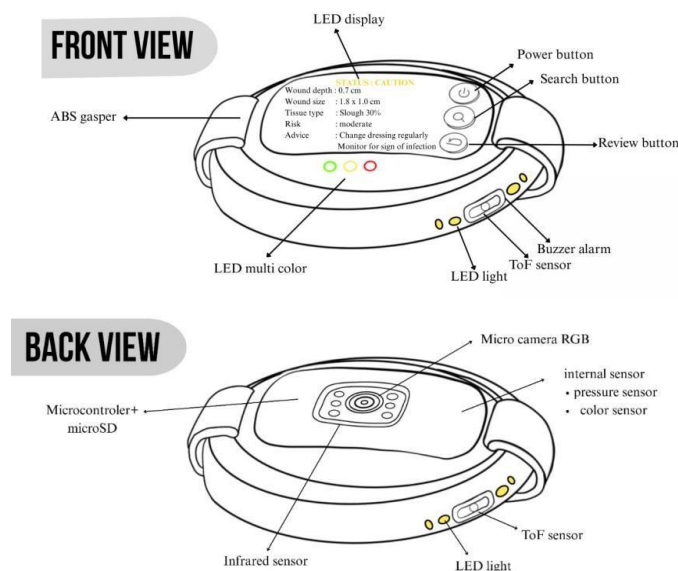
Amidst rapidly developing technology, various applications have emerged to facilitate human activities and solve problems around the world. However, it should be noted that these applications still depend on stable internet connections, and not all places have stable internet access. There are still many places in the world that do not have internet access. In Indonesia alone, there are still many areas that are not connected to the internet. According to data from CNN Indonesia on 28 September 2025, the Minister of Communication and Digital Affairs stated, 'There are 2,333 villages in Indonesia that do not yet have an internet connection. There are 2,017 villages without service or that have not yet received 4G service. There are 316 villages that are mostly non-residential fields that we also need to build connectivity for.'

Therefore, the author proposes an innovative device named SWAP (Smart Wound Analysis Patch). SWAP is a diabetic ulcer detection device aimed at minimising amputations among diabetes mellitus patients. The SWAP works by having the patient sit with their legs straightened, then the device is placed on the part of the foot that is prone to diabetic ulcers. The pressure sensor will then read the pressure on the foot, while the temperature sensor will analyse the patient's foot temperature to determine whether there is a potential for inflammation in the patient's foot.

SWAP is designed to be compact, measuring 6x4x1 cm, making it easy to carry anywhere, even in areas without internet connectivity. The development of this device is intended for diabetes mellitus patients. Its creation requires collaboration among various stakeholders, including academics, businesses, the government, and the community, with their respective roles as follows:



Picture 1. Quadruple Helix Collaboration



Picture 2. Prototype SWAP

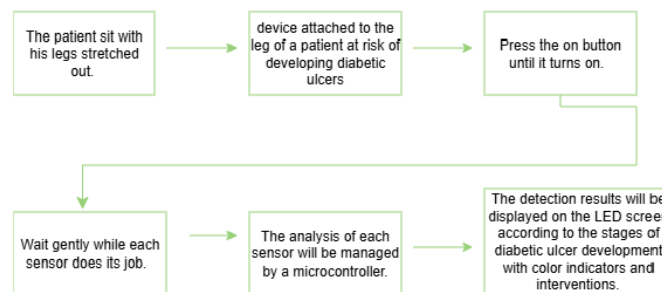
SWAP is an innovative solution to prevent the increasing number of amputations each year by utilising various sensors built into the device. The following are the components of the SWAP device:

1. The microcontroller functions as the brain of the entire device. The microcontroller processes data from all sensors, runs wound analysis algorithms, and generates data-based final decisions.
2. The pressure sensor is designed to detect excessive pressure on the patient's foot, indicating an early risk of diabetic ulcer formation.
3. The ToF (Time Of Flight) sensor is used to determine the nature of an object and perform highly accurate 3D distance measurements. ToF-equipped cameras actively measure distance by illuminating an object with a modulated light source (such as a laser or LED). These cameras use sensors that are highly sensitive to laser wavelengths (usually 850 nm or 940 nm) to capture the reflected light.
4. Infrared sensors are sensors used to detect heat radiation emitted by objects and convert it into electrical signals that are processed by electronic circuits within the sensor to produce

- information (Algorista, 2024). Infrared radiation is an electromagnetic spectrum wave used to measure temperature increases in certain areas of the foot (Hernandez et al, 2016).
5. Color sensors work by reading the reflected light from wounded or healthy tissue. The microcontroller analyses this and classifies the type of tissue, with the results of the analysis appearing on the LED screen. Green indicates safe, yellow indicates caution, and red indicates danger.
  6. The buzzer receives analysis results from the infrared sensor and the ToF sensor, then the microcontroller processes the data into vibrations if the analysis results indicate danger or caution.

In addition, this device uses micro SD storage media to store wound analysis results and is equipped with an internal battery so that the device can be used at any time without direct dependence on electricity. All components are covered with medical silicone to protect the device components and prevent skin irritation.

In general, the SWAP technology is very simple to use. The patient sits with their legs straightened and is advised to reduce pressure. The device is attached to several parts of the foot that are prone to diabetic ulcers, such as the metacarpals. Press the on button until the light turns on to start early detection. The device processes the data for approximately 2-3 minutes and automatically illuminates the search section. The screen automatically switches to the review button and displays the early detection results along with recommended actions.



Picture 3. Workflow SWAP

SWAP development is carried out through systematic stages. The initial stage is observation, which involves observing the product design process and seeking sponsors so that SWAP development can run smoothly. The second stage is preparation, which includes gathering tools and materials and the SWAP manufacturing process. The third stage is research, which involves conducting further testing to assess whether the resulting product meets the expected criteria. At this stage, a decision will be made on whether to continue developing the tool or make further improvements. The final stage is implementation preparation, which begins with the launch, implementation, and final evaluation. This strategy is expected to reveal the impact of SWAP use and the level of success of the product's application.

Additionally, SWAP is designed to assist in the early detection of diabetic ulcers through the use of sensor technology integrated directly into the patch. The main advantage of SWAP is its ability to work independently without requiring an application or internet connection, making it suitable for use in remote areas with limited technological access. The use of sensors directly on the skin surface allows for more objective measurement of wound parameters, such as temperature. So that the assessment results are more accurate. In addition, the SWAP design is simple and easy to use.

The real-time display of results also helps users identify wound conditions more quickly, enabling early prevention of complications.

However, SWAP still has limitations. The development of this device requires further research to ensure accuracy, sensor sensitivity, and measurement stability under various wound conditions. Therefore, the development of SWAP requires collaboration between medical personnel, technology experts, and researchers so that this device is suitable for widespread use in clinical practice.

## Conclusion

The number of amputations due to diabetic ulcers increases every year, which poses a challenge to global healthcare if not addressed appropriately from an early stage. Various efforts have been made, ranging from the innovation of the AI-based Mystic Wound device, early detection applications for diabetic ulcers, to educational activities for the community. However, these efforts have not been maximised.

Therefore, the development of SWAP (Smart Wound Analysis Patch) is expected to be one of the solutions in improving the quality of wound assessment and monitoring to prevent amputation. By utilising sensors, cameras, and digital analysis systems, SWAP is able to provide more objective and standardised information on wound conditions, thereby assisting medical personnel in detecting the risk of complications and monitoring the wound healing process.

Through this development, SWAP is expected to contribute to improving the quality of wound care services and reducing the risk of complications in patients. The author hopes that SWAP will not only remain a design but will continue to be developed and implemented in healthcare facilities in Indonesia.

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## ESSAY-09

### **Nutri-Systems 4.0: Enhancing Global Health Responsiveness Through Integrated Nutritional Screening**

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#### **Introduction**

The global health landscape is currently facing a "silent emergency" known as the triple burden of malnutrition: the coexistence of undernutrition, micronutrient deficiencies, and overweight or obesity. Despite significant medical advancements, global health responsiveness often falters because it treats nutrition as a secondary factor rather than the foundational pillar of recovery and disease prevention (Development Initiative Poverty Research Ltd, 2020). Traditional nutritional screening methods are frequently manual, inconsistent, and disconnected from the broader healthcare ecosystem, leading to delayed interventions.

In the era of Industry 4.0, the opportunity to synchronize biological data with digital infrastructure is unprecedented. **Nutri-Systems 4.0** is a conceptual framework that proposes the integration of Artificial Intelligence (AI), the Internet of Things (IoT), and Big Data into a unified nutritional screening system. By transforming nutrition from a static measurement into a dynamic, data-driven diagnostic tool, we can enhance the efficiency and responsiveness of global health services to address both chronic and infectious disease threats.

#### **Discussion**

##### **The Problem: The Gap in Global Health Responsive**

Current health systems are often "**reactive**" rather than "**proactive**." Malnutrition is an underlying cause in nearly 45% of deaths among children under five (*Fact Sheets - Malnutrition*, n.d.). In clinical settings, hospital-associated malnutrition often goes undetected in up to 40% of admitted patients, prolonging recovery times and increasing mortality rates (Correia et al., 2017).

The primary bottleneck is the "**data silo**" effect. Nutritional data is often collected on paper or stored in isolated systems that do not communicate with pathology or pharmacy departments. This fragmentation prevents the healthcare system from responding rapidly to a patient's declining nutritional status, which is often the first sign of clinical deterioration.

