

Assessing the Policy-to-Practice Gap in the Implementation of Nutritional Guidelines for Diabetes and Hypertension in Region 3, Guyana: A Mixed-Methods Study Using the Social Ecological Model, RE-AIM and Knowledge-to-Action Frameworks

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Abstract Diabetes and hypertension remain major public health challenges in Guyana. The extent to which evidence-based nutrition guidelines are translated into routine clinical practice remains insufficiently understood. This study assessed the policy-to-practice gap in the implementation of nutrition guidelines for diabetes and hypertension in Region 3, Guyana. A convergent mixed-methods implementation study was conducted across four public health facilities. Quantitative data were obtained from 2,745 patient records, facility audits and healthcare provider surveys, while qualitative data were collected through focus group discussions, community outreach activities, and key informant interviews. The study was guided by the Social Ecological Model (SEM), the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework, and the Knowledge-to-Action (KTA) framework. Although all facilities demonstrated moderate policy readiness (60%), overall implementation fidelity remained low, with a mean implementation score of 40%. Patients frequently reported receiving nutrition counselling; however, documentation of counseling within clinical records was limited. Healthcare providers demonstrated moderate knowledge of nutrition recommendations, but implementation practices were comparatively weaker, with training deficiencies and limited educational resources identified as major provider barriers. Patient awareness was positively associated with reported dietary practices, although elevated blood pressure and random blood sugar levels remained common. Cost and affordability (63.5%) and cultural food norms (19.7%) were the most frequently reported barriers to implementing recommended dietary practices. The combined application of the SEM, RE-AIM, and KTA frameworks identified implementation gaps across organizational, provider, community, and policy levels. A substantial policy-to-practice gap exists in the implementation of nutrition guidelines for diabetes and hypertension in Region 3, Guyana. Strengthening provider capacity, implementation monitoring, clinical documentation and culturally responsive, affordable nutrition interventions are essential to improve implementation fidelity, support knowledge translation and enhance the sustainability of nutrition services within primary healthcare.

Keywords Diabetes Mellitus, Guyana, Hypertension, Implementation Fidelity, Implementation Science, Knowledge-to-Action (KTA), Mixed-Methods, Nutrition Guidelines, Policy-to-Practice Gap, RE-AIM, Social Ecological Model (SEM).

Introduction

Diabetes mellitus and hypertension are major contributors to the global burden of non-communicable diseases (NCDs), causing substantial morbidity, disability and premature mortality. The burden is particularly pronounced in low- and middle-income countries (LMICs), where health-system constraints, socioeconomic inequalities and limited resources can weaken prevention and long-term disease management [1-4]. Both conditions increase the risk of cardiovascular disease, stroke and chronic kidney disease, making effective lifestyle and clinical management a public-health priority.

Nutrition is central to the prevention and management of diabetes and hypertension. Evidence-based recommendations, including national Food-Based Dietary Guidelines (FBDGs), the Dietary Approaches to Stop Hypertension (DASH) dietary pattern and clinical nutrition guidance, support healthier food choices, blood-pressure management and glycaemic control. However, the existence of evidence-based guidance does not ensure consistent implementation. Across resource-constrained settings, translation into routine care may be limited by insufficient provider training, inadequate educational materials, inconsistent counselling and documentation, competing clinical priorities, and weak monitoring and evaluation systems [3, 4].

The Caribbean carries a substantial NCD burden, with diabetes and hypertension contributing importantly to premature morbidity and mortality [5]. Dietary transitions, dependence on imported and ultra-processed foods, the cost of healthier diets and culturally embedded food practices can make recommended dietary changes difficult to sustain [5, 6]. Regional initiatives, including the Port of Spain Declaration and the Pan American Health Organization HEARTS initiative, have therefore emphasized integrated primary care, cardiovascular risk management and healthier lifestyles; nevertheless, consistent

implementation across Caribbean health systems remains challenging [7].

Guyana has developed national FBDGs and has promoted evidence-based approaches for NCD prevention and management, including DASH principles and WHO HEARTS [6, 7]. The revised FBDGs and implementation strategy provide an important policy foundation, but monitoring of implementation and long-term outcomes has remained limited [6]. Consequently, a policy-to-practice gap may occur when guidance is available but is not consistently embedded in routine counselling, documentation, monitoring and patient support. Published evidence examining this implementation process in Guyana, particularly across different levels of the health system, remains limited. This evidence gap is important because policy evaluation based only on the presence of guidelines or dissemination activities cannot determine whether patients are reached, whether providers adopt recommendations, whether counselling is delivered consistently, or whether implementation is maintained over time. Direct assessment of routine practice is therefore needed to distinguish policy readiness from implementation fidelity.

Implementation science provides useful approaches for examining this gap. The Social Ecological Model (SEM) identifies interacting influences at individual, interpersonal, organizational, community and policy levels [8]. RE-AIM assesses Reach, Effectiveness, Adoption, Implementation and Maintenance, enabling evaluation of both uptake and sustainability [9]. The Knowledge-to-Action (KTA) framework focuses on the processes required to move evidence into practice, including adaptation, implementation, monitoring, evaluation and sustainability [10, 11]. Used together, these frameworks permit assessment of contextual determinants, implementation performance and knowledge translation across the policy-to-practice pathway.

