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RESEARCH ARTICLE

NUTRITIONAL LIFESTYLE INTERVENTIONS FOR NON-COMMUNICABLE DISEASE PREVENTION IN UNIVERSAL HEALTH COVERAGE SYSTEMS: A NARRATIVE REVIEW

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Abstract

Background: Non-communicable diseases (NCDs) account for 75% of global deaths, with 82% of premature NCD mortality occurring in low- and middle-income countries (LMICs). Poor diet is among the leading modifiable risk factors, yet nutritional interventions remain underintegr ated into primary health care.The "Food Is Medicine" (FIM) movement has gained momentum primarily in the United States, but its applicabili ty to universal health coverage (UHC) systems in LMICs has not been examined.

Methods: We conducted a narrative review following SANRA guidelines, searching PubMed, Scopus, Web of Science, and Google Scholar for literature published between 2015 and 2026. We synthesized evidence on nutritional lifestyle interventions--including FIM programs, dietary counseling, culinary medicine, and digital nutrition tools—and analyzed their integration potential within UHC-based primary care systems, with emphasis on LMIC contexts.

Results: Substantial evidence from high-income settings demonstrates that medically tailored meals, produce prescriptions, and dietary counseling improve cardiometabolic outcomes and reduce health care utilization. However, these models are embedded in US-specific financing mechanisms and are not directly transferable to LMIC UHC systems. We identified five key adaptation domains for UHC integration: (1) leveraging existing primary care infrastructure, (2) task-shifting to community health workers, (3) incorporating culturally relevant traditional dietary patterns, (4) utilizing digital and mobile health platforms, and (5) aligning with UHC benefit package design. Thailand's National Health Security Office (NHSO) scheme is presented as a primary case study.

Conclusions: Nutritional lifestyle interventions hold substantial promise for NCD prevention within UHC systems, but require deliberate adaptation to local contexts, financing structures, and dietary cultures. We propose the "NutriUHC Framework" for LMIC policy makers and primary care practitioners.

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Introduction:-

Non-communicable diseases (NCDs)—principally cardiovascular diseases, diabetes, cancers, and chronic respiratory diseases—represent the dominant global health challenge of the 21st century. According to the World Health Organization (WHO), NCDs caused at least 43 million deaths in 2021, accounting for 75% of non-pandemic-related deaths globally.[1] The burden falls disproportionately on low- and middle-income countries (LMICs), where 82% of premature NCD deaths (before age 70) occur.[1] Among modifiable risk factors, unhealthy diet has emerged as one of the leading contributors: a US-based comparative risk assessment estimated that 45.4% of cardiometabolic deaths were associated with suboptimal dietary intake,[2] while the Global Burden of Disease Study found that dietary risks account for a substantial proportion of global NCD disability and mortality.[3]In response to this burden, the "Food Is Medicine" (FIM) paradigm has gained substantial traction over the past decade. FIM encompasses a spectrum of food-based nutritional treatments integrated into health care, ranging from medically tailored meals (MTMs) and medically tailored groceries (MTGs) for patients with complex chronic conditions, to produce prescriptions (PRx) and nutrition education programs for broader at-risk populations.[4] A growing body of evidence, including 14 randomized controlled trials identified in a 2024 American Heart Association (AHA) systematic review, suggests that FIM interventions can improve diet quality, glycemic control, food security, and clinical outcomes while potentially reducing health care costs.[5]

However, a critical limitation of the current evidence base is its overwhelming concentration in the US health care context. The FIM infrastructure—including its financing through Medicaid Section 1115 waivers, Medicare Advantage supplemental benefits, and private insurance pilots—is structurally tied to the US payer system.[4,6] As the 2024 JACC State-of-the-Art Review noted, the United States leads globally in FIM development, with programs in other nations only beginning to be piloted.[4] This US-centricity creates a significant knowledge gap for the majority of the world's population that accesses health care through universal health coverage (UHC) systems.UHC—defined as ensuring that all individuals receive the health services they need without suffering financial hardship—has been adopted as a cornerstone of global health policy, enshrined in Sustainable Development Goal 3.8.[7] The WHO reports that at least half the world's population remains without comprehensive coverage of essential health services.[7] UHC systems built around primary health care networks and capitated financing models represent a fundamentally different ecosystem for health service delivery than the fee-for-service, insurance-based US model. Yet no review has systematically examined how nutritional lifestyle interventions can be adapted for and integrated within these UHC frameworks.This narrative review aims to fill this gap. We synthesize current evidence on nutritional lifestyle interventions for NCD prevention, analyze the structural features of UHC systems relevant to nutrition service delivery, identify barriers and enablers for integration, and propose a practical framework for LMIC policy makers and primary care practitioners. We use Thailand's National Health Security Office (NHSO) scheme as a primary case study, given its status as one of the most successful UHC models among middle-income countries.

