Integrated Training Program in Lifestyle Medicine and Health Literacy for Diabetes Coaches: A Research and Development Study in Community-Based Prediabetes Management

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Abstract

Background: Prediabetes significantly increases risk for type 2 diabetes mellitus (DM) and cardiovascular disease. Lifestyle modification represents the most effective preventive approach but requires strong health literacy and self-management skills for sustainable implementation in community settings.

Objectives: To develop and evaluate an integrated training program combining lifestyle medicine and health literacy for DM coaches in managing prediabetes within Thai communities. This evaluated whether intensive coach training could produce superior outcomes and assessed peer coaches' effectiveness in delivering lifestyle interventions.

Methods: This 12-month research and development study following the ADDIE framework was conducted across 7 provinces in northeastern Thailand. A total of 4998 participants with prediabetes were enrolled: 1127 trained as DM coaches through an intensive 2-day training which integrated lifestyle medicine, health literacy, and coaching techniques while implementing personal lifestyle modifications. The other 3871 received peer coaching from trained coaches. Primary outcomes included fasting blood glucose (FBG), blood pressure (BP), anthropometrics, body composition, knowledge, and lifestyle medicine scores. Linear mixed model (LMM) analysis assessed within-group changes and between-group differences as rates of change over time.

Results: Both groups demonstrated significant improvements in all parameters ($P < .001$). The DM coach group achieved substantial reductions in FBG (-8.4 mg/dL), body weight (-0.8 kg), systolic BP (-1.5 mmHg), and diastolic BP (-2.0 mmHg). LMM analysis revealed superior daily improvements in diastolic BP (-0.012 mmHg/day, $P = .020$) in the coach group. Knowledge scores improved by 4.5 points and coaching skills by 1.6 points in the coach group.

Conclusions: The integrated DM coach training program effectively improved clinical outcomes, knowledge, and lifestyle practices. This community-based approach offers a promising, scalable strategy for DM prevention in resource-limited settings.

Keywords: Prediabetes, Lifestyle medicine, Health literacy, Community health coach, Diabetes prevention

Citation: Sirichaisit K. Integrated training program in lifestyle medicine and health literacy for diabetes coaches: a research and development study in community-based prediabetes. *Res Med J*. 20XX; XX(X):e277974. doi:10.33165/rmj.2026.277974

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Received: 30 September 2025
Revised: 16 December 2025
Accepted: 18 December 2025
Published: 26 January 2026

Introduction

Prediabetes is defined by impaired fasting glucose (100-125 mg/dL) or elevated hemoglobin A_{1c} (HbA_{1c}) (5.7%-6.4%).[1, 2] It is a critical health concern globally. Individuals with prediabetes face a substantially elevated risk of progressing to overt type 2 diabetes mellitus (DM) and heightened risks for cardiovascular disease (CVD) and all-cause mortality.[2]

DM is a major global health concern, with its prevalence steadily increasing in both developed and developing countries. In Thailand, the prevalence of diabetes among adults aged 20-79 years has risen from 7.5% in 2011 to 10.2% in 2024, and it is projected to reach 11.6% by 2050.[3] Additionally, approximately 7.6% of the population is estimated to have prediabetes, a condition characterized by impaired fasting glucose that significantly elevates the risk of progression to type 2 DM and associated complications.[4] Health Region 8, 1 of 13 administrative health regions established by the Ministry of Public Health, comprises 7 provinces in northeastern Thailand: Udon Thani, Sakon Nakhon, Nakhon Phanom, Loei, Nong Khai, Nong Bua Lamphu, and Bueng Kan. In 2024, data from Thailand's Health Data Center reported that in Health Region 8 the prevalence of prediabetes was 2.5% and DM was 7.1%, highlighting a substantial and growing burden of glycemic disorders in the region.[5] Currently, routine prediabetes management in Health Region 8 follows Thailand's national guidelines, which include annual screening, and brief lifestyle counseling at primary care facilities. However, limited healthcare personnel, and geographic barriers result in suboptimal engagement and behavior change.