This study therefore assessed the implementation of nutrition guidelines for diabetes and hypertension across selected public health facilities in Region 3, Guyana, using a convergent mixed-methods design informed by SEM, RE-AIM and KTA. It examined facility readiness and implementation fidelity, provider knowledge and practice, patient awareness and reported dietary practices, clinical indicators, and multilevel barriers to implementation. By integrating quantitative and qualitative evidence, the study sought to identify where implementation weakened and to generate contextually relevant recommendations for strengthening nutrition services and implementation monitoring in Guyana.

Materials and Methods

Study Design and Setting

The researcher carried out a convergent mixed-methods implementation research study to assess the implementation of nutritional guidelines for diabetes and hypertension in Region 3, Guyana. The quantitative and qualitative parts were conducted simultaneously and integrated during the analysis phase to provide a comprehensive evaluation of implementation fidelity and contextual factors influencing policy implementation. The mixed-methods approach allowed the triangulation of the findings from different data sources and thus improved the analysis of implementation outcomes. The study was conducted in four public health facilities within Region 3: Goed Intent Health Centre (GIHC), Parfaite Harmonie Health Centre (PHHC), Leonora Cottage Hospital (LCH) and West Demerara Regional Hospital (WDRH). These facilities provide primary and secondary healthcare services and routinely manage patients with diabetes and hypertension.

Implementation Frameworks

The study was informed by three complementary implementation science frameworks. The Social Ecological Model (SEM) guided the examination of implementation determinants operating at the individual, interpersonal, organizational, community and policy levels. The Reach, Adoption, Effectiveness, Implementation and Maintenance (RE-AIM) framework was used to evaluate implementation across five implementation dimensions: including Programme reach, effectiveness, organizational adoption, implementation fidelity and maintenance. The Knowledge-to-Action (KTA) framework informed the assessment of knowledge translation processes, including adaptation of evidence, implementation, monitoring, and sustainability of nutrition guidelines within routine healthcare practice.

Population and Sampling

The study population comprised patients, healthcare providers, policymakers and community members. The quantitative component included a retrospective review of 2,745 patient records obtained from the four participating facilities. After data cleaning, 2,737 records containing valid blood pressure measurements and 2,055 records containing valid random blood sugar measurements were retained for analysis. Seventeen (17) healthcare practitioners, including physicians, nurses, nutrition specialists and multidisciplinary healthcare professionals engaged in the care and management of diabetes and hypertension, completed provider surveys. The qualitative component included semi-structured interviews with Ministry of Health officials and Programme managers responsible for implementing nutrition policy, eight focus group discussions with patients and community members and two community outreach activities to explore cultural, behavioral and socioeconomic factors influencing dietary

practices and implementation of nutrition recommendations.

Inclusion and Exclusion Criteria

Eligible subjects were ≥ 18 years of age and had a confirmed diagnosis of hypertension, diabetes mellitus, or both. Healthcare practitioners directly involved in the clinical management of these conditions, including the provision of nutrition counselling and related patient care, were invited to participate. Policymakers responsible for the formulation, coordination or implementation of nutrition policies and Programme were eligible to participate.

Patient records were excluded for incomplete identifiers, implausible clinical measurements, or any other issue related to data integrity that could affect the robustness of the analysis. After data cleaning, eight implausible blood pressure values and one implausible random blood sugar value were excluded. Records without an RBS measurement were treated as missing rather than excluded from the overall dataset. For the qualitative component, participants who did not give informed consent for interviews or focus group discussions were excluded. In a similar way, participants with major co-morbidities not related to diabetes or hypertension were excluded as appropriate.

Data Collection and Study Variables

Data Collection

Data was collected using multiple complementary methods.

Facility Audit

A standardized facility audit instrument was used to assess implementation fidelity. The instrument comprised three domains: policy readiness, facility implementation, and general implementation. Policy readiness was evaluated based on the availability of nutrition policy documents, the Food-Based Dietary Guidelines (FBDGs), Dietary Approaches to Stop Hypertension (DASH) recommendations, World Health Organization (WHO) HEARTS

materials, patient education resources, and supporting implementation documents. Facility implementation assessed the availability and documentation of nutrition counselling services, counselling resources, staff training, implementation protocols, and oversight mechanisms. General implementation examined the integration of nutrition counselling into routine clinical practice, monitoring and reporting systems, and mechanisms to support sustainability. An overall implementation fidelity score was derived using predefined audit criteria by averaging the policy readiness and facility implementation scores. The resulting implementation fidelity scores are presented in the Results section.

Patient Record Review

A systematic data extraction form was used to extract demographic and clinical data from the patient records. Variables included diagnosis, blood pressure measurements, random blood glucose, nutritional counselling, and other clinical markers relevant to management of diabetes and hypertension.

Healthcare Provider Survey

Healthcare practitioners completed standardized questionnaires on their knowledge of nutrition guidelines, current practices, perceived barriers to implementation, previous nutrition training and availability of educational resources.

Patient Survey

Participants completed interviewer-administered questionnaires to assess their knowledge of Food-Based Dietary Guidelines, Dietary recommendations for DASH, WHO HEARTS recommendations on salt and sugar reduction, receipt of nutritional counselling and self-reported eating habits.

Interviews, Focus Groups and Community Outreach

Semi-structured interviews with policymakers explored policy implementation processes, organizational challenges, and health system barriers. Eight focus group discussions and two community outreach activities explored community perceptions of healthy eating, cultural food practices, affordability of healthy diets, and barriers to adopting nutrition recommendations.