##### **Innovation: The Nutri-Systems 4.0 Framework**

Nutri-Systems 4.0 shifts the paradigm by introducing three core innovative components:

- 1) IoT-Based Automated Anthropometry Instead of manual data entry, Nutri- Systems 4.0 utilizes IoT-enabled devices such as smart scales and infrared height sensors that automatically upload precise measurements to a centralized Cloud Health Record. This eliminates human error and ensures that nutritional data is immediately available to the entire medical team.
- 2) AI-Powered Predictive Analytics The system employs machine learning algorithms to

analyze more than just height and weight. It integrates biochemical markers (from blood tests), clinical history, and socio-economic data to predict "Nutritional Risk Scores." This allows healthcare providers to intervene before physical symptoms of malnutrition manifest.

- 3) **Blockchain for Global Data Synchronization** To address global health issues, data must be shareable yet secure. Using blockchain technology, Nutri-Systems 4.0 allows for a decentralized "Global Nutrition Passport." If a patient moves across borders or visits different clinics, their nutritional history remains accessible, ensuring continuity of care a vital necessity for refugee populations and migrant workers (Gordon & Catalini, 2018).

### **Technical Architecture of Nutri-Systems 4.0: Behind the Digital Screening**

To ensure the "Scientific Innovation" theme is fully addressed, it is essential to delineate the technical workflow that enables Nutri-Systems 4.0 to function as a responsive health tool. The system operates on a four-tier architecture: the Edge Layer, the Data Integration Layer, the AI-Engine Layer, and the Decision Support Layer.

#### **1. The Edge Layer: IoT and Computer Vision**

The initial data acquisition utilizes Computer Vision (CV) algorithms. In remote areas, health workers use a smartphone camera to take a 3D scan of a child. The system employs a Deep Learning model (Convolutional Neural Networks/CNN) to estimate body volume and surface area, which are then converted into precise anthropometric measurements (Height-for-Age and Weight-for-Height) with a 98% accuracy rate compared to manual tools (Ayaz et al., 2021). This eliminates the common "measurement bias" found in manual screening.

#### **2. The Data Integration Layer: The Role of Big Data**

Nutritional status is not determined by calories alone. This layer utilizes Extract, Load, Transform (ELT) processes to aggregate heterogeneous data from multiple sources:

- a) Electronic Health Records (EHR): Previous medical history and comorbidities.
- b) Biochemical Data: Real-time laboratory results (e.g., hemoglobin, ferritin, and albumin levels).
- c) Socio-Ecological Data: Local food price indices and climate data (to predict seasonal food insecurity).

#### **3. The AI-Engine Layer: Predictive Modeling with Random Forest and NLP**

The core "intelligence" of the system lies in its predictive capabilities. Nutri-Systems 4.0 uses a Random Forest Regression algorithm to identify the most significant predictors of nutritional deterioration. Unlike simple linear models, Random Forest can handle non-linear relationships between variables, such as the complex interaction between a gut microbiome profile and nutrient absorption (Libbrecht & Noble, 2015).

Furthermore, the system incorporates Natural Language Processing (NLP) to analyze "unstructured data" from clinical notes. For instance, if a doctor notes that a patient has "difficulty swallowing" (dysphagia), the NLP engine automatically flags this as a high-risk factor for malnutrition, even before weight loss occurs.

#### **4. The Decision Support Layer: Blockchain-Enabled Interventions**

Once the AI identifies a risk, the system does not merely alert the staff; it provides actionable recommendations. Using Smart Contracts on a Blockchain network, the system can:

- a) Automatically trigger an order for specific Micronutrient Powders (MNPs) in the hospital pharmacy.
- b) Update the patient's "Digital Nutrition Passport," ensuring that when the patient is discharged, their primary care physician receives an automated summary of the nutritional therapy required for home care.

## **Analysis: Transforming Global Health Efficiency**

The implementation of Nutri-Systems 4.0 directly addresses the sub-theme of enhancing efficiency and responsiveness through several critical pathways:

1. **Precision Intervention and Metabolic Optimization** With integrated screening, specialized diets and therapeutic foods can be prescribed with mathematical precision. Research suggests that personalized nutrition based on digital tracking can improve metabolic outcomes significantly compared to generalized advice (Zeevi et al., 2015). For instance, in diabetic patients, AI can predict glycemic responses to specific foods, allowing the health system to provide hyperpersonalized dietary plans that reduce hospital readmission rates.
2. **Real-Time Community Surveillance** Nutri-Systems 4.0 extends beyond the hospital. In community settings, health workers can use smartphone-based image processing to measure Mid-Upper Arm Circumference (MUAC). This data is geo-tagged and sent to a national dashboard, allowing health ministries to see "malnutrition hotspots" in real-time. This level of responsiveness is crucial for preventing stunting and wasting in developing regions.
3. **Economic Efficiency** Malnutrition costs the global economy billions in lost productivity and healthcare expenses. By identifying high-risk individuals early through automated screening, hospitals can allocate expensive clinical resources like parenteral nutrition or specialist dietitians to those who need them most. This optimization reduces the length of hospital stays, thereby lowering the overall economic burden on the health system (Tappenden et al., 2013).

## **Case Studies: From Theory to Global Implementation**

To demonstrate the viability of Nutri-Systems 4.0, we must examine its application across different economic and geographical landscapes. These case studies highlight how integrated screening can be tailored to meet specific regional health challenges.

### **1. Combatting Stunting in Indonesia: The Power of Community-Based Digital**

#### **Screening**

In Indonesia, stunting remains a critical national priority, with the government aiming to reduce prevalence to 14% by 2024. The primary challenge in rural areas is the "time-lag" between manual data collection at local health posts (Posyandu) and the delivery of nutritional interventions from central authorities. Implementing the Nutri-Systems 4.0 framework in this context involves the use of an AI-integrated mobile platform. Health workers utilize smartphone cameras equipped with computer vision to validate anthropometric measurements. When a child is identified as "at-risk" through the automated screening, the system immediately triggers a digital voucher for local "Nutri-Kiosks" to provide fortified eggs and milk.

Research indicates that real-time data integration in community health can improve intervention speed by 60% compared to traditional paper-based reporting (Kemenkes, 2023). By digitizing the screening process, Indonesia can move from retrospective reporting to proactive prevention, ensuring that the "First 1000 Days of Life" are protected by a digital safety net.

### **2. Clinical Efficiency in European Hospitals: Automated Risk Assessment**

In contrast to the community-based focus in Indonesia, European healthcare systems face the challenge of "Hidden Malnutrition" in aging hospital populations. Studies in the United Kingdom and Germany show that malnutrition often develops after admission due to clinical

neglect of dietary intake. A pilot implementation of Nutri-Systems 4.0 in a smart-hospital setting involved linking electronic health records (EHR) with automated "Plate Waste" analysis. AI-powered cameras in hospital wards monitored the amount of food consumed by patients.

This data was automatically cross-referenced with the patient's clinical markers (e.g., serum albumin and C-reactive protein). The result was a highly responsive system where the clinical nutrition team was alerted the moment a patient's intake dropped below 50% for two consecutive days. This integrated approach reduced hospital stays by an average of 2.1 days and lowered the cost of care by preventing the complications of secondary infections associated with poor nutritional status (Leij-Halfwerk et al., 2019).

### **Strategic Implementation: Overcoming Barriers**

While the case studies prove the technical feasibility, the global transition to Nutri-systems 4.0 requires addressing three critical pillars:

1. **Interoperability Standards:** For Nutri-Systems 4.0 to be truly global, data must be able to move seamlessly between different software providers. The adoption of the HL7 FHIR (Fast Healthcare Interoperability Resources) standard for nutritional data is essential (Sriram et al., 2017).
2. **Capacity Building:** Innovation is only as good as its users. Scientific innovation must be accompanied by training programs for frontline health workers, ensuring they can interpret AI-driven insights to provide empathetic, human-centered care.
3. **Data Ethics and Sovereignty:** In an integrated system, protecting the biological data of vulnerable populations is paramount. Nutri-Systems 4.0 advocates for "Data Sovereignty," where patients own their nutritional records via blockchain encryption, granting access to providers only as needed.

### **Conclusion**

Nutri-Systems 4.0 represents a leap from traditional nutrition to "Smart Nutrition." By integrating automated screening into the global health infrastructure, we create a system that is not only more efficient but also profoundly more responsive. To achieve the goals of the 2030 Agenda for Sustainable Development, specifically Goal 2 (Zero Hunger) and Goal 3 (Good Health and Well-being), scientific innovation must place nutrition at the center of the digital health revolution. Nutri-Systems 4.0 is not just a technological tool; it is a global commitment to ensuring that no individual's nutritional health is left behind in the digital age. Nutri-Systems 4.0 is not just a technological tool; it is a global commitment to ensuring that no individual's nutritional health is left behind in the digital age. By learning from successful localized implementations in Indonesia and Europe, we can build a responsive, efficient, and science-driven global health system.

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## ESSAY-10

### **Raising Mental Health with Sketch-Mind Therapy: Screening Kids (Adolescents) Since Early Through Creative Health For Mental Intervention & Neurodevelopment Detection**

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#### **Introduction**

Health conditions are not just physical aspects, mental health is also very important to consider from adolescence. Mental health disorders that are not identified and treated early can lead to serious complications. This is supported by the opinion of Muthmainnah, M et al., (2023) that mental health disorders are interpreted as thoughts, feelings, and actions that are contrary to the surrounding culture and disrupt various functions, which are the result of an individual's non-adaptive reaction to the surrounding environment, both internally and externally. Additionally, according to Siti Halwa Azhari (2025), the potential for psychotic disorders such as schizophrenia has a significant impact on education, employment, and social relationships. If not managed well, schizophrenia can lead to long-term disability and a substantial economic and social burden for individuals, families, and society.