Lifestyle modification (LSM) is universally recognized as the cornerstone intervention for preventing type 2 DM. LSM, achieved through controlling diet and increasing physical activity, which is supported by the strongest evidence of effectiveness for reversing prediabetes.[6] LSM programs, which are derived from major clinical trials, such as the Diabetes Prevention Program (DPP), often target a reduction in body weight and an increase in physical activity to at least 150 minutes per week.[7, 8] Such an intensive LSM can significantly reduce type 2 DM incidence by up to 58% during active intervention periods, with long-term benefits sustained for years after program completion.[8, 9] LSM is considered part of lifestyle medicine, a specialized field emphasizing evidence-based behavioral and lifestyle adjustments as the primary methods for preventing and treating noncommunicable diseases (NCDs).[10, 11] The lifestyle medicine for DM-Coach curriculum developed for this study adapted DPP and Finnish Diabetes Prevention Study methodologies to integrate 6 lifestyle medicine pillars: nutrition, physical activity, stress management, sleep optimization, substance cessation, and positive relationships.[8, 9]

While LSM programs have demonstrated efficacy in controlled research settings, their translation to under-resourced communities faces significant barriers: limited specialized personnel, geographic distance to healthcare facilities, and low health literacy hampering comprehension and self-management, as well as cultural-linguistic mismatch in standard educational materials. Furthermore, existing programs often deliver lifestyle education without adequately addressing health literacy-the fundamental capacity to understand and act on health information. This gap is critical because low health literacy predicts poor diabetes self-management independent of disease knowledge.[12-14]

Effective LSM requires strong self-management skills, which are underpinned by health literacy.[15] Health literacy refers to the capacity to obtain, process, and understand health information to make appropriate decisions.[16] Low health literacy is a significant obstacle to controlling blood glucose and successful diabetes self-management. Conversely, adequate health literacy is positively correlated with improved diabetes knowledge.[17] Therefore, interventions should incorporate health literacy strategies, such as providing information in easily comprehensible language, encouraging "teach-back" to confirm understanding.[15, 18] Additionally, motivational interviewing techniques are integrated into the coaching methodology to enhance behavior change.[19]

This study aimed to: 1) develop an integrated training program combining lifestyle medicine and health literacy for DM coaches through a systematic research and development (R&D) process; 2) evaluate the program's effectiveness on clinical outcomes — specifically fasting blood glucose (FBG), blood pressure (BP), body weight, body mass index (BMI), waist circumference, and body composition (muscle and fat mass percentages); 3) assess behavioral outcomes including diabetes knowledge scores, lifestyle medicine practice scores, and coaching skill development; and 4) compare the rate of change in these outcomes between the DM coach group (who received intensive training and delivered interventions) and the pre-DM group (who received coaching from trained coaches). The hypothesis posited that both the coaching and coached groups would demonstrate significant improvements in clinical parameters, knowledge, and self-management capabilities compared to controls, with potential differences based on their respective roles in the program. This approach allowed for evaluation of the program's effectiveness on cardiometabolic and behavioral outcomes in high-risk individuals while simultaneously assessing the impact of the training experience on the coaches themselves.

Methods

Study Design

This research utilized a R&D design. The R&D process followed the ADDIE framework: analysis (situation analysis and literature review), design (curriculum development), development (training materials and protocols), implementation (coach training and intervention delivery), and evaluation (outcome assessment). The study was conducted in Health Region 8, Thailand, over a 12-month period (September 2024 to August 2025) with the following timeline, Phase 1 (months 1-2): situational analysis and literature review; Phase 2 (months 3-4): program development and curriculum design; Phase 3 (months 5-10): implementation and coaching delivery; and Phase 4 (months 11-12): outcome evaluation and analysis.

Setting

The study was conducted within upper northeast Thai community. The intervention was delivered in community-based settings that were familiar and convenient for participants, including local health promotion centers, community halls, and primary care clinics. The community-based approach involved: 1) partnership with provincial health offices and local health promotion centers; 2) recruitment through existing village health volunteer networks; 3) intervention delivery in familiar community venues (health centers, temples, village halls) rather than clinical settings; 4) peer-to-peer learning model where DM coaches from the same communities supported their neighbors; 5) incorporation of culturally appropriate examples and local foods in nutritional education; and 6) ongoing support through existing community social structures for between-session communication. This community-centered approach was chosen to maximize participation rates and ensure the sustainability of the lifestyle medicine coaching model within the existing Thai healthcare system. The setting facilitated peer-to-peer learning and community engagement, which are essential components of effective health behavior change interventions in collectivist cultures.