Study Variables

Primary implementation outcomes included: policy readiness, implementation fidelity, provider knowledge, provider practice, patient awareness and reported dietary practices. Clinical outcome variables included elevated blood pressure, defined as $\geq 140/90$ mmHg, elevated random blood sugar, defined as ≥ 200 mg/dL, and missing random blood sugar measurements. Independent variables included age, sex, health facility, diagnosis, provider knowledge, patient awareness, and implementation indicators.

Statistical Analysis

IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, NY, USA) was used to analyze the quantitative data. Summary statistics, including frequencies, percentages, means and standard deviations, were generated to describe the study variables. Chi-square tests were performed to examine differences among health facilities in patient awareness, dietary practices, documentation practices, and clinical outcomes. To determine associations between provider knowledge and implementation practice ($p = 0.78$, $p < 0.001$) and between patient awareness and reported dietary practices ($p = 0.707$, $p < 0.001$), Spearman's rank correlation coefficient was used. The researchers conducted multivariable logistic regression analyses to identify factors

associated with high patient awareness, favorable dietary practices, elevated blood pressure, elevated random blood sugar and missing random blood sugar measurements. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported, and statistical significance was established at $p < 0.05$.

Trustworthiness and Rigour

Qualitative findings were further corroborated by methodological triangulation (interviews, focus group discussions, community outreach activities, provider surveys and patient record analysis). Reliability was ensured by maintaining an audit trail of the selections made during data collection and analysis. Reflexive journaling and regular methodological conversations within the research team to minimize researcher bias strengthened the reliability of the findings. Transferability was enhanced through comprehensive descriptions of the study setting, participant characteristics and implementation context that would allow readers to assess the relevance of the findings to similar low- and middle-income healthcare contexts.

Results

Implementation Readiness and Policy-to-Practice Gap (KTA Framework)

All four participating health facilities demonstrated similar implementation fidelity. Each facility achieved a policy readiness score of 60% and a facility implementation score of 20%, resulting in an overall implementation fidelity score of 40%. Although nutrition policies and guidelines were available across all facilities, the low implementation scores indicate that these policies had not been consistently translated into routine clinical practice. Detailed facility-level implementation scores are presented in Table 1.

Table 1. Facility Implementation Scoring Profile

Facility	Policy Readiness %	Facility Audit %	Overall Implementation %
GIHC	60.0	20.0	40.0
WDRH	60.0	20.0	40.0
PHHC	60.0	20.0	40.0
LCH	60.0	20.0	40.0

Facility assessments demonstrated similar implementation profiles across all four participating health facilities (Table 1). Each facility recorded a policy readiness score of 60.0%, a facility audit score of 20.0%, and an overall implementation score of 40.0%. Although nutrition policy documents, including the Food-Based Dietary Guidelines (FBDGs) and the WHO HEARTS guidance, were

available across all facilities, implementation at the operational level remained limited. Deficiencies were observed in documentation systems, patient education resources, structured nutrition counselling tools and routine implementation processes.

Provider Adoption and Implementation (RE-AIM Framework)

Table 2. Provider Knowledge and Practice Profile

Facility	Provider n	Mean Knowledge %	Mean Practice %	Main Provider Barrier
GIHC	5	48.0	33.8	Training gap
WDRH	6	60.0	41.7	Materials gap
PHHC	4	45.0	46.9	Materials gap
LCH	2	60.0	50.0	Materials gap

Seventeen healthcare providers participated in the provider assessment. Mean provider knowledge scores ranged from 45.0% to 60.0% and mean implementation practice scores ranged from 33.8% to 50.0% across participating facilities (Table 2). The major implementation barrier at Goed Intent Health Centre (GIHC) was training deficiencies, whereas the main barriers at West Demerara Regional Hospital (WDRH), Parfaite Harmonie Health Centre (PHHC) and Leonora Cottage Hospital (LCH) were inadequate educational materials.

No statistically significant differences were observed among facilities in provider

knowledge ($p = 0.874$) or implementation practice ($p = 0.748$). However, provider knowledge was strongly positively correlated with implementation practice (Spearman's $\rho = 0.780$, $p < 0.001$). In other words, the higher the knowledge score, the better the implementation practice.

These findings suggest moderate adoption of nutrition guidelines by healthcare providers, although consistent implementation remained limited across the participating facilities.

Patient Reach, Awareness and Adoption (RE-AIM Framework)

Table 3. Reported Dietary Practice and Patient Awareness

Facility	FBDG Aware %	DASH Aware %	High Awareness %	Low-salt Practice %	Low-sugar Practice %	High Practice %
GIHC	51.7	16.9	—	47.4	39.6	—
WDRH	75.6	48.2	52.2	—	—	—
PHHC	—	—	28.2	—	—	70.9
LCH	—	—	—	85.2	70.9	98.2

Patient awareness of nutrition recommendations varied significantly across the participating facilities (Table 3). Awareness of the Food-Based Dietary Guidelines (FBDGs) ranged from 51.7% to 75.6%, whereas awareness of the DASH dietary recommendations ranged from 16.9% to 48.2%. Overall high awareness varied from 28.2% at Parfaite Harmonie Health Centre (PHHC) to 52.2% at West Demerara Regional Hospital (WDRH).

Reported dietary practices also differed across facilities. High dietary practice was reported by 70.9% of the participants at Goed Intent Health Centre (GIHC) and 98.2% at Leonora Cottage Hospital (LCH). LCH had the lowest awareness of DASH dietary recommendations (16.9%) but had the highest

percentage of participants reporting favorable dietary practices (98.2%).