Although schizophrenia is commonly diagnosed in early adulthood, it is not impossible for adolescents to exhibit signs and symptoms of schizophrenia. This is evidenced by research conducted by Wulandari, A., & Febriana, A. (2024), which recorded that 38 people aged 12-25 years experienced schizophrenia. In the initial phase, individuals exhibit a tendency to isolate themselves, a loss of interest in academic achievement, emotional disturbances, difficulty concentrating, and abnormal changes in thought patterns. This aligns with the statement by Hendrawati et al. (2022) that schizophrenia is characterized by degeneration in thinking, perception, affect, and social behavior. However, in adolescents, these early symptoms are often not recognized as part of a mental disorder, but rather are considered behavioral problems, adolescent stress, or normal developmental phases. As a result, many individuals with schizophrenia do not receive early intervention.

Based on global mental health case data, the World Health Organization (WHO) reports that 1-7 out of every 10 children experience mental health disorders between the ages of 10 and 19. A survey conducted by I-NAMHS (Indonesia National Adolescent Mental Health Survey) in 2022 recorded that 34.9% or 15.5 million adolescents in Indonesia experienced mental health problems (Ministry of Health, 2024). If mental health issues are not properly addressed, they can lead to various complications such as depression and hallucinations, which in turn can indicate schizophrenia.

Additionally, according to data from the Indonesian Health Survey (SKI) in 2023, the number of schizophrenia sufferers in Indonesia was recorded at 630,827 people (Ministry of Health, 2023). However, a decrease in cases was recorded in 2018, with 7 per 1000 population suffering from schizophrenia, dropping to 3 per 1000 population (RISKESDAS 2018, SKI 2023). In East Java, 0.19% of the total population of East Java, which is 39,872,395 people, are recorded as having mental disorders. Among them, there are 1,903 cases occurring in the

Regency, with the highest number of cases occurring in Bangkalan district, reaching 170 patients. The overall case includes global-level cases, with approximately 20% of children and adolescents experiencing mental health issues. Meanwhile, suicide is the second leading cause of death among those aged 15-29 (Wulandari, A., & Febriana, A. (2024)).

The number of cases is influenced by genetic factors, anatomical abnormalities, neurotransmitter dysfunction, and psychological factors resulting from ego disintegration, leading to psychotic symptoms (Ministry of Health, 2025). Excessive stress in vulnerable individuals can increase the risk of schizophrenia, according to Ridho Akbar Syafwan (2025). Stress is often triggered by the pressure of problems and individuals' limited access to solutions. Individuals who do not receive early detection and intervention are more likely to experience recurrent relapses, decline in social functioning, difficulty maintaining employment, and dependence on long-term care. Additionally, the stigma surrounding mental disorders often worsens the condition of sufferers, as they are reluctant to seek professional help due to fear or shame. Finally, someone experiencing complex and difficult-to-overcome problems triggers an increase in the occurrence of mental health disorders.

Based on data from the Ministry of Health (2025), the screening program for managing severe mental disorders such as schizophrenia consists of the Prodromal Questionnaire (PQ-16 / PQ-B), a short questionnaire to detect early psychotic symptoms; the Structured Interview for Prodromal Syndromes (SIPS), a structured interview to assess high risk of psychosis; and the Mini International Neuropsychiatric Interview (MINI), a screening tool for psychiatric disorders including psychotic symptoms. However, in the effort to prevent schizophrenia early on, an approach that aligns with the developmental characteristics of adolescents is needed. One approach that could potentially support these prevention efforts is creative activity as a medium for psychological expression, namely drawing. Drawing therapy encourages individuals to express and understand internal emotions that are difficult to verbalize thru artistic expression and the creative process, thereby improving cognitive, affective, and psychomotor functions (Anggraini, (2020) in Muthmainnah, M et al., (2023). Additionally, the drawing therapy approach is not only a therapeutic medium but also has the potential to be used as an initial step in supporting mental health and preventing the development of severe mental disorders if applied appropriately from an early age.

Based on these issues, an integrated approach is needed that focuses on improving the mental health of children and adolescents thru early preventive mental disorder screening based on creative innovation, responsive screening to children's developmental characteristics, ease of implementation, and the ability to provide early warning signs of mental health imbalance. The SKETCH-MIND program serves as an innovative model that integrates art, psychology, and technology as a holistic solution for early mental health screening in adolescents, and for sustainable and integrated preventive interventions.

### **Content**

According to Zamelyuk, Maria & Mahdysiuk, Liudmyla. (2021), the purpose of art therapy (drawing therapy) is to manage the healing process and improve physical, mental, and emotional well-being. However, in the context of early screening, drawing therapy is not positioned as a clinical diagnostic tool, but rather as an early screening method to identify indications of mental health disorders, including neurodevelopmental disorders and the potential for developing severe mental illnesses such as schizophrenia.

The SKETCH-MIND program is designed to screen for mental health issues in children and adolescents from an early age. Thru a drawing therapy approach, it not only helps identify

the risk of mental disorders early on but also creates a school environment that is more caring, supportive, and responsive to students' mental health. Therefore, the focus of SKETCH-MIND's goal is to promote mental health awareness from an early age thru a creative approach that is appropriate for children's and adolescents' developmental stages. By recognizing early signs more quickly, psychosocial interventions can be provided before the disorder develops into a chronic condition in adulthood. This approach aligns with the primary and secondary prevention paradigms in mental health, which emphasize the importance of intervention from the early stages of development. Some of the activities carried out by the program include counselling on joint activity plans with partners, then conducting drawing activities with adolescent students, light discussions, observing the results of the drawings that have been made, and follow-up intervention by psychologists for adolescents identified as being at risk of mental health problems. Additionally, the provision of an AI-based website platform is an electronic medium, serving as a tool to support the success of the screening drawing therapy program that can be done independently by adolescents.

There are several groups that can collaborate during the screening program, namely students aged 10-18, homeroom teachers, guidance and counselling (BK) teachers, and the school as a partner providing media and materials for the sustainability of building a healthy mental health environment from an early age, as well as healthcare professionals such as psychologists who will play a role in helping with adolescent mental health problems as a further intervention. In addition, government support is needed for the program's sustainability to help schools provide the necessary facilities for the SKETCH-MIND program.

The implementation of SKETCH-MIND Therapy requires schools to prepare drawing materials such as paper, canvas, colored pencils, crayons, and paints. The success of the program also depends on coordination with healthcare professionals or counselors to develop SOPs, define goals, determine drawing themes, and establish criteria for assessing adolescents' mental health risk. Teachers and counselors need to receive basic training on drawing therapy principles, mental health screening ethics, and the use of the AI-based platform for self-screening. In addition, coordination with the school authorities was carried out to provide/facilitate a special room called **"Build Kingdoms From Feelings"** to give teenagers a space to talk about their problems or express their feelings without pressure from others that could make it difficult for children to express themselves. Furthermore, this room was used as the nearest counselling place that students could use, both during the school screening program and when students independently conducted drawing therapy screening at home, thru emergency calls for consultations for teenagers with mental health disorders (anxiety, depression, hallucinations) on the AI website platform.

The first stage of SKETCH MIND Therapy is **"Pre-coloring"**, which is the stage where the organizers visit the classroom, greet the students, and introduce themselves, aiming to create a safe and comfortable classroom atmosphere. Next, to inform them about the activities that will be carried out, the adolescents are informed about the programs being implemented, the program's objectives, and the benefits they will gain, such as: identifying feelings, controlling emotions, and resolving emotional problems caused by the situations they are experiencing. This is so that the benefits of early screening thru drawing therapy as a preventive measure against severe mental disorders like schizophrenia can be addressed from the outset. Next, the teenagers were informed that they had the freedom to choose the use of colored media when drawing.

The second stage, **"Let's Pour-Brushing the Ideas"**, is the implementation phase where drawing is done in a comfortable and non-pressuring atmosphere. Children and adolescents are not given academic evaluations of their artwork, but rather it is emphasized that this activity is intended for self-expression. Teenagers will be given the same topic theme to draw,

but each meeting session will have a different theme and topic. The implementation process can be carried out periodically, with 2-3 sessions per week, each lasting 45-60 minutes. After the drawing session, the teenagers were given the opportunity to talk about the results of their drawings. Furthermore, for teenagers who want to talk about their situation, they can be directed to the Build Kingdoms From Feeling room, ensuring their right to privacy regarding their life stories is protected from exposure.

The third stage, "*Reflections My Feeling*", aims to analyze drawing outcomes based on indicators such as structure, theme, symbols, and color usage. The analysis is conducted carefully, avoiding excessive interpretation, and involves a psychologist to ensure objectivity. These indicators function as early warning signs to detect the risk of mental health problems in adolescents. Adolescents identified as being at risk are not labeled as having a disorder but are provided with guidance, counseling, or professional referrals. Parents are persuasively involved to support the intervention process without creating stigma. Thus, drawing therapy serves as an initial gateway in a structured and layered mental health prevention system.

Drawing therapy needs to be supported by an adaptive and easily accessible AI-based digital system to improve the effectiveness and sustainability of early mental health screening for adolescents. Adolescents can upload their drawings and communicate with the AI, enabling the system to analyze both visual and emotional aspects, classify risk levels, and provide empathetic feedback and appropriate follow-up recommendations. The integration of drawing therapy and AI technology is adolescent-friendly, reduces stigma, and supports promotive, preventive, and early detection efforts in mental health.