Participants

The study population consisted of 2 comparative groups: individuals with prediabetes who were trained as DM coaches (DM coach group), and individuals with prediabetes who received coaching from the trained DM coaches (pre-DM group). This represented a comprehensive community-based intervention where both groups participated in the prediabetes management program, but with different roles and levels of training.

Participants were purposively selected based on their roles in the community health system. Village health volunteers and primary care staff with prediabetes were invited to become DM coaches and received the intensive training delivered by a multidisciplinary team. Community members with prediabetes were recruited as the pre-DM group and received lifestyle coaching from the trained DM coaches through monthly group sessions and individual consultations.

Participants were included in the study if they were diagnosed with prediabetes, aged between 35-40 years, had the ability to read and write Thai, and demonstrated willingness to participate throughout the study period. The age range was chosen to capture the pre-aging population, early to mid-adulthood individuals at elevated risk for prediabetes progression yet physiologically capable of lifestyle modification. This group represented a critical window for preventive intervention before metabolic decline and comorbidities complicated diabetes management. Exclusion criteria included individuals with a history of severe chronic illness or those who had received previous specialized training in prediabetes management within 6 months prior to the study.

The study flow diagram shows participant recruitment, allocation, follow-up, and analysis (Figure 1). A total of 4998 participants were enrolled, including 1127 in the DM coach group and 3871 in the pre-DM group.