There were significant differences between facilities for patient awareness ($\chi^2 = 87.48$, $df = 3$, $p < 0.001$; Cramer's $V = 0.179$) and reported dietary practice ($\chi^2 = 229.65$, $df = 3$, $p < 0.001$; Cramer's $V = 0.289$). Furthermore, a significant positive correlation was observed between patients' awareness and reported dietary practices (Spearman's $\rho = 0.707$, $p < 0.001$); suggesting that patients with higher awareness were more likely to report adherence to the recommended dietary practices.

Overall, the Programme reach and adoption varied across facilities, and increased patient knowledge appears to be related to increased self-reported adherence to the recommended dietary practices.

Table 4. Factors Associated with High Reported Dietary Practice: Multivariable Logistic Regression Analysis.

Adjusted Model for High Reported Dietary Practice

Predictor	Adjusted OR (95% CI)	p value
Age	0.99 (0.98–1.00)	0.170
Facility: LCH vs GIHC	145.53 (64.88–326.43)	<0.001
Facility: PHHC vs GIHC	3.40 (2.33–4.94)	<0.001
Facility: WDRH vs GIHC	10.12 (6.85–14.95)	<0.001
Patient awareness %	1.11 (1.10–1.12)	<0.001
Barrier: Culture/Food norms vs Availability/Access	0.54 (0.29–0.99)	0.047
Barrier: Lack of knowledge vs Availability/Access	4.56 (2.21–9.42)	<0.001

Multivariable logistic regression identified several factors independently associated with high reported dietary practice (Table 4). Patient awareness was a significant predictor of

favorable dietary practice (adjusted OR = 1.11; 95% CI: 1.10–1.12; $p < 0.001$). Compared with participants attending Goed Intent Health Centre (GIHC), those receiving care at Leonora

Cottage Hospital (LCH) (adjusted OR = 145.53; 95% CI: 64.88–326.43; $p < 0.001$), West Demerara Regional Hospital (WDRH) (adjusted OR = 10.12; 95% CI: 6.85–14.95; $p < 0.001$), and Parfaite Harmonie Health Centre (PHHC) (adjusted OR = 3.40; 95% CI: 2.33–4.94; $p < 0.001$) had significantly greater odds of reporting favorable dietary practices.

Participants identifying cultural food norms as their principal barrier had significantly lower odds of reporting high dietary practice (adjusted OR = 0.54; 95% CI: 0.29–0.99; $p = 0.047$), whereas those reporting lack of knowledge as

the primary barrier had significantly higher odds of reporting favorable dietary practices (adjusted OR = 4.56; 95% CI: 2.21–9.42; $p < 0.001$). Age was not significantly associated with reported dietary practice (adjusted OR = 0.99; 95% CI: 0.98–1.00; $p = 0.170$). The model demonstrated good explanatory ability, accounting for approximately 40.6% of the variation in reported dietary practice (Pseudo $R^2 = 0.406$).

Clinical Indicators and Implementation Performance

Table 5. Facility-Level Clinical Indicators and Implementation Scores

Facility	BP Analysis n	BP $\geq 140/90\%$	RBS Analysis n	RBS $\geq 200\%$	RBS Missing %	Implementation %
GIHC	529	66.4	396	42.9	25.3	40.0
WDRH	1257	56.7	941	37.4	25.6	40.0
PHHC	500	66.2	305	30.2	39.0	40.0
LCH	451	59.0	413	32.9	8.4	40.0

Note: BP = blood pressure; RBS = random blood sugar; GIHC = Goed Intent Health Centre; WDRH = West Demerara Regional Hospital; PHHC = Parfaite Harmonie Health Centre; LCH = Leonora Cottage Hospital. Elevated BP was defined as $\geq 140/90$ mmHg; elevated RBS was defined as ≥ 200 mg/dL among records with valid measurements. RBS missing (%) represents the proportion of patient records without a recorded RBS measurement.

As shown in Table 5, among the $n = 2,737$ patient records with valid blood pressure measurements, the prevalence of elevated blood pressure ($\geq 140/90$ mmHg) ranged from 56.7% at West Demerara Regional Hospital (WDRH) to 66.4% at Goed Intent Health Centre (GIHC). Among the 2,055 records with valid random blood sugar measurements, the prevalence of elevated random blood sugar (≥ 200 mg/dL) ranged from 30.2% at Parfaite Harmonie Health Centre (PHHC) to 42.9% at GIHC. The proportion of missing random blood sugar results varied significantly across facilities, ranging from 8.4% at Leonora Cottage Hospital (LCH) to 39.0% at PHHC. Despite the

differences in clinical indicators, the overall implementation score was still 40.0% in all of the facilities that participated.

Statistically significant differences were observed among facilities for elevated blood pressure ($\chi^2 = 22.32$, $df = 3$, $p < 0.001$; Cramer's $V = 0.090$), elevated random blood sugar ($\chi^2 = 14.95$, $df = 3$, $p = 0.002$; Cramer's $V = 0.085$) and missing random blood sugar measurements ($\chi^2 = 118.12$, $df = 3$, $p < 0.001$; Cramer's $V = 0.207$).