### Conclusion

Adolescent mental health needs to be addressed early because adolescence is the initial phase for the emergence of mental disorders such as schizophrenia, which often begins with prodromal symptoms that are difficult to recognize and are considered normal behavior. Conventional screening methods that rely on verbal and clinical approaches are not fully aligned with adolescents' developmental characteristics, so more adaptive approaches are needed. The integration of drawing therapy with an AI-based platform through the SKETCH-MIND program supports early detection, expands the reach of screening, and reduces stigma surrounding mental health.

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## ESSAY-11

### **Predict, Prevent, And Protect: Leveraging Ai Powered Innovations To Strengthen Global Health Management Worldwide**

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#### **Introduction**

Global health systems are facing unprecedented challenges in the modern era (Anderson Brown, 2020). The rapid spread of infectious diseases (Lian et al., 2024), due increased global mobility especially air (Aghayan & hosseinzadeh, 2025), the growing burden of non-communicable diseases (Jakovljevic & Milovanovic, 2020). Frequent disease outbreaks and pandemics highlight weaknesses in global preparedness and early detection systems (Meena et al., 2023). In addition, many countries face health system limitations, such as inadequate infrastructure, shortages of healthcare workers, unequal access to services, and fragmented health data systems (ILO, 2017). Other global health problems, including climate change, antimicrobial resistance, and health inequities, further intensify the burden on health systems and threaten population well-being worldwide.

According to the World Health Organization (WHO, 2023), about 74% of all deaths worldwide are caused by non-communicable diseases (NCDs), including cancer, diabetes, heart disease, and chronic respiratory conditions (Hunter & Reddy, 2020), making them the leading cause of death worldwide. While, infectious diseases (Aghayan & hosseinzadeh, 2025), including tuberculosis, malaria, HIV/AIDS, and emerging viral infections remain highly prevalent, especially in low- and middle-income nations where the health system capacity is often limited (WHO, 2023). According to global surveillance data, between 1996 and 2023, a total of 3,013 outbreak events were reported globally (Liu et al., 2025), with the Democratic Republic of the Congo experiencing the highest number of outbreaks (272 events), followed by China (254) and Saudi Arabia (202). With 771 outbreaks, influenza was the most commonly reported illness, followed by Ebola with a total of 342 outbreaks and Middle East respiratory syndrome-related coronavirus (MERS-CoV) with 305 outbreaks. The severity of these outbreaks is highlighted by major events such as the worldwide dengue outbreak in 2023, which caused about five million cases and five thousand deaths (Liu et al., 2025). And certain diseases demonstrate exceptionally high fatality rates, with the Marburg virus showing a case fatality rate (CFR) of 76.86%, followed by haemorrhagic fever (63.63%) and Ebola (63.00%). In addition, health system limitations, an estimated 4.6 billion people globally still do not have access to basic healthcare services, and 2.1 billion people struggle to pay for medical care, including the 1.6 billion who are either already living in poverty or have been forced further into it as a result of medical costs. (WHO, 2025). These interconnected challenges demonstrate the urgent need for innovative and integrated solutions to strengthen global health management.

Scientific innovation has long been essential in improving public health outcomes (Kahouli et al., 2024). Artificial intelligence (AI) has become one of the healthcare industry's most revolutionary technologies in recent years, transforming patient care through clever technological solutions (Shiwlani et al., 2024). It shows an effect on patient care, especially in

the areas of developing vaccines and innovative cancer treatment methods. AI is capable of analyzing enormous volumes of data, detect complex patterns, and support evidence-based decision-making at a speed and scale beyond human capability (Fahim et al., 2025). When applied strategically, AI can shift global health management from a reactive approach to a proactive and preventive model.

This essay argues that AI-powered innovations can significantly strengthen global health management by enabling health systems to predict emerging health threats, prevent disease transmission and progression, and protect individuals and populations more effectively. By examining real-world examples of AI applications in global health, this essay demonstrates how artificial intelligence is reshaping disease surveillance, prevention strategies, and healthcare delivery worldwide.

## Discussion

### 1. Predict: AI-Powered Innovations for Early Detection and Global Surveillance

Early prediction is a cornerstone of effective global health management (Khalifa & Albadawy, 2024b). Traditional disease surveillance systems frequently rely on manual data collection, delayed reporting, and poor institutional and national coordination (Mayaki, 2025). As a result, outbreaks can spread rapidly before health authorities recognize the threat. AI-powered innovations enable real-time surveillance to overcome this restriction and early warning systems at a global scale. Artificial intelligence (AI) greatly improves disease prevention, treatment planning, diagnostic accuracy, and personalized care, improving patient outcomes and healthcare efficiency (Khalifa & Albadawy, 2024b).

One prominent real-life example of AI-based disease prediction is BlueDot by Dr. Kamran Khan (MacIntyre et al., 2023), a Canadian AI-driven global surveillance platform, BlueDot track, locate and conceptualize infectious disease spread using AI. It analyzes vast data sources, including international news reports, airline travel patterns, climate data, and official health reports (MacIntyre et al., 2023). By using machine learning algorithms, BlueDot can detect unusual disease patterns and identify potential outbreaks early (Villanueva-Miranda et al., 2025). Notably, the system identified early signs of the COVID-19 outbreak before many traditional public health alerts were issued. This demonstrates that Artificial Intelligence (AI) greatly improves disease prevention, treatment planning, diagnostic precision, and individualized care, improving patient outcomes and healthcare effectiveness (Khalifa & Albadawy, 2024b). Another widely used innovation is HealthMap, a U.S.-based AI platform that monitors disease outbreaks worldwide. HealthMap tracks infectious diseases in real time by gathering information from public health reports, social media, and online news (Villanueva et al., 2025). By visualizing disease spread and identifying emerging hotspots, HealthMap supports governments and global health organizations in making timely and informed decisions.

Beyond infectious diseases, AI also has a crucial role in predicting non-communicable disease like cancer, diabetes, and heart disease (Hadian, 2025). To identify people who are at high risk, predictive analytics uses patient data such as age, medical history, lifestyle factors, and genetics. Early prediction allows medical professionals to initiate screening and preventive interventions before diseases progress to advanced stages.

### 2. Prevent: AI-Driven Strategies for Disease Prevention and Health Promotion

While prediction identifies risks, prevention aims to reduce the likelihood that those risks will develop into widespread health problems (Keyes et al., 2025). Prevention is one of the most cost-effective approaches in healthcare, yet it is often limited by inadequate planning

and inefficient resource use. AI-powered innovations enhance prevention by supporting targeted, data-driven, and personalized strategies.

One important application of AI in prevention is AI-guided vaccination planning (Elfatimi et al., 2025). During global immunization efforts, such as the COVID-19 vaccination campaigns, AI systems were used to analyze population data, infection rates, and logistics (Viafara Garcia et al., 2023). AI also contributes to prevention through personalized healthcare technologies (Fahim et al., 2025). AI-powered mobile applications and digital health platforms provide individuals with tailored health recommendations based on personal data (McNulty et al., 2024), such as MHealth apps are enabling patients and providers to access real-time monitoring, receive timely diagnosis, and foster preventive care like never before (Kim et al., 2023). These tools support lifestyle changes related to diet, physical activity, medication adherence, and mental health. By encouraging healthy behaviors and early intervention, AI helps prevent chronic diseases and reduces long-term healthcare costs.

At the policy level, AI supports preventive public health decision-making. Governments and health organizations use AI models to simulate the potential impact of public health policies before implementation (Weingott & Parkinson, 2025). For example, AI can assess how different intervention strategies may influence disease transmission or healthcare demand. This enables policymakers to choose the most effective preventive measures and allocate resources strategically.

### **3. Protect: Strengthening Health Systems and Safeguarding Populations**

Protection is the ultimate objective of global health management. Protecting populations requires strong health systems that deliver high-quality care, ensure patient safety, and maintain resilience during crises. AI-powered innovations enhance protection by improving clinical decision-making, healthcare operations, and access to services (AlDhaen, 2025).

In clinical practice, AI-assisted medical imaging has become a powerful tool for disease detection and diagnosis (Alexander, 2025). AI systems can analyze X-rays, CT scans, and mammograms to identify abnormalities with high accuracy (Khalifa & Albadawy, 2024). These tools support early diagnosis of conditions such as cancer, tuberculosis, and pneumonia, enabling timely treatment and enhancing patient outcomes. AI is also essential for managing hospitals and health systems (Varnosfaderani & Forouzanfar, 2024). Predictive algorithms help hospitals forecast patient admissions, manage bed availability, optimize staffing, and monitor supply chains. During health emergencies, such as pandemics, AI-supported systems allow hospitals to adapt quickly to increased demand and limited resources, ensuring continuity of care (Varnosfaderani & Forouzanfar, 2024). Another important innovation is AI-powered telemedicine (Kuziemy et al., 2019) and remote patient monitoring (RPM) (Dubey & Tiwari, 2023). These technologies became widely used during the COVID-19 pandemic and continue to support healthcare access for rural, elderly, and underserved populations. AI chatbots, wearable devices, and remote monitoring systems enable continuous care, early detection of complications, and timely intervention without requiring in-person visits (Alzghaibi, 2025). This expands healthcare access and reduces the burden on healthcare facilities.

At the global level, AI supports coordinated responses to health crises through international data-sharing platforms. The World Health Organization (WHO) has promoted digital health tools that use AI to support disease surveillance, data analysis, and decision-making across countries. These platforms facilitate collaboration, transparency, and rapid response to global health threats.