Methods:-

We conducted a narrative review following the Scale for the Assessment of Narrative Review Articles (SANRA) guidelines.[8] Literature searches were performed in PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar between [AUTHOR INPUT: specify exact date range of search, e.g., "February 15 and March 10, 2026"] using combinations of the following search terms: ("Food Is Medicine" OR "nutritional intervention" OR "dietary counseling" OR "culinary medicine" OR "lifestyle medicine" OR "food prescription" OR "produce prescription") AND ("universal health coverage" OR "UHC" OR "primary care" OR "primary health care") AND ("non-communicable disease" OR "NCD" OR "diabetes" OR "cardiovascular" OR "obesity" OR "hypertension") AND ("low-income" OR "middle-income" OR "LMIC" OR "developing countries" OR "Southeast Asia" OR "Thailand").We included peer-reviewed articles, systematic reviews, meta-analyses, and relevant policy documents published between January 2015 and March 2026 in English. We supplemented database searches with manual screening of reference lists from key articles and relevant WHO and governmental reports. Studies were excluded if they focused exclusively on pediatric populations, were conference abstracts without full text, or addressed only micronutrient supplementation without broader dietary intervention components.Given the narrative nature of this review, we did not conduct formal risk of bias assessment. Instead, we prioritized systematic reviews and large-scale trials where available, and organized the synthesis thematically according to our research objectives.

Nutritional Lifestyle Interventions: Current Evidence:-

Food Is Medicine Programs:-

The FIM paradigm encompasses several distinct intervention types, each operating at different levels of clinical intensity and population reach.[4] At the highest intensity, medically tailored meals (MTMs) are fully prepared, home-delivered meals designed by registered dietitians for patients with complex diet-sensitive conditions such as heart failure, diabetes with complications, and cancer. A 2025 microsimulation study estimated that nationwide MTM implementation in the US could be net cost-saving in 49 of 50 states within one year, with the number needed to treat to avert one hospitalization ranging from 2.3 to 6.9.[9] Medically tailored groceries (MTGs) operate at a slightly lower intensity, providing unprepared food items tailored to patients' conditions, with reported improvements in HbA1c, medication adherence, and fruit and vegetable consumption.[4,10]Produce prescriptions (PRx) represent the broadest FIM intervention, providing subsidized or free fruits and vegetables to patients identified as food-insecure or at risk of diet-related chronic diseases. A scoping review of food prescription programs identified growing evidence for improvements in food security, diet quality, and patient engagement, though noted that most studies were conducted in the US and few evaluated long-term health outcomes.[11] A 2024 randomized clinical trial published in JAMA Internal Medicine found that an intensive food-as-medicine program for adults with diabetes and food insecurity significantly increased engagement with preventive health care, though effects on glycemic control were modest.[12]

Dietary Counseling in Primary Care:-

Beyond structured FIM programs, individual dietary counseling delivered by dietitians or trained health care providers in primary care settings represents a more widely available intervention. A systematic review of randomized controlled trials found that dietetic consultations in primary care are effective for improving diet quality, diabetes outcomes (including blood glucose and HbA1c), and weight loss outcomes, though evidence for improvements in lipid levels and blood pressure was less consistent.[13] A subsequent systematic review focusing on cardiovascular risk confirmed that dietetic counseling is effective for lowering triglyceride levels in high-risk primary care patients.[14] The US Preventive Services Task Force recommends behavioral counseling interventions for adults with cardiovascular risk factors, including dietary counseling, based on moderate-certainty evidence of benefit.[15]A critical challenge for dietary counseling in primary care is the limited time available during routine visits and insufficient nutrition training among physicians. A JAMA commentary noted that nutrition counseling remains underutilized despite its proven effectiveness, with significant gaps in physician training.[16] The 5A's framework (Assess, Advise, Agree, Assist, Arrange) has been proposed as a structured approach to integrate nutrition counseling into time-limited primary care encounters, with emerging evidence of feasibility.[17] This framework may be particularly relevant for adaptation to LMIC primary care settings, where physician time constraints are often more severe.