Multilevel Barriers to Nutrition Guideline Implementation (SEM Framework)

Table 6. Patient-Level Barriers to Nutrition Guideline Implementation

Barrier Category	Patient n	Patient %
Cost/Affordability	1,743	63.5
Culture/Food norms	540	19.7
Lack of knowledge	180	6.6
Time/Workload	161	5.9
Availability/Access	121	4.4

The most frequent barriers to adopting the recommended dietary practices were financial constraints and affordability, reported by 63.5% of the respondents (Table 6). The second most common barrier was cultural diet norms (19.7%), followed by lack of knowledge (6.6%), lack of time or workload (5.9%) and limited food availability or access (4.4%).

There was a significant association between the classification of barriers and patient awareness ($\chi^2 = 39.81$, $df = 4$, $p < 0.001$; Cramer's $V = 0.120$) and documented dietary behavior ($\chi^2 = 20.23$, $df = 4$, $p < 0.001$;

Cramer's $V = 0.086$). The quantitative data were supplemented by qualitative insights from focus group discussions and community outreach activities, which illuminated the primary themes influencing the implementation of nutrition guidelines: cultural and household food practices, communication and outreach strategies, understanding of disease management, awareness of healthy diets, and cost.

Integrated Implementation Science Assessment

Breakpoints occurred between recognized guidance, operational facility tools, and recorded nutrition counseling.



Figure 1. Policy-to-Practice Pathway for Nutrition Guideline Implementation

Figure 1 illustrates the progression of nutrition guidelines from national policy development to routine implementation within participating healthcare facilities. Although evidence-based guidance, including the Food-Based Dietary Guidelines (FBDGs), Dietary Approaches to Stop Hypertension (DASH) recommendations and the WHO HEARTS framework, was available across the health

system, discontinuities were observed between policy availability and routine implementation. These gaps were evident in the availability of implementation resources, documentation systems, structured nutrition counselling, and monitoring processes, highlighting measurable breakpoints along the policy-to-practice pathway.

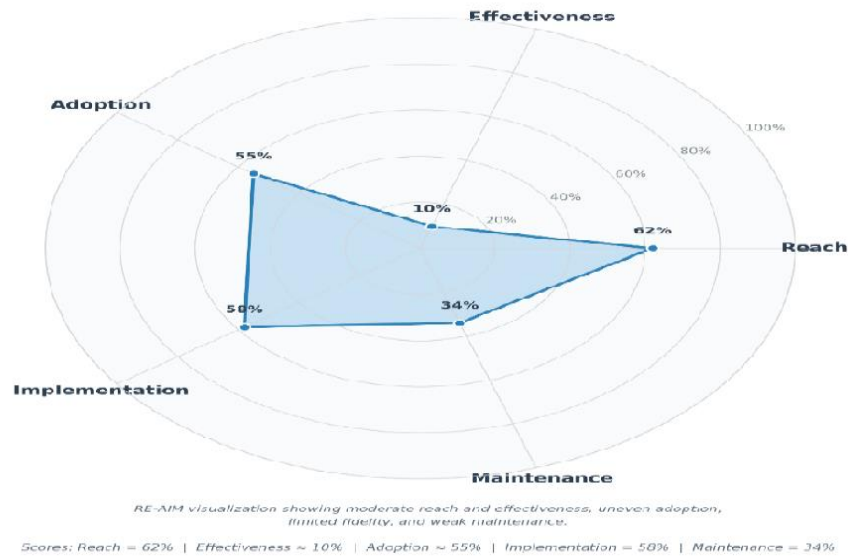


Figure 2. RE-AIM Assessment of Nutrition Guideline Implementation

As illustrated in Figure 2, the RE-AIM evaluation revealed moderate levels of program efficacy across the various areas of implementation. Program reach was estimated at 62%, adoption at 55%, and implementation at 58%. Maintenance (34%) and effectiveness

(approximately 10%) were much lower. These results reveal inconsistencies across the five RE-AIM dimensions and indicate that long-term sustainability and program efficacy were less favorable than initial program reach and adoption.



Figure 3. Application of the Knowledge-to-Action (KTA) Framework

Figure 3 illustrates the application of the Knowledge-to-Action (KTA) framework to nutrition guideline implementation, across the participating health facilities. Performance was strongest during the knowledge creation phase,

as is evidenced by the availability of the Food-Based Dietary Guidelines (FBDGs), Dietary Approaches to Stop Hypertension (DASH) recommendations and the WHO HEARTS framework. In contrast, comparatively lower

performance was observed during the action cycle, particularly in knowledge adaptation, implementation, monitoring, evaluation, feedback and sustainability. These findings

highlight measurable gaps in the translation of evidence-based nutrition guidance into routine clinical practice.