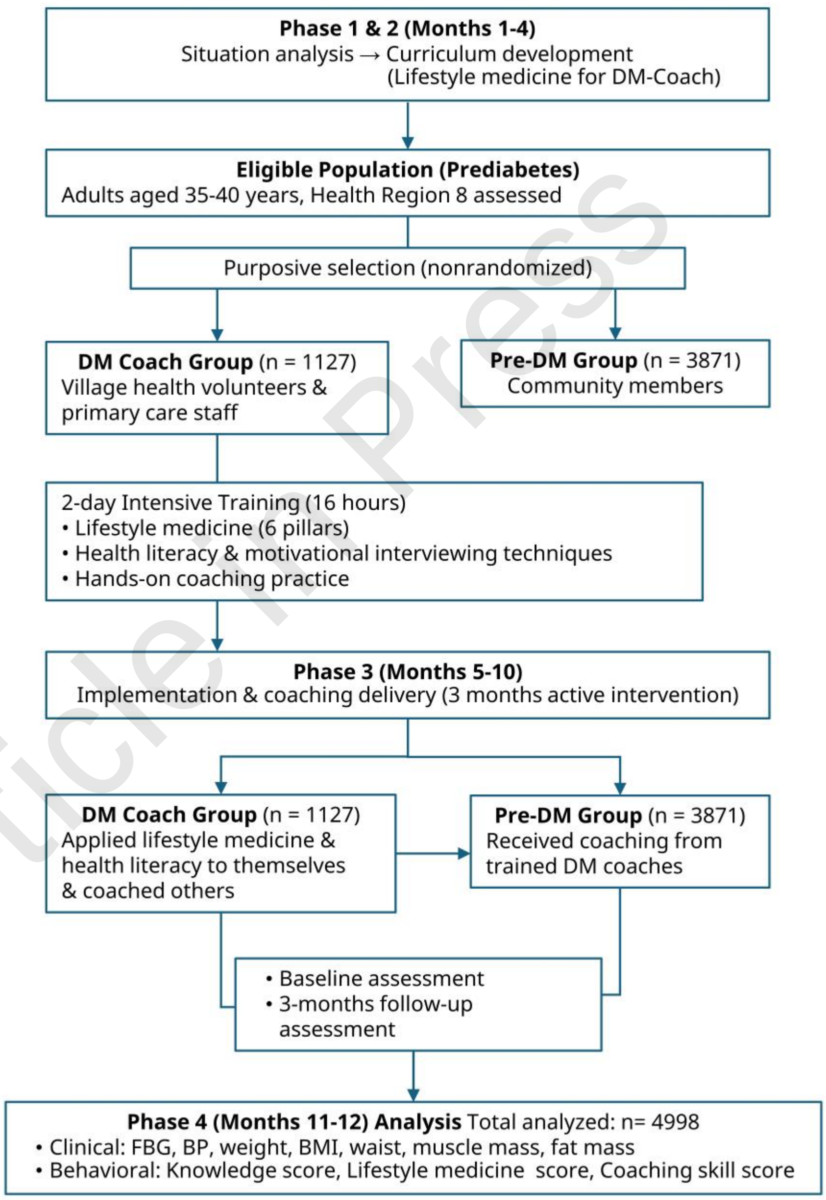
Intervention

The intervention involved an integrated training program for DM coaches that combined lifestyle medicine principles with health literacy enhancement. The integrated training program referred to the overall intervention model (training DM coaches plus delivering coaching to community members), while the lifestyle medicine for DM-Coach curriculum represented the specific training content delivered to DM coaches. The lifestyle medicine for DM-Coach curriculum was a locally developed, evidence-based training program created during Phase 1. The curriculum integrated lifestyle medicine principles adapted to Thai cultural context, and incorporated health literacy strategies validated in low-resource settings.

The training program was delivered over 2 consecutive days (approximately 16 contact hours) to the DM coach group. The curriculum encompassed 7 key components: 1) lifestyle medicine fundamentals (1 hour: diabetes pathophysiology and 6 lifestyle medicine pillars); 2) nutrition and dietary management (5 hours: plant-based diets, carbohydrate counting, and meal planning with hands-on food preparation); 3) physical activity and exercise prescription (1.5 hours: FITT principles, and safety protocols); 4) stress management and sleep optimization (2 hours: mental health assessment, and relaxation techniques); 5) substance use cessation strategies (1 hour); 6) positive relationships and environmental health (1 hour: social support, and Blue Zones principles); and 7) health literacy and motivational interviewing (4.5 hours: V-SHAPE model, stages of change theory, and motivational interviewing techniques with extensive practical training).

This intensive 2-day approach aimed to equip coaches with the necessary knowledge and skills to effectively support individuals with prediabetes in making sustainable lifestyle modifications. Following training, coaches implemented their learned techniques with assigned pre-DM participants over a 3-month period, providing individual counseling, facilitating group support, and receiving ongoing professional mentorship.

Figure 1. Study Flow Diagram



Abbreviations: BMI, body mass index; BP, blood pressure; DM, diabetes mellitus; FBG, fasting blood glucose.

Outcome Measures

The study's primary outcomes, measured at 3 months follow-up, encompassed clinical parameters including FBG, systolic and diastolic BP, body weight, BMI, and waist circumference, along with body composition measures of muscle mass percentage and fat mass percentage. Additionally, the research evaluated participants' knowledge scores, lifestyle medicine scores, and coaching skills scores using the following instruments.

Knowledge score (0-30 points): assessed using a 30-item multiple-choice questionnaire covering diabetes pathophysiology, risk factors, complications, prevention strategies, self-management principles, lifestyle medicine concepts, nutrition and dietary practices, physical activity, stress management, sleep health, substance avoidance, positive relationships, health literacy, and behavior change theories (1 point per correct answer).

Lifestyle medicine score (0-50 points): measured using a self-assessment questionnaire evaluating 6 domains: nutrition practices (fruit/vegetable intake, whole grains, portion control, and sugar consumption), physical activity (frequency, duration, and intensity of exercise), stress management (relaxation practices, coping strategies), sleep quality (duration, consistency), substance use avoidance (smoking status, and alcohol consumption), and positive relationships (social connections, and support from others). Responses were based on frequency scales, with points assigned per item (totaling up to 50 points across domains). Higher scores indicate better lifestyle practices, categorized as: 0-20 (poor), 21-30 (fair), 31-40 (good), and 41-50 (excellent).

Coaching skills scores (0-10 points, assessed only in DM coach group): evaluated using a 10-item multiple-choice questionnaire testing competencies in motivational interviewing techniques, stages of change (precontemplation, contemplation, preparation, action, maintenance, and termination), reflective listening, goal-setting facilitation, and follow-up strategies.