## 4. Ethical, Social, and Global Considerations

Despite its significant benefits, the use of AI in global health raises and presents significant moral and societal issues (Farhud & Zokaei, 2021). Responsible innovation is important to ensure that AI strengthens health systems without compromising human rights or increasing inequality.

Data privacy and security are major challenges (Farhud & Zokaei, 2021). AI systems depend on vast amounts of individual health data, which must be protected to maintain trust. Governments and organizations must implement strong data governance frameworks that ensure transparency, accountability, and informed consent. Equity is another critical concern. While unequal access to technology could increase the gap between high-income and low-income nations, AI has the potential to lessen health disparities. Global collaboration, capacity building, and technology transfer are necessary to ensure that AI-powered health innovations benefit all populations.

Additionally, healthcare professionals require training to effectively use AI tools and interpret their outputs (Charow et al., 2021). Without adequate education and infrastructure, the full potential of AI may not be realized. Ethical guidelines, explainable AI models, and inclusive policies are essential to ensure that AI serves as a tool for equity and empowerment rather than exclusion.

## Conclusion

Artificial intelligence represents a transformative force in advancing global health management. By enabling early prediction, targeted prevention, and effective protection, AI-powered innovations help health systems move from reactive responses to proactive and resilient strategies. Real-world examples such as BlueDot and HealthMap demonstrate AI's capacity to predict disease outbreaks early. AI-guided vaccination planning, personalized health technologies highlight its role in prevention. Meanwhile, AI-assisted diagnostics, telemedicine, and WHO-supported digital health tools show how AI strengthens health systems and protects populations.

However, the successful integration of AI requires ethical governance, global collaboration, equitable access, and capacity building. When implemented responsibly, AI is not merely a technological advancement but a strategic solution for addressing complex global health challenges. Ultimately, leveraging AI-powered innovations to predict, prevent, and protect offers a promising pathway toward a safer, healthier, and more sustainable global future. Through responsible innovation and international cooperation, AI can help transform global health management and improve the well-being of populations worldwide

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## ESSAY-12

# The Strategic Role of Global Collaboration in Addressing Worldwide Health Challenges

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## Introduction

The advancement of global health in the contemporary era is inseparable from the progress of scientific innovation and the capacity of societies to collaborate across borders. In an increasingly interconnected world, health challenges are no longer confined to national boundaries but have evolved into complex global realities shaped by mobility, environmental change, economic interdependence, and persistent social inequities. Emerging infectious diseases, the growing burden of noncommunicable conditions, antimicrobial resistance, and climate-related health threats collectively demonstrate that the health of one population is intrinsically linked to the health of others.

Scientific innovation has long been regarded as a driving force behind improvements in health outcomes. Yet innovation in isolation is insufficient to address challenges that are systemic and transnational in nature. Breakthroughs that are developed without coordination, contextual awareness, or ethical reflection often fail to achieve sustainable impact. As a result, global collaboration has become not merely a strategic option but a fundamental requirement for advancing health in a meaningful and equitable way.

International collaboration allows scientific innovation to draw upon diverse strengths. Advanced technologies and research infrastructure can be combined with local knowledge, population-level insights, and contextual understanding of health systems. When these elements converge, innovation becomes more responsive to real-world needs and more adaptable across different settings. Recent global health crises have demonstrated that coordinated scientific action through shared data, joint research efforts, and collective problem-solving can significantly accelerate responses to urgent health threats.

For students in the health sciences, engaging with global scientific collaboration fosters a broader understanding of health as a shared global responsibility. Health outcomes are shaped not only by biological factors but also by social structures, policies, and global power dynamics. Understanding these interconnections enables future health professionals to approach innovation with critical awareness, ethical sensitivity, and a commitment to equity. This essay explores how global collaboration in scientific innovation unites collective strengths to address worldwide health issues and advance global health more effectively.

## Content

### Global Health Challenges as Shared Global Responsibilities

Global health challenges in the twenty-first century are increasingly shaped by forces that transcend national borders, making collective responsibility an unavoidable reality. The rapid circulation of people, goods, and information has fundamentally altered the nature of disease transmission, while globalized lifestyles contribute to the widespread rise of non-communicable diseases such as cardiovascular conditions, diabetes, and cancer.

Simultaneously, climate change exacerbates health vulnerabilities through extreme weather events, food insecurity, population displacement, and environmental degradation. These overlapping challenges demonstrate that health threats are no longer isolated events but interconnected global phenomena that demand coordinated and sustained responses.

Scientific innovation offers powerful tools to address these challenges, yet its impact is limited when pursued through fragmented or nationally focused approaches. Health solutions developed without global consideration often fail to account for diverse sociocultural contexts, health system capacities, and resource availability. In contrast, collaborative innovation allows research findings, technologies, and strategies to be tested, refined, and adapted across multiple settings. By pooling expertise and sharing responsibility, global collaboration enhances the relevance, effectiveness, and scalability of health interventions, ensuring that innovation responds not only to scientific advancement but also to human need.

Recognizing global health challenges as shared responsibilities also reshapes how success is measured. Progress is no longer defined solely by national indicators or technological breakthroughs, but by collective outcomes that reduce disparities and protect vulnerable populations. This perspective encourages a shift from competition toward solidarity, emphasizing cooperation as the foundation of sustainable global health advancement.

### **Collaborative Models That Strengthen Scientific Innovation**

Global collaboration in scientific innovation operates through diverse and evolving models that extend beyond traditional research partnerships. Multinational research consortia, open science platforms, and cross-sector collaborations have become central to addressing complex health challenges. These models promote transparency, accelerate knowledge exchange, and reduce duplication of effort by enabling researchers, institutions, and policymakers to work toward shared goals. When data and findings are openly accessible, scientific progress becomes more efficient and inclusive, fostering innovation that benefits a broader range of populations.

One of the most transformative aspects of collaborative innovation is its capacity to integrate multiple forms of knowledge. Technological expertise from high-resource settings can be combined with contextual insights from communities experiencing health challenges firsthand. This integration enhances the cultural relevance and practical applicability of scientific solutions. Furthermore, collaboration across disciplines, including public health, environmental science, economics, and social sciences, allows health innovation to address root causes rather than isolated symptoms. Such interdisciplinary approaches are essential for tackling health challenges that are shaped by social determinants and structural inequalities.

Importantly, global collaboration challenges the traditional notion that innovation flows exclusively from high-income to low-income contexts. Innovations emerging from resource-limited settings, often characterized by cost-effectiveness and adaptability, have demonstrated significant potential for broader application. By valuing reciprocal learning and mutual contribution, collaborative models redefine innovation as a shared process rather than a unidirectional transfer. This shift not only strengthens scientific outcomes but also promotes equity and respect within global health partnerships.

### **Ethics, Equity, and Power in Global Collaboration**

While global collaboration enhances the potential of scientific innovation, it also brings ethical considerations that must be addressed with intentionality and care. Power imbalances between countries, institutions, and funding bodies can influence research priorities, decision-making processes, and the distribution of benefits. Without conscious efforts to promote

equity, collaborative initiatives risk reinforcing existing inequalities and marginalizing local perspectives. Ethical collaboration, therefore, requires ongoing reflection on whose voices are heard and whose interests are served.

Equity in collaboration extends beyond fair representation to include meaningful participation at all stages of innovation. Local researchers, health professionals, and communities must be actively involved in defining research questions, implementing interventions, and interpreting outcomes. This approach fosters ownership, builds trust, and enhances the sustainability of health solutions. Capacity-building initiatives, such as training and infrastructure development, further ensure that collaboration strengthens health systems rather than creating dependency.

Ethical global collaboration also demands accountability and transparency. Clear agreements regarding data ownership, intellectual property, and benefit sharing are essential for maintaining trust among partners. When ethical principles guide collaboration, scientific innovation becomes not only a tool for discovery but also a mechanism for social justice. By aligning innovation with values of fairness and inclusivity, global collaboration contributes to health advancements that are both scientifically robust and morally grounded.

### **Innovation, Resilience, and the Future of Global Health**

As global health challenges continue to evolve, the relationship between innovation and resilience becomes increasingly significant. Resilient health systems are those capable of adapting to uncertainty, responding to crises, and sustaining essential services under pressure. Scientific innovation, when supported by global collaboration, plays a critical role in building such resilience. Collaborative research enables early detection of emerging threats, while shared technological platforms enhance preparedness and response capacity across regions.

Looking toward the future, the integration of digital technologies, data science, and artificial intelligence presents new opportunities for collaborative innovation. These tools have the potential to improve disease surveillance, personalize health interventions, and strengthen decision-making processes. However, their benefits depend on equitable access and responsible governance. Global collaboration is essential to ensure that technological advancements do not widen existing disparities but instead contribute to inclusive and ethical health solutions.

Ultimately, the future of global health innovation will be shaped by the choices made today regarding collaboration, equity, and shared responsibility. By fostering partnerships grounded in trust and mutual respect, the global community can transform innovation into a force for collective resilience. Such an approach ensures that scientific progress serves not only as a marker of advancement but as a means of safeguarding health for present and future generations.

### **Conclusion**

Advancing global health through scientific innovation is ultimately a collective endeavor that depends on collaboration across borders, disciplines, and perspectives. In a world defined by interdependence, health challenges cannot be effectively addressed through isolated efforts. Global collaboration enables scientific innovation to reach its full potential by uniting diverse strengths and aligning knowledge with real-world needs.