Culinary Medicine and Lifestyle Medicine Synergies:-

Culinary medicine (CM) bridges the gap between nutrition knowledge and practical food preparation skills. A 2025 narrative review highlighted the synergistic integration of CM with the broader lifestyle medicine (LM) framework, demonstrating how teaching kitchens and shared medical appointments can translate dietary recommendations into sustainable behavior change.[18] CM interventions have shown improvements in diet quality, cooking confidence, clinical outcomes, and psychosocial well-being.[18]The six pillars of lifestyle medicine—nutrition, physical activity, restorative sleep, stress management, avoidance of risky substances, and positive social connection—provide a comprehensive framework for NCD prevention.[19] A 2025 report from the Philippines documented the integration of lifestyle medicine into that country's UHC framework, representing one of the few published examples of LM-UHC integration in a LMIC setting.[20] However, this initiative focused broadly on all pillars rather than examining nutrition-specific interventions in depth.

Digital and Mobile Health Nutrition Interventions:-

The rapid proliferation of mobile phone ownership in LMICs has created new opportunities for delivering nutrition interventions at scale. A systematic review found that digital health interventions using counseling and feedback led to positive dietary behavior changes among adults with chronic diseases.[21] A narrative review of technology's impact on lifestyle medicine pillars found that evidence is strongest for physical activity and dietary self-management when interventions incorporate behavior change techniques such as prompts, gamification, and goal-setting.[22]For LMIC settings specifically, digital interventions offer the advantage of scalability and low marginal cost per user, potentially overcoming barriers of geographic distance and workforce shortages. However, challenges

remain regarding digital literacy, data connectivity in rural areas, and the need for culturally and linguistically appropriate content.[22]

Uhc Systems And Nutrition: The Interface:-

Structural Features of UHC Relevant to Nutritional Interventions:-

UHC systems in LMICs share several structural features that distinguish them from the US health care model and that create both opportunities and challenges for integrating nutritional interventions. First, most UHC systems are organized around primary health care as the foundation of service delivery, with community-level health facilities serving as the primary point of contact for populations.[7] This architecture provides a ready-made platform for population-level nutrition screening and counseling.Second, UHC financing typically employs some combination of tax-based funding, social insurance contributions, and capitated payments to providers, rather than fee-for-service models.[23] Capitated payment systems create incentives for prevention and health promotion, as providers benefit from keeping their enrolled populations healthy. However, the proportion of UHC budgets allocated to preventive services is often marginal—in Thailand, for example, the prevention and promotion component has been marginalized from 15% to approximately 10% of the total UC scheme budget.[24]Third, UHC benefit packages define the scope of covered services, creating a formal mechanism for including or excluding nutritional interventions. The process of determining benefit packages—typically through health technology assessment (HTA) and cost-effectiveness analysis—provides a systematic pathway for the introduction of evidence-based nutritional interventions, provided sufficient evidence exists.[25]

Thailand's NHSO as a Case Study:-

Thailand declared the achievement of UHC in 2002, when the newly elected government introduced the Universal Coverage (UC) scheme managed by the National Health Security Office (NHSO).[24] The UC scheme covers both preventive and curative care for approximately 47 million Thais not covered by civil servant or social security schemes, making it one of the most comprehensive UHC programs among middle-income countries.[25]Several features of the Thai system are relevant to the integration of nutritional interventions. The District Health System (DHS) network, contracted by NHSO, provides outpatient and preventive services to entire district populations through Contracting Units for Primary Care (CUPs) and Primary Care Units (PCUs).[25] The Ministry of Public Health owns almost all of the approximately 9,806 subdistrict health centres nationwide.[26] Thailand's UC scheme already includes NCD-related preventive services, such as metabolic screening targets requiring 45% of the population above 15 years to receive screening.[24] Performance-based financing mechanisms incentivize providers to meet these targets. However, dedicated nutritional counseling or food-based interventions are not currently prominent features of the benefit package.Over 1.07 million village health volunteers (VHVs) serve as a crucial link between the health system and communities, supporting screening of diabetes and hypertension in target populations.[26,27] VHVs have demonstrated capacity for NCD-related activities including blood pressure measurement, blood glucose screening, and health education,[26] suggesting potential for extending their role to include structured nutrition counseling.