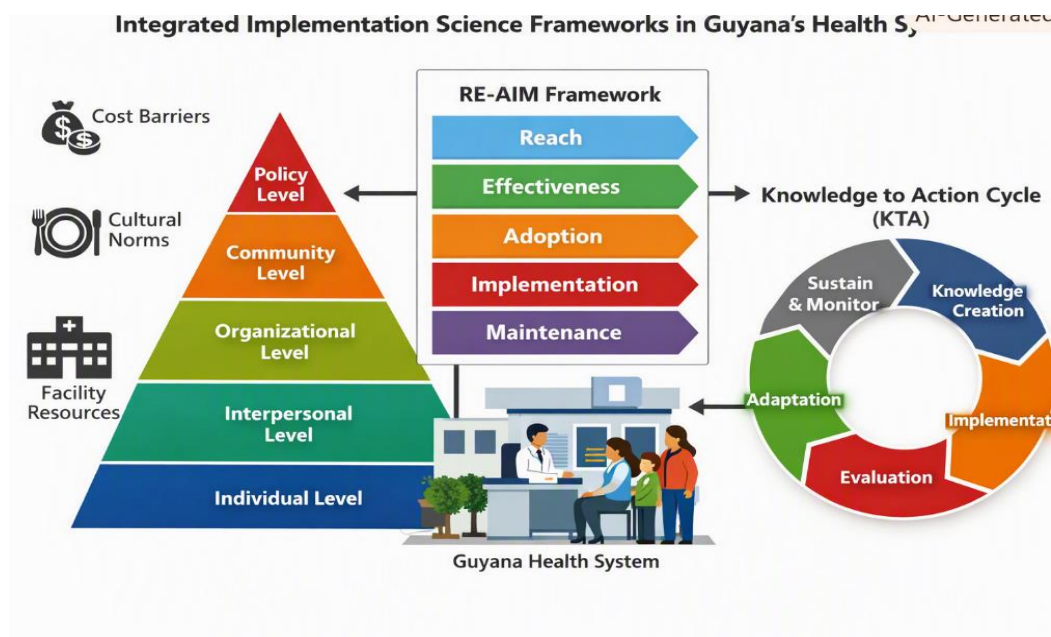


Figure 4. Integrated SEM-RE-AIM-KTA Framework for Nutrition Guideline Implementation

Figure 4 presents an integrated implementation science framework synthesized from the study findings. The framework illustrates how the Social Ecological Model (SEM), the Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework, and the Knowledge-to-Action (KTA) framework complement one another in evaluating the implementation of nutrition guidelines for diabetes and hypertension. It explores how policy-related mandates, organizational implementation approaches, healthcare provider acceptance, patient outreach and engagement and complex contextual barriers influence the integration of evidence-based nutrition guidelines into routine clinical practice in Region 3, Guyana.

Discussion

This mixed-methods research revealed a significant gap between policy and practice in implementing nutritional guidelines for diabetes and hypertension across four public health institutions in Region 3 of Guyana.

Evidence-based nutritional guidelines were in place, but policy readiness was average, and the overall implementation rate was 40%. Providers' knowledge was moderate but not consistently translated into practice. However, patient awareness varied across facilities and was associated with reported dietary behavior; hence, substantial proportions of patients had elevated blood pressure and random blood glucose levels. These clinical observations should not be viewed as direct evidence of implementation effectiveness, but rather as the ongoing clinical challenges to successful disease management in the cohort under study. The quantitative and qualitative findings further indicated that organizational capacity, documentation systems, provider resources, affordability, household practices and cultural food norms influenced the translation of nutritional guidance into routine care. These central findings, therefore, are not due to a lack of nutritional policy, but to an incomplete translation of existing policies and guidelines into sustained routine practice. The RE-AIM

assessment reinforces this interpretation by showing that the reach (62%), adoption (55%) and implementation (58%) were moderate, whereas maintenance (34%) and effectiveness (approximately 10%) were substantially weaker. This pattern suggests that the initial dissemination and uptake were more advanced than the mechanisms needed to sustain implementation and achieve a measurable clinical impact. These findings therefore support conceptualizing implementation as a continuum, in which policy availability and the initial adoption represent only part of the pathway towards sustained delivery and improved health outcomes.

Policy Readiness versus Implementation Fidelity: A Knowledge-to-Action Perspective

All participating facilities recorded policy readiness of 60% but facility implementation of only 20%, producing an overall implementation score of 40%. This discrepancy indicates that policy availability and recognition did not correspond to equivalent operationalization within routine services. Guyana's FBDGs, DASH recommendations and WHO HEARTS provide an evidence base for nutrition-related NCD care, but implementation requires additional mechanisms that support local adaptation, counselling delivery, documentation, monitoring and feedback [12].

The KTA framework helps locate this breakpoint. Knowledge creation appeared comparatively well established through the availability of recognized guidance, whereas weaknesses were more apparent within the action cycle. In particular, the findings point to gaps in adaptation to local service conditions, operational implementation, documentation, monitoring, evaluation and sustainability [13, 14]. The policy-to-practice gap therefore appears to emerge mainly after policy adoption, when guidance must be incorporated into everyday clinical workflows. This distinction has practical importance for policy evaluation.

Counting policies, guidelines or training events can overestimate implementation if routine service processes are not assessed. Implementation indicators should therefore capture whether counselling is delivered, documented, supported with appropriate resources and reviewed through ongoing quality-improvement mechanisms [15]. Facility-level audit findings also showed that the same broad implementation weaknesses were present across settings despite differences in facility size and service delivery. This uniformity may indicate system-wide limitations in the structures supporting nutrition care rather than isolated shortcomings at a single facility. It also suggests that national or regional implementation standards may be useful for establishing minimum expectations for counselling, documentation, training, supervision and monitoring. The discrepancy between patient reports of counselling and limited clinical documentation illustrates this challenge. Undocumented counselling cannot be assumed to represent absence of care; however, inconsistent documentation weakens continuity, quality monitoring and the ability to determine whether implementation is occurring as intended.