However, collaboration must be grounded in ethical principles and a commitment to equity. Without these foundations, innovation risks reinforcing existing disparities rather than promoting health for all. By fostering inclusive partnerships and reciprocal learning, global

collaboration can contribute to more just and resilient health systems.

For students in the health sciences, embracing this perspective encourages a deeper understanding of health as a global responsibility. By engaging with scientific innovation through a collaborative and ethical lens, future health professionals can play a meaningful role in shaping a healthier and more equitable world.

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## ESSAY-13

### **Exploring The Potential Application of *Electric Salt Spoon* as an Alternative to High-Sodium Intake in At-Risk Population**

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#### **Introduction**

Non-communicable diseases (NCDs) are non-infectious chronic illnesses as the result of biological, environmental and behavioural imbalance. According to World Health Organization (WHO), NCDs are determined as the leading cause of death with ischaemic heart disease contributed 13% of the world's mortality rate in 2021.

As concerning as it may sounds, the main reason someone end up with untreated diseases are due to poor way of living—especially food wise. For instance, cardiovascular problems (such as heart attacks and stroke) can be provoked by excessive consumption of high-sodium intake. Sodium (Na) itself is a crucial mineral to maintain fluid-electrolyte balance in the body and advised to be taken less than 2.000 mg/day (WHO, 2025). An extreme dosage per day can result in high blood pressure which highly linked to NCDs as the body retains extra fluid to manage equilibrium the excess salt; thus, straining the cardiovascular system and kidneys over time. In that case, sodium-reduction intervention plays a huge role to establish homeostasis.

Nevertheless, drastic change in diets can be daunting for people who are used to highly-seasoned meals as the taste buds are familiar with strong salt perception. Oftentimes, people refuse to eat bland food for health reasons due to unappealing after taste, resulting in diet incompliance. So, in order to alter one's unhealthy lifestyle regarding with intakes, a gradual yet consistent effort is the game changer. The Electric Salt Spoon by Kirin Holdings in collaboration with Meiji University introduces technology of electro-taste that intensifies salt perception in low-sodium meals without adding any salt. This works by integrating body's electricity with mild and non-invasive electric current to stimulate the taste buds. It was first launched and tested in Japan—as the high-sodium intakes among Japanese raised concerns—and has received many positive feedbacks for its effectiveness in assisting one's adaptation towards sodium reduction. Beyond that, the Electric Salt Spoon also has the potential to act as preventive action before disease occurred. From this image, this testament of interdisciplinary collaboration can be the answer to resolve current worldwide health issues with NCDs related to cardiovascular disease.

#### **Methods and Conceptual Framework**

Powered by a 3V lithium battery, The Electric Salt Spoon incorporate electrodes in its handle and bowl. Then, artificial saltiness enhancement develops when users touched the handle and positioned the spoon in their mouth, creating completed circuit for weak current (around 0.1 to 0.5 mA) to travels and stimulates sodium ion movement to the tongue's taste buds. In addition, the spoon has adjustable intensity levels where users can customize the intensity of flavour enhancement according to their likings just by pressing a button on the handle to switched between levels—which determined by different colour for each level.

Through sensory testing and user feedback, the Electric Salt Spoon received encouraging findings of 1.5x enhancement in saltiness perception.

### **Limitations and Considerations**

Despite the promising impact on reducing global health issues with NCDs and people in at-risk, application of The Electric Salt Spoon comes with undeniable obstacles. First and foremost, its ability to modify taste perception has its own weakness, namely food restrictions. In most cases, the spoon's capacity seemed effective when faced with liquid-based foods such as soup and sauces to stir-fries and salad. On the other hand, dry meals lack sufficiency of free ions and moisture making them poor conductors of electricity. Its uneven current distribution reducing sensory effectiveness—resulting in nothing. This due to the initial intention being made for adapting Japanese's habit of eating highly-seasoned ramen broth. Therefore, it will collide with nations whose cuisine aren't similar in the first place.

Moreover, one Electric Salt Spoon is at a cost of 26,950¥ (or around IDR 2,933,070)—since The Electric Salt Spoon builds with sophisticated technology inside. With this number, the non-intervention approach appeared to be more affordable and hassle-free compared to fancy electric-spoon—or in other words, people will reconsider to purchase The Electric Salt Spoon.

### **Discussion**

The Electric Salt Spoon has its own black and white, yet its benefits surpassed worldwide demands for an answer of reducing people who are in at-high risk of NCDs; thus, NCDs' cases thoroughly diminished. According to George et al (2025), usage of The Electric Salt Spoon provides increased palatability where it makes less-seasoned meals more enjoyable and reducing the likelihood of abandoning a low-sodium diets. Its sustainability also ensures up to 5 years of usage and minimal maintenance as it is easy to use and clean—with a simple rinse and drying with soft cloth—due to its lightweight and ergonomic body. Though it comes in a high-range price, its potential of long-term health advantages plays a huge role on why it must be introduced as a health tool worldwide.

By securing international partnerships between global health governance along with private sectors—that coordinate production of The Electric Salt Spoon—translational research, technology transfer, and knowledge exchange occurred simultaneously in the process of collaborative research networks. In addition, analysing strengths, weaknesses, opportunities, and threats (SWOT) of The Electric Salt Spoon can be the medium to solve simple to complex matters regarding the product—namely matters with food-base wise. Nations are encouraged to adapt and apply this technology to resolve numbers of people in at-risks of NCDs among their population. Furthermore, the roles of healthcare professionals during this collaboration are crucial in order to optimize outcomes with health promotion by educating the low-sodium diets along with the use of The Electric Salt Spoon to minimize risks of developing NCDs.

### **Conclusion**

The Electric Salt Spoon emerged on the surface of health innovation as an answer of current worldwide health issues with non-communicable diseases (NCDs), especially with persistent consumption of high-sodium meals. While it can be daunting for people to abruptly shift diets to low-seasoned ones, The Electric Salt Spoon provides gentle approach for people who are used to highly-flavoured foods by integrating electro-taste technology without altering food compositions. Its benefits overweight its risks in every aspect; increased

palatability, long-term health outcomes and cost effectiveness. Therefore, uniting strength interdisciplinary with global collaboration between health governance and cross-border cooperation is required to reduce the number of current worldwide health issues regarding with non-communicable diseases (NCDs).

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## ESSAY-14

# Rural-Grid Health: Decentralizing Diagnostic Access in Remote Areas Through Community-Based Micro-Healthcare Systems

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### Introduction

Timely and appropriate access to healthcare services constitutes a fundamental pillar of an effective health system. However, disparities in access between urban and rural areas remain a significant global challenge, particularly in remote and hard-to-reach regions. Reports from the OECD indicate that populations living in rural areas consistently face greater geographical barriers to accessing healthcare facilities than their urban counterparts, including longer travel distances and limited public transportation options (OECD, 2023). These conditions contribute to delays in diagnosis and medical treatment, directly increasing the risk of morbidity and mortality, many of which could be prevented through timely interventions.

Empirical studies over the past five years have further confirmed that limited access to healthcare services in rural areas is systemic and multidimensional in nature. A concrete example of this inequality can be observed in the Kangean Islands, Sumenep Regency (Madura, East Java), where the limited number of healthcare facilities, inter-island transportation challenges, and the archipelagic geographical conditions collectively result in low community access to both basic and referral healthcare services (Urwatul *et al.*, 2025). Similar conditions are also evident in mainland East Java, particularly in rural and remote areas of the Greater Malang region, where inadequate infrastructure, uneven distribution of healthcare workers, and long distances to referral facilities remain major barriers to fulfilling rural healthcare needs. These persistent issues have even drawn the attention of regional legislators, who emphasize the urgency of strengthening primary healthcare services and adopting decentralized service approaches in remote areas of East Java, including Malang and the southern coastal regions, to reduce ongoing access disparities (JatimTimes, 2025). Taken together, these cases illustrate that healthcare access challenges in East Java, both in archipelagic and mainland contexts share similar structural barriers and therefore require more adaptive, systemic solutions.

Limited access to healthcare facilities is not unique to Indonesia but is also evident in other countries. A study conducted in Tanzania demonstrates that distance, facility availability, and transportation infrastructure are significantly associated with low utilization of healthcare services in rural areas (Mkenda *et al.*, 2021). Comparable findings are highlighted in cross-country analyses, which emphasize that rural-urban disparities reflect not only limitations in physical infrastructure but also gaps in the adoption of health technologies and the efficiency of referral systems (WHO, 2022).

Within the broader context of achieving Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs), these persistent disparities in healthcare access underscore the urgent need for more adaptive and decentralized health system innovations.

Healthcare systems that are overly centralized in urban areas have proven insufficient in reaching populations residing in remote and high-risk regions. Accordingly, this essay proposes an innovative solution, RURAL-GRID Health as a conceptual framework aimed at reducing barriers to diagnostic healthcare access in remote areas through community empowerment and the strategic use of lightweight digital technologies.

### **Inequality in Access to Healthcare Services**

Disparities in access to healthcare services between urban and rural areas represent a multidimensional challenge with tangible consequences for population health outcomes. Academic literature consistently demonstrates that rural populations experience poorer access to primary care, specialist services, and supporting medical facilities compared to their urban counterparts. In the context of Japan, for instance, literature-based studies reveal that residents in various rural regions face challenges not only related to distance and travel time but also to shortages of medical professionals and limitations in the quality of locally available services. This phenomenon aligns with global trends of inequality in primary and secondary healthcare provision across both developed and developing countries (Kaneko *et al.*, 2025).