The Thai Health Promotion Foundation (ThaiHealth), established in 2001 with revenue from a 2% surcharge on tobacco and alcohol taxes, provides a separate funding stream for population-level health promotion activities, including some nutrition-related initiatives.[24] This dual financing structure—NHSO for service delivery plus ThaiHealth for promotion—could provide a model for integrating nutritional lifestyle interventions.Thailand also possesses rich traditional dietary heritage. Traditional Thai cuisine, with its emphasis on herbs, vegetables, fish, and balanced flavors, offers a cultural foundation for nutrition interventions that resonate with local food practices.[28] Foods such as kang liang (a low-calorie, high-fiber curry with mixed vegetables and herbs), kang som (sour curry with seafood and vegetables), and the liberal use of herbs and spices with documented anti-inflammatory and antioxidant properties represent a dietary tradition that aligns well with evidence-based NCD prevention principles.[28]

Other LMIC UHC Models:-

Beyond Thailand, other LMIC UHC models offer relevant lessons. India's Ayushman Bharat scheme includes approximately 160,000 Health and Wellness Centers (HWCs) that explicitly target health promotion and NCD screening at the primary care level, though nutritional intervention components remain underdeveloped.[29] Brazil's Sistema Único de Saúde (SUS), with its Family Health Strategy delivering primary care to over 130 million people, has published nationally acclaimed dietary guidelines that emphasize food-based rather than nutrient-based recommendations and explicitly warn against ultra-processed foods—a model that other LMICs could adapt.[30] Rwanda's community-based health insurance scheme demonstrates how community health worker networks can

extend health service delivery to remote populations, a model potentially applicable to community-based nutrition interventions.[31]

Barriers And Enablers For Integration:-

Health System-Level Barriers:-

Several systemic barriers impede the integration of nutritional lifestyle interventions within UHC systems. The most fundamental is the curative-care bias of most LMIC health systems. Despite the rhetoric of prevention, the majority of health spending in LMICs is directed toward treatment of acute and advanced disease, with preventive services receiving marginal allocation.[32] Nutrition services are often invisible within UHC benefit packages, falling into a gap between health sector and agricultural/food system responsibilities.Workforce limitations represent a second major barrier. LMICs face severe shortages of registered dietitians and nutrition professionals. Even in Thailand, clinical dietitians are primarily concentrated in tertiary hospitals and are rarely available at primary care units.[26] Financing constraints constitute a third barrier. The addition of new services to UHC benefit packages requires evidence of cost-effectiveness and budget impact analysis, yet the economic evidence for nutritional interventions in LMIC settings is sparse.[9][AUTHOR INPUT: Add specific barriers from your daily practice, e.g., "In the author's experience operating a primary care unit under Thailand's UC scheme, nutritional counseling is not a separately reimbursable service, and the capitation budget does not include dedicated funding for dietary interventions. Primary care visits averaging [X] minutes leave minimal time for meaningful nutrition discussions."]

Patient-Level Factors:-

At the patient level, health literacy—particularly food and nutrition literacy—is a critical determinant of intervention effectiveness. In many LMIC settings, limited understanding of the relationship between diet and chronic disease, combined with marketing pressures from ultra-processed food industries, creates a challenging environment for dietary behavior change.[33] The nutrition transition—the shift from traditional diets toward Western-style diets high in processed foods, added sugars, and saturated fats—is occurring rapidly across LMICs, driven by urbanization, rising incomes, and global food system integration.[34]

Enablers:-

Despite these barriers, several enablers support integration. The existing primary care infrastructure of UHC systems provides a foundation for reaching populations at scale. Thailand's network of over 1.07 million village health volunteers offers a mechanism for extending nutrition services beyond facility-based care.[27] VHVs already support diabetes and hypertension screening and could be trained to deliver structured nutrition counseling using simplified protocols.[26]The rise of digital health provides a second enabling factor. Mobile phone penetration in LMICs now exceeds 80% in many countries,[22] creating opportunities for scalable nutrition education, dietary monitoring, and behavior change interventions. Traditional dietary wisdom represents a third, often overlooked enabler. Many LMIC traditional dietary patterns—including Thai, Indian, and Mediterranean-influenced diets—incorporate principles that align with evidence-based NCD prevention.[28]