Statistical Analysis

Sample size was determined based on prior lifestyle intervention studies reporting effect sizes of 0.3-0.4 for FBG reduction. To detect a between-group difference of 5 mg/dL in FBG change (80% power, $\alpha = 0.05$), assuming a standard deviation of 15 mg/dL and an intraclass correlation coefficient (ICC) of 0.05 for clustering, which indicated approximately 284 participants per group were required. The actual enrolled sample ($n = 1127$ DM coaches; $n = 3871$ pre-DM participants) substantially exceeded this requirement. Recruitment of a larger sample size was undertaken to ensure robustness against attrition (estimated at 15%) and to meet the data requirements of the linear mixed model (LMM) analysis. The substantial sample size provided sufficient degrees of freedom to control for baseline covariates and socioeconomic differences inherent in the purposive selection design, while enabling accurate estimation of random effects across the study's hierarchical structure.

Data were analyzed using R version 4.5.1 (R Project for Statistical Computing). Descriptive statistics included mean (SD) for continuous variables and frequencies (percentages) for categorical variables. Baseline comparisons between DM coach and pre-DM groups used independent sample *t* test for normally distributed continuous variables, Mann-Whitney *U* test for nonnormally distributed variables, and chi-square test for categorical variables.

Within-group changes from baseline to postintervention were assessed using paired *t* test for normally distributed data and Wilcoxon signed rank test for nonnormally distributed data. Between-group differences in change over time were analyzed using LMM with fixed effects for group, time, and group × time interaction, plus random intercepts for participants and clusters to account for hierarchical data structure and repeated measures. Statistical significance was set at $P < .05$ with 95% CI reported for effect estimates.

Results

Baseline Characteristics

A total of 4998 participants were enrolled, including 1127 in the DM coach group and 3871 in the pre-DM group. Significant baseline differences were observed between groups (Table 1). While both groups consisted of individuals with prediabetes, they were distinguished by their roles in the intervention delivery model. The baseline differences reflect the purposive selection strategy: individuals with higher education and government employment were preferentially recruited as DM coaches due to their potential for sustained community leadership and health promotion activities. The DM coach group was slightly younger (mean [SD], 39.9 [2.91] vs 40.2 [2.72] years; $P = .002$), had a higher proportion of females (83.6% vs 81.2%; $P = .033$), and demonstrated higher educational attainment with 36.1% holding bachelor's degrees compared to 8.9% in the pre-DM group ($P < .001$).

Occupational distribution differed significantly, with the DM coach group having more government employees (38.2% vs 6.4%) and fewer agricultural occupation (39.3% vs 59.2%) compared to the pre-DM group. Health insurance coverage also varied, with the pre-DM group having higher universal coverage scheme enrollment (82.4% vs 49.2%). The intervention was implemented across 7 provinces in northeastern Thailand, with Udon Thani contributing the largest proportion of participants (26.3% in DM coach group, and 31.3% in pre-DM group), followed by Sakon Nakhon (21.9% and 21.0%, respectively).

Baseline clinical parameters were generally similar between groups, although the DM coach group had slightly higher body weight (mean [SD], 65.18 [13.57] vs 64.25 [12.30] kg; $P = .029$), lower FBG (mean [SD], 105.85 [6.10] vs 106.80 [6.59] mg/dL; $P < .001$), and higher baseline knowledge scores (mean [SD], 21.21 [5.52] vs 19.03 [4.68]; $P < .001$).

Table 1. Baseline Characteristics

Characteristic	No. (%) DM Coach (n = 1127)	Pre-DM (n = 3871)	*P* Value
Age, mean (SD), y	39.90 (2.91)	40.2 (2.72)	.002
Female	942 (83.6)	3145 (81.2)	.033
Education			
Primary education	50 (4.4)	424 (11.0)	< .001
Lower secondary education	131 (11.6)	891 (23.0)	
Upper secondary/diploma	517 (45.9)	2188 (56.5)	
Bachelor's degree	407 (36.1)	343 (8.9)	
Higher than bachelor's degree	22 (2.0)	25 (0.6)	

Table 1. Baseline Characteristics (Continued)