Provider Knowledge, Adoption and the Knowledge-Practice Gap

Provider knowledge scores ranged from 45% to 60%, while practice scores ranged from 33.8% to 50.0%. Although provider knowledge and practice were positively correlated, the small provider sample ($n = 17$) requires cautious interpretation. The findings nevertheless suggest that knowledge alone is insufficient to ensure consistent nutrition counselling. Providers identified training gaps and limited educational materials as important constraints, with the predominant barrier differing by facility. At GIHC, training gaps were the most prominent barrier, whereas limited materials were reported more frequently at WDRH, PHHC and LCH. These differences

are important because they demonstrate that similar implementation scores can arise from different underlying constraints. These results are consistent with implementation evidence showing that evidence-based recommendations are more likely to become routine when provider capability is supported by appropriate resources, workflow integration, supervision and organizational reinforcement [4, 16, 17].

From a RE-AIM perspective, moderate provider knowledge suggests partial adoption, whereas lower practice scores indicate weaker implementation. This distinction is important because dissemination and professional awareness do not necessarily produce high implementation fidelity. Facility-specific barriers also suggest that a uniform intervention may be less effective than strategies tailored to local organizational needs. Refresher training, practical counselling tools, standardized documentation and supportive supervision may therefore be more useful when implemented as part of a coordinated facility-level strategy rather than as isolated educational activities.

Patient Reach, Awareness and Reported Dietary Practices

Patient awareness varied substantially across facilities. FBDG awareness ranged from 51.7% to 75.6%, while DASH awareness ranged from 16.9% to 48.2%; high overall awareness ranged from 28.2% to 52.2%. Reported low-salt and low-sugar practices also varied, demonstrating that reach and behavioural uptake were not uniform across facilities. Awareness of the FBDGs was consistently higher than awareness of DASH, while higher awareness was associated with more favourable reported dietary practice. In the adjusted model, patient awareness remained independently associated with high reported dietary practice, supporting the importance of nutrition education. However, the very large facility effect observed for LCH and other facility differences should not be interpreted as causal rankings of facility quality. They may reflect differences in patient

composition, counselling exposure, outcome prevalence or other measured and unmeasured contextual characteristics.

Reported dietary practice also requires cautious interpretation. The composite measure reflected selected behaviours, particularly low-salt and low-sugar practices, rather than comprehensive adherence to the full FBDG or DASH dietary pattern. Recall and social-desirability bias may therefore have contributed to the relatively favourable practice classifications. The findings support continued patient education [18], but education should emphasize practical application of dietary recommendations using affordable and culturally acceptable foods, barrier assessment and realistic goal setting [19, 20].

Clinical Indicators and the Policy-to-Practice Gap

Elevated blood pressure and random blood sugar remained common despite comparatively favourable reported dietary practices. Elevated blood pressure affected more than half of patients at each facility, ranging from 56.7% to 66.4%, while elevated random blood sugar ranged from 30.2% to 42.9% among records with available measurements. These findings highlight the distinction between implementation-related behavioural indicators and clinical control. Facility differences in these indicators were statistically significant but had small effect sizes, suggesting that facility context explained only a limited proportion of clinical variation. Clinical control is influenced by multiple factors beyond dietary awareness, including medication adherence, disease duration and severity, comorbidities, healthcare access and socioeconomic conditions. The cross-sectional design also prevents determination of whether reported dietary practices preceded the measured clinical outcomes. These findings therefore reinforce that awareness and self-reported behaviour are important implementation outcomes but should

not be treated as substitutes for objective clinical improvement.

Missing random blood sugar measurements also varied across facilities. This is relevant not only as a data-quality issue but as a potential indicator of differences in monitoring processes. Strengthening implementation should therefore include reliable clinical measurement and documentation alongside counselling and patient education.

Multilevel Barriers: A Social Ecological Perspective

Cost and affordability were the dominant patient-level barriers (63.5%), followed by cultural food norms (19.7%). Lack of knowledge (6.6%), time or workload constraints (5.9%) and availability or access (4.4%) were less frequently reported but remained relevant. Barrier category was significantly associated with both patient awareness and reported dietary behaviour, although effect sizes were small, indicating that these relationships should be interpreted as part of a wider set of influences rather than as dominant causal explanations. Qualitative findings similarly emphasized household food practices, information pathways, disease understanding and the practical affordability of healthier choices. The SEM demonstrates why interventions directed only at individual knowledge are unlikely to be sufficient. Patients may understand dietary recommendations but remain constrained by household preferences, food prices, cultural expectations and access to appropriate foods [21-25].

Organizational barriers interacted with these patient-level constraints. Limited educational materials, training gaps, inconsistent documentation and variable counselling practices reduced the capacity of facilities to support sustained behaviour change. Implementation strategies should therefore operate across levels: strengthening provider and organizational capacity within facilities

while also addressing community communication, culturally appropriate dietary adaptation and affordability.

Integrated Interpretation Through SEM, RE-AIM and KTA

The three frameworks provided complementary rather than competing explanations. KTA identified the weakening of translation after policy adoption; RE-AIM demonstrated moderate reach and adoption but weaker implementation, effectiveness and maintenance; and SEM located the determinants of these outcomes across individual, interpersonal, organizational, community and policy levels. Their integration provides a coherent explanation of why the presence of evidence-based guidance has not yet produced consistent routine implementation.

The framework synthesis also helps explain why apparently positive findings in one domain should not be interpreted in isolation. For example, moderate reach does not guarantee effectiveness, provider adoption does not guarantee consistent implementation, and the existence of national guidance does not guarantee maintenance. Similarly, patient knowledge may support healthier choices but cannot remove financial or cultural constraints. Considering these dimensions together avoids attributing implementation failure solely to patients or providers and instead identifies modifiable system-level conditions. This integrated interpretation is an important contribution of the study. It shifts attention from whether nutrition policies exist to whether the health system has the processes, resources and contextual supports needed to sustain them. In Region 3, strengthening implementation will require coordinated action across policy, facility, provider and community levels, with routine monitoring used to identify gaps and adapt strategies over time.