Proposed Framework For Integration:-

Based on our synthesis, we propose a five-domain framework—the "NutriUHC Framework"—for integrating nutritional lifestyle interventions into UHC-based primary care in LMICs (Figure 1):

Domain 1: Primary Care Platform. Embed nutrition screening and brief dietary counseling into routine NCD screening visits already covered under UHC benefit packages. The 5A's framework (Assess, Advise, Agree, Assist, Arrange) can be adapted for 3- to 5-minute nutrition encounters within standard primary care visits.[17]

Domain 2: Workforce Task-Shifting. Train community health workers, village health volunteers, and existing primary care staff to deliver structured nutrition counseling using locally adapted protocols. This addresses the dietitian shortage without requiring new professional cadres and aligns with WHO recommendations for task-shifting.

Domain 3: Cultural Dietary Contextualization. Develop nutrition intervention content grounded in local traditional dietary patterns and food availability. Rather than importing Western dietary guidelines, identify and promote traditional foods and preparation methods that align with NCD prevention evidence.

Domain 4: Digital Health Integration. Deploy mobile health tools for nutrition education, dietary self-monitoring, and remote follow-up. Content must be developed in local languages and adapted for varying levels of digital literacy.

Domain 5: UHC Benefit Package Design. Advocate for the explicit inclusion of nutritional assessment and counseling within UHC benefit packages, supported by health technology assessment evidence. Performance-based financing indicators can incentivize nutrition service delivery. Innovative financing mechanisms—such as Thailand's model of using earmarked health promotion taxes—can provide dedicated funding streams.[24]

Research Priorities and Policy Recommendations:-

Research Priorities:-

First, effectiveness trials of nutritional interventions within LMIC UHC primary care settings are urgently needed. Pragmatic trials evaluating task-shifted dietary counseling, culturally adapted food-based interventions, and mHealth nutrition tools in LMIC primary care should be prioritized.

Second, cost-effectiveness studies using LMIC-specific cost structures and health system parameters are essential to inform UHC benefit package decisions.

Third, implementation science research should examine optimal delivery models, workforce training approaches, and integration strategies within diverse UHC systems.

Fourth, research should explore how traditional dietary patterns in specific cultural contexts can be systematically leveraged for NCD prevention, moving beyond descriptive documentation toward interventional evidence.

Policy Recommendations:-

For governments and UHC administrators: Explicitly include nutritional assessment and brief dietary counseling in UHC benefit packages for NCD prevention; establish or strengthen nutrition workforce capacity at the primary care level through task-shifting protocols; and consider earmarked health promotion financing for population-level nutrition programs.

For primary care practitioners: Integrate brief nutrition screening into routine NCD consultations using standardized tools; leverage local traditional dietary knowledge in patient counseling; and utilize available digital tools for patient education and follow-up.

For the international community: Support the generation of LMIC-specific evidence on nutritional interventions; facilitate South-South learning between UHC systems; and advocate for nutrition to be explicitly addressed in UHC benefit package guidance.

Conclusions:-

The Food Is Medicine movement has produced compelling evidence that nutritional interventions, when integrated into health care, can meaningfully improve NCD outcomes. However, the concentration of this evidence in the US health care system limits its global applicability. Universal health coverage systems in LMICs—with their primary care orientation, capitated financing, and population-based coverage—offer a natural but underexploited platform for delivering nutritional lifestyle interventions at scale.Successful integration will require deliberate adaptation across multiple domains: embedding nutrition into existing primary care workflows, task-shifting to community-based health workers, grounding interventions in local dietary cultures, leveraging digital health tools, and securing a place for nutrition within UHC benefit packages. The NutriUHC Framework proposed in this review provides a starting point, while acknowledging that context-specific adaptation and rigorous evaluation are essential.The stakes are high. With NCD mortality continuing to rise in LMICs, and with unhealthy dietary patterns accelerating through the nutrition transition, the failure to integrate evidence-based nutritional interventions into the primary care systems that serve the majority of the world's population represents a missed opportunity of profound consequence.

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