Characteristic	No. (%) DM Coach (n = 1127)	Pre-DM (n = 3871)	*P* Value
Occupation			
Agricultural occupation	443 (39.3)	2292 (59.2)	< .001
Self-employed/small business owner	76 (6.7)	390 (10.1)	
Private sector employee	72 (6.4)	202 (5.2)	
Government officer/public sector employee	431 (38.2)	249 (6.4)	
Daily wage laborer/general laborer	101 (9.0)	694 (17.9)	
Unemployed	4 (0.4)	44 (1.2)	
Health insurance			
Universal coverage scheme	554 (49.2)	3190 (82.4)	< .001
Civil servant medical benefit scheme	331 (29.4)	167 (4.3)	
Social security scheme	163 (14.5)	394 (10.2)	
Local government health scheme	19 (1.7)	20 (0.5)	
Other	60 (5.3)	100 (2.6)	
Body weight, mean (SD), kg	65.18 (13.57)	64.25 (12.30)	.029
BMI, mean (SD), kg/m^2	25.68 (4.91)	25.54 (5.13)	.413
SBP, mean (SD), mmHg	119.32 (12.54)	120.34 (12.68)	.017
DBP, mean (SD), mmHg	75.41 (9.60)	76.00 (9.35)	.066
Waist circumference, mean (SD), cm	84.04 (10.83)	84.37 (10.14)	.334
FBG, mean (SD), mg/dL	105.85 (6.10)	106.80 (6.59)	< .001
Muscle mass, %	35.72 (101.29)	30.49 (9.77)	.002
Fat mass, %	31.22 (7.58)	31.00 (7.92)	.394
Knowledge score, mean (SD)	21.21 (5.52)	19.03 (4.68)	< .001
Lifestyle medicine score, mean (SD)	33.82 (6.61)	32.77 (6.46)	< .001
Coaching skill score, mean (SD)	6.61 (2.03)	NA	NA
Province			
Udon Thani	296 (26.3)	1211 (31.3)	.001
Sakon Nakhon	247 (21.9)	811 (21.0)	
Nakhon Phanom	140 (12.4)	486 (12.6)	
Loei	140 (12.4)	400 (10.3)	
Nong Khai	107 (9.5)	336 (8.7)	
Nong Bua Lamphu	88 (7.8)	343 (8.9)	
Bueng Kan	109 (9.7)	274 (7.1)	

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood sugar; NA, not applicable; SBP, systolic blood pressure.

Intervention Outcomes

Both groups demonstrated significant improvements in all measured parameters from baseline to postintervention (Table 2). The DM coach group achieved substantial reductions in FBG (-8.4 mg/dL), body weight (-0.8 kg), BMI (-0.3 kg/m^2), and BP (systolic: -1.5 mmHg, diastolic: -2.0 mmHg), all with $P < .001$.

Knowledge scores improved markedly in both groups, with the DM coach group increasing by 4.5 points (from 21.2 to 25.7, $P < .001$) and the pre-DM group by 5.5 points (from 19.0 to 24.5, $P < .001$). Lifestyle medicine scores increased by 4.3 points in both groups ($P < .001$). The coaching skills score in the DM coach group improved from 6.6 to 8.2 (change of 1.6 points, $P < .001$).

The magnitude and direction of change scores across all measured outcomes for both study groups were determined (Figure 2). The horizontal bar chart indicated that negative values indicated beneficial decreases in clinical and anthropometric parameters, while positive values indicated improvements in knowledge-based assessments. Notable patterns emerged in the comparative effectiveness between groups, with the coach group demonstrating more pronounced reductions in certain cardiovascular risk markers, particularly diastolic BP, while showing similar performance in metabolic parameters such as FBG. The visualization highlights the differential impact of the 2 intervention approaches, with knowledge acquisition outcomes (lifestyle medicine scores and knowledge scores) showing the largest effect sizes among all measured variables. Body composition changes appeared relatively modest in both groups, suggesting that the intervention period may have been insufficient to produce substantial shifts in muscle and fat mass percentages, despite improvements in other anthropometric measures such as waist circumference and overall body weight.