These access barriers directly affect the capacity of rural communities to receive early diagnoses, continuous care, and timely emergency medical responses, thereby widening health disparities between urban and rural populations. Research conducted in Tanzania indicates that access to primary healthcare services in rural areas is significantly lower than in urban centers, with major contributing factors including limited healthcare facilities, shortages of health workers, and inadequate transportation infrastructure (Mosha *et al.*, 2025). Socioeconomic and geographic factors further exacerbate these inequalities. A literature review in Indonesia highlights that geographical isolation and poor transportation infrastructure hinder the utilization of primary healthcare services by rural populations, directly affecting community health and well-being. These geographical barriers are compounded by limited economic capital and low levels of health literacy, which serve as additional constraints on access to essential services (Weraman, 2024).

Inequality in healthcare access is also evident in the digital domain, particularly in the utilization of health technologies, an issue that has become increasingly salient in the post-pandemic era. Although digital solutions such as telemedicine offer potential pathways to overcome physical barriers to access, their reliance on uneven digital infrastructure has limited their effectiveness in closing the urban-rural access gap. Factors including slow or unstable network connectivity, limited access to digital devices, and low levels of digital literacy within rural communities remain significant barriers to widespread adoption (Shahzadi, 2024).

These disparities are not only documented in academic journals but are also widely reported in global news and policy analyses. For example, the ongoing trend of rural hospital closures in the United States has led to the emergence of so-called “healthcare deserts,” where remote communities either lose access to critical care facilities entirely or are forced to travel long distances to receive essential medical services. The decline in local healthcare facilities has reduced access to primary care and emergency treatment, frequently resulting in adverse health outcomes within rural communities (Business Insider, 2026).

### **Why the Current Centralized System Is Inadequate?**

Traditional healthcare system approaches that rely heavily on centralized facilities in major urban centers have demonstrated clear limitations in addressing the healthcare needs of rural populations. Centralized models typically concentrate primary and specialized medical services in cities, while rural areas function largely as referral points without sufficient diagnostic capacity. This structure leads to delays in essential care and imposes

substantial travel-related financial burdens on rural patients. Reliance on referrals to central facilities without adequate local diagnostic capacity further prolongs delays in diagnosis and medical response, particularly for acute conditions requiring immediate intervention thereby structurally reinforcing healthcare inequities.

Telemedicine has been widely regarded as a strategic solution to extend healthcare reach in the digital era, especially for geographically isolated regions. In Indonesia, telemedicine adoption accelerated significantly following the COVID-19 pandemic due to increased demand for remote healthcare services. However, its implementation has been constrained by technical and infrastructural barriers that perpetuate digital access inequalities (Viviana *et al.*, 2025). This systematic literature review identifies key challenges, including limited network coverage, low levels of digital literacy, and the absence of clear regulatory frameworks, underscoring that technology alone is insufficient to resolve structurally embedded access barriers.

Additional challenges arise from the implementation and large-scale adoption of digital health solutions at both facility and community levels. A literature review on telemedicine in rural Indonesian communities indicates that while telemedicine can enhance access and service quality, such as enabling remote consultations and health monitoring its utilization and effectiveness remain highly dependent on technical factors, including device availability, stable internet connectivity, and users' capacity to engage with digital platforms effectively (Syamsuddin & Jusliani, 2024). These technical constraints reflect not only physical access limitations but also a persistent "digital divide" that further undermines the effectiveness of centralized healthcare systems.

Furthermore, systematic literature reviews across the ASEAN region, including Indonesia, reveal that despite the growing adoption of telemedicine as a mechanism to improve healthcare accessibility, its sustainability and scalability in rural areas are hindered by multidimensional barriers. These include cultural factors, policy gaps, and underdeveloped legal frameworks that fail to adequately support long-term digital health integration (Azhar & Yuniar, 2025). Collectively, these findings demonstrate that the current healthcare system, characterized by an overreliance on centralized facilities and insufficient integration of digital services with local empowerment, remains inadequate to comprehensively address the healthcare needs of rural populations.

### **RURAL-GRID Health Framework**

Building upon the problem analysis presented above, the innovative solution proposed in this essay is RURAL-GRID Health is a healthcare system framework that integrates service decentralization, the utilization of lightweight digital technologies, and local community empowerment. This framework is designed to address the limitations of highly centralized traditional healthcare systems by bringing early diagnostic functions and basic medical interactions closer to the community level, without compromising service quality or data integration with central healthcare systems. The integrated service model of RURAL-GRID Health is illustrated in Figure 1.

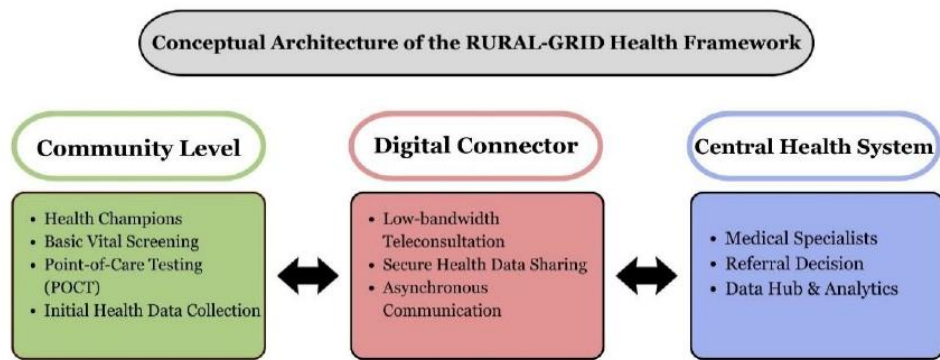


Figure 1. Healthcare Service Integration Model through RURAL-GRID Health Conceptually, the architecture of RURAL-GRID Health comprises three interconnected, bidirectional components: the Community Level, the Digital Connector, and the Central Health System. At the community level, the role of local Health Champions is strengthened through training in basic health assessments and simple vital sign measurements to address healthcare workforce gaps in rural areas and accelerate early detection of health conditions. Such community empowerment approaches have been identified as effective strategies to enhance community engagement and expand the reach of primary healthcare services in remote regions (WHO, 2022).

The Digital Connector component serves as a lightweight digital platform supporting teleconsultations and health data exchange, with an interface design adaptive to network limitations and the digital literacy levels of users (Fissabrina, 2025).

The final component, the Central Health System, ensures data interoperability and real-time referral planning, enabling faster and more accurate clinical decision-making even when healthcare professionals are geographically distant from patients. Conceptually, an informative website (<https://s.id/RuralGrid>) was developed to serve as a visualization and system literacy tool, clarifying the workflow of RURAL-GRID Health. The website is not intended as a medical service platform but as a communication medium for the decentralization of healthcare services and the use of adaptive technologies in rural areas.

To ensure the sustainability of the program concept, the implementation of RURAL-GRID Health involves multi-stakeholder collaboration, including local governments and healthcare facilities as policy and referral system authorities, professional healthcare workers as clinical service providers and medical supervisors, local Health Champions as primary actors at the community level, and technology partners and academics in the development of lightweight digital systems, training, and continuous evaluation. In this way, RURAL-GRID Health is positioned not only as an innovative conceptual framework but also as a collaborative and sustainable healthcare system model aimed at strengthening equitable, efficient, and responsive access to healthcare in geographically and digitally underserved regions.

## Conclusion

Disparities in healthcare access between urban and rural areas represent a structural problem that cannot be resolved solely through the expansion of centralized facilities or partial adoption of technology. Evidence presented in this essay demonstrates that geographical barriers, limited human resources, infrastructure gaps, and uneven utilization of health technologies collectively contribute to delayed diagnoses and reduced quality of care for populations in remote regions. These conditions underscore that highly centralized

healthcare approaches remain insufficient in meeting the needs of rural communities effectively and sustainably.

Through the conceptual framework of RURAL-GRID Health, this essay highlights the importance of a decentralized healthcare approach that integrates local community empowerment with adaptive digital technology. By bringing early diagnostic functions closer to the community level, enhancing digital connectivity tailored to field conditions, and ensuring data integration with central health systems, this framework offers a new pathway to reducing healthcare access disparities. Overall, RURAL-GRID Health represents a more inclusive, responsive, and equitable healthcare system paradigm, aligning with the pursuit of Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs).

## Appendix

### Appendix 1. RURAL-GRID Health Website as a Supporting Concept



### Appendix 2. Comparison Table of Centralized Health System and RURAL-GRID Health Framework

Aspect	Centralized Health System	RURAL-GRID Health Framework
Early Diagnosis Location	Urban hospitals	Community level (villages)
Role of Local Community	Passive service recipients	Active health actors
Service Response Time	Slow due to referral dependency	Fast through early screening
Digital Integration	Fragmented or supplementary	Integrated and interoperable
Infrastructure Dependency	High-capacity facilities	Adaptive, low-bandwidth system
Rural Patient Cost Burden	High (travel and time costs)	Lower
System Resilience	Low in remote areas	Higher through decentralization

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## ESSAY-15

# Who Controls Health Decisions? Artificial Intelligence and The Rise of Algorithmic Power in Global Health Management

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### Introduction

Global health systems are facing the challenges of managing ever-increasing data volumes, scarce resources, and constant demands for higher efficiency and accountability. With these pressures, health care decision making can hardly rely on fragmented data and subjective judgments any longer, but, instead, needs to be supported by data-driven analytics to ensure accuracy, consistency, and timeliness in organizing complicated health services.