Implications for Policy and Practice

The findings indicate that strengthening nutrition services in Guyana requires greater emphasis on implementation systems, not only policy development. Facilities should introduce standardized, low-burden counselling and documentation tools, including brief nutrition-assessment prompts and structured fields for recording counselling topics, agreed dietary goals, referrals and follow-up plans. These tools should be integrated into existing workflows so that documentation supports continuity of care, implementation monitoring and quality improvement without creating unnecessary administrative burden.

Provider development should combine refresher education with practical counselling skills, culturally responsive communication, behaviour-change approaches and access to appropriate patient-education materials. Training should be reinforced through supportive supervision and periodic competency review so that knowledge is translated into observable routine practice. Facility managers should also ensure that counselling resources are consistently available at points of care and that responsibility for nutrition counselling and follow-up is clear within multidisciplinary teams. Because the dominant provider barriers differed across facilities, implementation support should be responsive to local needs while maintaining common minimum standards for counselling and documentation.

The predominance of affordability and cultural food norms also requires action beyond health facilities. Community-based nutrition initiatives and collaboration across health, agriculture, education and social-protection sectors should support access to affordable healthy foods and culturally appropriate dietary modification. Nutrition education should translate FBDG and DASH principles into realistic meals that reflect household resources and local food practices.

Finally, routine implementation monitoring should include facility fidelity indicators, provider competency, counselling documentation, patient-reported outcomes and relevant clinical measures. Monitoring should be designed as a feedback mechanism rather than solely as an accountability exercise. Regular review of facility-level indicators could help teams identify gaps, test corrective actions and determine whether improvements are maintained. Where feasible, implementation data should be linked with clinical indicators so that increases in counselling and documentation can be assessed alongside blood-pressure and glycemic outcomes. These data can support continuous quality improvement and allow managers to identify where implementation is weakening. Future research should use longitudinal designs to determine whether improvements in implementation fidelity are sustained and whether they translate into better behavioural and clinical outcomes, and should examine implementation across other regions of Guyana.

Strengths and Limitations

A major strength of this study was its integration of implementation science frameworks with mixed-methods evidence. The combined use of SEM, RE-AIM and KTA enabled implementation to be examined across multiple ecological levels while also assessing implementation performance and knowledge translation. Triangulation of facility audits, provider assessments, 2,745 patient records, patient data and qualitative evidence from interviews, focus groups and community outreach provided a broad view of both measurable implementation outcomes and the context in which they occurred. Inclusion of four public facilities spanning different service-delivery settings also strengthened the relevance of the findings to Region 3.

Several limitations require consideration. The cross-sectional design precludes causal or temporal conclusions regarding

implementation, awareness, dietary behaviour and clinical outcomes. Some provider and patient measures were self-reported and may be affected by recall or social-desirability bias. The provider sample was small ($n = 17$), limiting statistical power and the generalizability of provider-level comparisons and correlations. Missing random blood sugar measurements varied across facilities and may have influenced glycaemic comparisons. Identical facility-audit scores may reflect shared implementation conditions but may also indicate limited sensitivity of the audit instrument to more subtle differences in implementation quality. Finally, the study involved four selected facilities in Region 3; findings should not automatically be generalized to all facilities or administrative regions in Guyana. Despite these limitations, the convergence of multiple data sources provides a robust basis for identifying priority implementation gaps. The qualitative component is particularly valuable because it helps explain why similar quantitative implementation scores may coexist with different provider and patient experiences across facilities. Nevertheless, the qualitative findings are context-specific and should be interpreted as explanatory evidence rather than population prevalence estimates.

Conclusion

A substantial policy-to-practice gap was identified in the implementation of nutrition guidelines for diabetes and hypertension across the participating facilities in Region 3, Guyana. Evidence-based guidance was available, but routine implementation was constrained by weak implementation fidelity, inconsistent documentation, provider resource and training limitations, and socioeconomic and cultural barriers.

The integrated SEM, RE-AIM and KTA analysis showed that successful implementation requires more than policy availability: it depends on effective knowledge

translation, supportive organizational systems, practical provider capacity, culturally responsive patient support and sustained monitoring. Strengthening these components can improve the consistency and sustainability of nutrition services and provides a practical direction for health-system improvement in Guyana and comparable LMIC settings.

Conflict of Interest

The authors declare no conflicts of interest related to the design, conduct or reporting of this study.

Ethical Approval

Ethical approval for the study was obtained from Texila American University and the Institutional Review Board (IRB) of the Ministry of Health, Guyana (Approval Reference: 029/2026). The study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision). All participating healthcare providers and patients provided informed consent before inclusion in the study. Patient data were anonymized at the point of extraction to protect confidentiality and privacy.

Author's Contribution

Selese Melanee Shepherd-Holder: Conceptualization, Methodology, Investigation, Formal analysis, Writing—original draft. Michael Olabode Tomori: Supervision, Project administration, Writing—review and editing. Both authors reviewed and approved the final manuscript.

Data Availability

The datasets generated and analyzed during this study are not currently publicly available due to patient confidentiality. However, once permission is granted by the Guyana Ministry of Health, the corresponding author can make the data available.

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