LMM analysis revealed differential rates of change between groups (Table 3). The intervention demonstrated significant daily improvements in several key outcomes: -0.012 mmHg/day of diastolic BP (95% CI, -0.021 to -0.002; $P = .020$); -0.009%/day of muscle mass percentage (95% CI, -0.016 to -0.002; $P = .008$); and -0.014 points/day of knowledge score (95% CI, -0.019 to -0.010; $P < .001$)

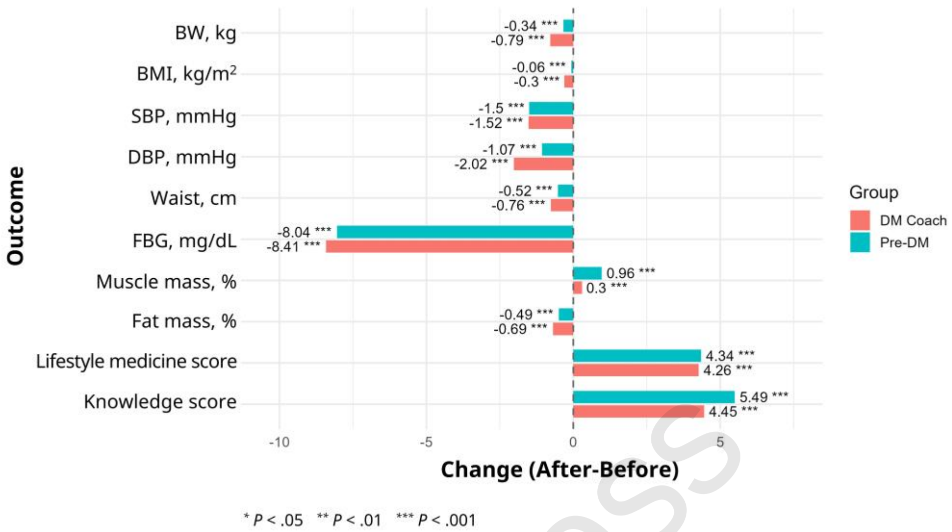
Trends toward improvement were observed for body weight (-0.028 kg/day, $P = .054$) and BMI (-0.005 kg/m^2/day, $P = .067$), although these did not reach statistical significance.

Table 2. Comparison of Pre- and Postintervention Outcomes in DM Coach and Pre-DM Groups

Outcome	DM Coach				Pre-DM			
	Pre	Post	Δ (Post-Pre)	*P* Value	Pre	Post	Δ (Post-Pre)	*P* Value
Body weight, kg	65.2	64.4	-0.8	< .001	64.3	63.9	-0.3	< .001
BMI, kg/m^2	25.7	25.4	-0.3	< .001	25.6	25.5	-0.1	< .001
SBP, mmHg	119.3	117.8	-1.5	< .001	120.3	118.8	-1.5	< .001
DBP, mmHg	75.4	73.4	-2.0	< .001	76.0	74.9	-1.1	< .001
Waist, cm	84.0	83.3	-0.8	< .001	84.4	83.9	-0.5	< .001
FBG, mg/dL	105.9	97.4	-8.4	< .001	106.8	98.8	-8.0	< .001
Muscle mass, %	35.7	36.0	0.3	< .001	30.5	31.5	1.0	< .001
Fat mass, %	31.2	30.5	-0.7	< .001	31.0	30.5	-0.5	< .001
Knowledge score	21.2	25.7	4.5	< .001	19.0	24.5	5.5	< .001
Lifestyle medicine score	33.8	38.1	4.3	< .001	32.8	37.1	4.3	< .001
Coaching Skill score	6.6	8.2	1.6	< .001	NA	NA	NA	NA

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood sugar; NA, not applicable; SBP, systolic blood pressure.

Figure 2. Pre-Post Changes in Clinical, Anthropometric, and Knowledge Outcomes by Group



Abbreviations: BMI, body mass index; BW, body weight; DBP, diastolic blood pressure; DM, diabetes mellitus; FBG, fasting blood sugar; SBP, systolic blood pressure.

The estimated daily slopes with 95% CI for clinical and anthropometric outcomes, which compared the DM coach (intervention) group and pre-DM (control) group across the study period, were presented (Figure 3). The forest plot visualization demonstrated the rate of daily change for each outcome measure, with negative slopes indicating favorable improvements over time. The figure revealed distinct patterns between groups, with the DM coach group showing more pronounced daily improvements in diastolic BP and waist circumference compared to the pre-DM group. Both groups exhibited similar trajectories for FBG, with overlapping confidence intervals suggesting comparable rates of change. For body composition measures, the confidence intervals for muscle mass percentage and fat mass percentage showed minimal separation between groups, indicating similar rates of change in both interventions. The visualization also highlighted that systolic BP, BMI, and body weight demonstrated relatively narrow confidence intervals for both groups, with the DM coach group consistently showing slightly more favorable trends. Notably, the figure illustrates that most confidence intervals for anthropometric measures do not cross zero, suggesting consistent directional changes across the intervention period for both study groups.