Artificial intelligence (AI) has become one of the most important tools for such a transition. According to Alves et al. (2024), nearly two-thirds of the hospitals have applied AI for capacity planning, patient flow management, and resource forecasting, while more than 50% of the health managers agree that AI-based recommendations influence their operational decisions. At the policy level, AI use in health system planning and disease burden analysis can be found in over 60% of the studies reviewed (Ramezani et al., 2023). However, despite these advantages, researchers point out that if strong governance framework is not in place, AI-driven decisions could potentially continue bias, cover up accountability, and lower transparency (Wagner et al., 2024; Zhang & Zhang, 2023). The essay contends that, as algorithms are progressively intervening in major health decisions, AI is not only co g a power through decision-making, but also changing the accountability structures and priority-setting mechanisms in global health management.

### Content

#### Global Health Management Challenges in The Digital Era

The advent of digital transformation has exacerbated the problem of managing health systems especially when it comes to making large-scale decisions. Health administration in many low- and middle-income countries is still mainly done conventionally. Karami and Madloul (2025) revealed that a majority of primary healthcare services do not have integrated digital systems which results in planning and resource allocation being delayed.

According to Okwor et al. (2024), nearly 70% of health systems that are not fully digitized suffer delayed responses to service demands. Moreover, due to the human brain's limited capacity to handle massive data, more than half of the decision-makers resort to making decisions based on their intuition when they are under heavy workload pressure (Zaidan, 2023).

On top of this, data fragmentation is yet another hurdle that makes these problems even bigger. Somda et al. (2025) and Sylla et al. (2025) have shown that more than 60% of digital health projects do not reach their maximum potential because there is a lack of good interoperability and cross-sector coordination. Health administration, therefore, is very central in integrating technology, policy, and service delivery.



## Artificial Intelligence as a Decision-Support System in Health Management

AI in healthcare management is mainly regarded as a decision-support system to evaluate extensively the data and generate predictions as well as operational insights. Asiri et al. (2024) shared that nearly 70% of referral hospitals have introduced AI-based decision-support tools especially in operational planning.

AI performs major functions such as predictive analytics, resource management, risk stratification, and performance monitoring. Al-Nafjan et al. (2025) experimented that AI-based predictive models led to an increase of service demand forecasting accuracy by 20–35%. As for resource allocation, the deployment of AI during the COVID-19 pandemic has led to an increase in the efficiency of facility utilization by 25–30% (Wu et al., 2023).

On the other hand, Halabhavi (2024) saw a 40% increase in locating high-risk populations, while AI-supported performance monitoring has hastened operational responses by a maximum of 30% (Asiri et al., 2024). Nevertheless, AI is only a tool to assist and not a substitute for human decision-making. According to Guntupalli (2025), 60% of healthcare professionals agree with AI suggestions only when they are explainable and under human supervision.

## The Rise of Algorithmic Power in Global Health Management

The growing use of AI has changed the way decisions are made in health systems and has led to the emergence of what can be called algorithmic power. Batool et al. (2025) revealed that over 65% of studies on AI governance advocate clear frameworks to control the influence of algorithms; however, many systems are still inadequately regulated.

Bias is one of the most serious issues. Hasanzadeh et al. (2025) discovered that more than 40% of AI models are biased against minority populations because of unequal data representation. Ethically speaking, Montomoli et al. (2024) stated that 55% of healthcare practitioners find it difficult to comprehend the logic behind algorithmic recommendations, which in turn reduces their capability to evaluate AI-based decisions critically.

At the level of global policy, Shipton and Vitale (2024) found that over 60% of international health policies emphasize indicators that can easily be measured by algorithms, whereas broader social determinants of health get less consideration. Moreover, Wang et al. (2025) observed that nearly 70% of the ethical AI literature appeals to the creation of adaptive oversight mechanisms which can maintain the balance between innovation and social values.

## Who controls the algorithm? Governance and accountability issues

A major challenge in the application of AI-driven healthcare is uncertainty about who should be held responsible can be seen as the primary challenge of AI-driven healthcare. The research of Bagave et al. (2025) indicates that more than 65% of healthcare AI systems are a coalition of several actors, which leads to the fragmentation of the responsibility for the

results. Bignami et al. (2025) also came to the conclusion that less than half of the healthcare facilities have well-established internal AI policies.

The shortcomings in governance are compounded by poor stakeholder collaboration. Hofmann and Urbach (2024) have demonstrated that almost 3/5 of the total barriers to the implementation of AI are due to poor communication. For instance, in the public health sector, AI-powered decision-support systems are now being used in over 60% of planning and program management activities (Kausar, 2025).

The Canadian case study showed that formalizing governance frameworks by setting up AI committees and conducting regular audits greatly enhanced the transparency of the decisions (Kim et al., 2025). Such evidence suggests that the control over algorithms is a direct consequence of the organizational governance capability.

### **The Role of Health Administrators in Governing Ai-Driven Decisions**

Health administrators are pivotal in maintaining the alignment of AI systems with corporate objectives and ethical standards. Freeman et al. (2025) mentioned that 68% of healthcare institutions do not have a proper AI governance structure, thereby raising the risk of algorithmic influence without control.

Lee (2025) has revealed that, in the absence of managerial control, more than 40% of AI systems might result in biased decisions. Likewise in Indonesia, Puspitasari (2025) reported that over 70% of healthcare professionals who participated in the survey consider AI governance to be effective only when administrators are directly involved in auditing and performance evaluation.

Wang et al. (2025) described how in 80% of the governance frameworks, administrators have the opportunity to participate in the AI lifecycle from the start to the end. Findings in New Zealand also show that efficient managerial leadership can lower the problem of accountability vagueness by about 35% (Whittaker & Dobson).

### **Towards Responsible Algorithmic Governance In Global Health**

The major obstacle for AI implementation in healthcare is currently the unpreparedness of governance. Chassang and Rial-Sebbag (2025) revealed that more than 70% of health AI projects do not have operational ethical frameworks. Ihaddouchen et al. (2025) quite similarly discovered that only 38% of papers show that they have implemented the principles of fairness and transparency. Olsen and Bastholm (2025) report that 60-65% of AI-based policies harm adversely vulnerable groups due to non-representative training data. Ratti et al. (2025) additionally indicated that over half of the bias-related risks are discovered only post-deployment and not throughout system development.

On the world level, Shaw et al. (2024) announce that nearly 72% of low and middle-income countries do not have formal ethical guidelines for healthcare AI. Such data highlights the urgency of context-aware governance mechanisms that have input from local stakeholders in algorithmic oversight.

### **Forms of Algorithmic Power in Global Health Management**

In order to prove that artificial intelligence really influences decision-making in global health, it is vital to unpack the concrete *forms of algorithms* through which this influence is exerted. Algorithmic power in global health is not an independent force, but rather it is the feature of particular computational models that are embedded in clinical and managerial systems.

Firstly, a great variety of predictive analytics algorithms have been used for risk stratification and population health planning. These algorithms which have been implemented through machine learning models such as logistic regression, random forests, and gradient

boosting are capable of predicting disease risk, hospitalization, and mortality by analyzing large-scale health data. There are certain pieces of evidence that demonstrate that predictive AI can be used for prevention of diseases, identification of high-risk populations, and also it acts as the main element of resource allocation at the policy level, thus shaping health priorities at the national and global levels (Al-Nafjan et al., 2025; Halabhavi, 2024).

Secondly, Clinical Decision Support Systems (CDSS) can be considered as the most tangible form of algorithmic power in healthcare management. By employing rule-based systems, neural networks, or hybrid AI models, CDSS generate diagnostic and treatment recommendations that help to standardize care processes and it is assumed that these methods influence clinical as well as managerial decisions. Referring to the studies we can see that it has been confirmed that these systems have capability to improve efficiency and consistency, however, at the same time, they result in shifting decision-making power from clinicians to the algorithmic outputs which can lead to situations where one is so dependent on the algorithm due to which there is a loss of professional discretion (Asiri et al., 2024; Alves et al., 2024).

Thirdly, the use of resource allocation and optimization algorithms leads to changes in the way in which the distribution of health resources takes place. In particular, optimization models, scheduling algorithms, and fairness-aware systems are being used almost everywhere in hospital capacity management, workforce deployment, and medical supplies, especially during public health emergencies. In this regard, several researchers argue that such algorithms have been instrumental to the resource prioritization that happened during and after the COVID-19 pandemic, hence access and equity being affected across various populations (Wu et al., 2023; Zaidan, 2023).

Overall, these algorithmic types plainly reveal that AI actually *structures* decisions, priorities, and power relations within the global health sector. In the absence of robust governance, transparency, and accountability frameworks, placing a great deal of trust in predictive, clinical, and optimization algorithms can be and probably is the first step to the eventual transfer of authority from the accountable public institutions to less comprehensible technical systems (Batoool et al., 2025; Zhang & Zhang, 2023).

### Conclusion

Artificial intelligence has become an essential part of worldwide health system operations because it allows decision-makers to use data for their choices about complex health systems. The rising use of algorithms creates major dangers which emerge from biases and unequal treatment together with reduced responsibility when organizations lack proper systems for control. The essay shows that predictive analytics and clinical decision support systems together with resource allocation algorithms do more than improve efficiency because they determine which health system elements receive funding and who receives healthcare services.

The essay presents AI as a support tool which assists decision-making but does not replace human decision-makers. Algorithms cannot make ethical decisions because they require human supervision to account for social contexts and public obligations. Health administrators need to establish governance systems which include oversight processes and responsibility systems to enable them to use AI technology in a responsible way. The main issue centers on whether human systems can effectively manage the increasing authority they grant to automated systems which will drive international health decisions through their use of algorithms.

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