The group × time interaction effects displayed the differences in estimated daily slopes between the DM coach and pre-DM groups across all measured outcomes (Figure 4). The forest plot showed slope differences with 95% CI, where negative values indicated that the DM coach group had greater daily improvements compared to the pre-DM group. The vertical dashed line at zero represents no difference between groups. Notable findings included that the knowledge score showed the largest negative slope difference, indicating substantially greater daily improvement in the DM coach group compared to the pre-DM group, with a narrow confidence interval that did not cross zero. Muscle mass percentage also demonstrated a significant negative slope difference, suggesting the DM coach group achieved better daily gains in muscle mass. Most clinical parameters, including body weight, BMI, systolic BP, diastolic BP, and waist circumference, showed confidence intervals that crossed or closely approached the zero line, indicating minimal differences in daily improvement rates between groups. FBG displayed the widest confidence interval and crossed zero, suggesting no significant difference in glycemic control improvement between groups. The lifestyle medicine score showed a slight negative slope difference with a confidence interval approaching zero, indicating marginally better performance in the DM coach group.

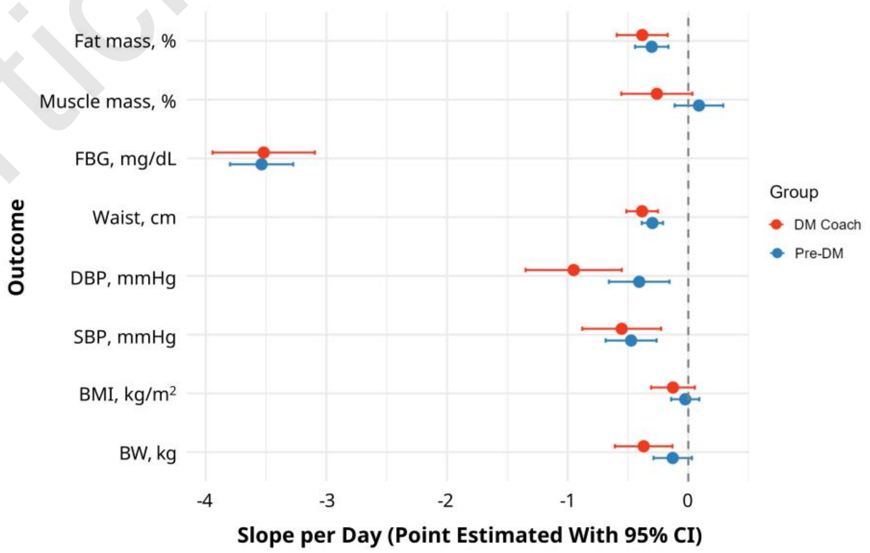
Table 3. Estimated Daily Change in Outcomes From Linear Mixed Models

Outcome	Estimate (95% CI)*	SE	*P* Value
Body weight, kg	-0.028 (-0.056 to 0.000)	0.014	.054
BMI, kg/m^2	-0.005 (-0.011 to 0.000)	0.003	.067
SBP, mmHg	-0.001 (-0.009 to 0.007)	0.004	.753
DBP, mmHg	-0.012 (-0.021 to -0.002)	0.005	.020
Waist circumference, cm	-0.002 (-0.005 to 0.001)	0.002	.143
FBG, mg/dL	0.003 (-0.008 to 0.013)	0.005	.582
Muscle mass, %	-0.009 (-0.016 to -0.002)	0.004	.008
Fat mass, %	-0.001 (-0.006 to 0.004)	0.003	.670
Knowledge score	-0.014 (-0.019 to -0.010)	0.002	< . 001
Lifestyle medicine score	-0.004 (-0.008 to 0.001)	0.002	.087

Abbreviations: BMI, body mass index; DBP, diastolic blood pressure; FBG, fasting blood sugar; SBP, systolic blood pressure.

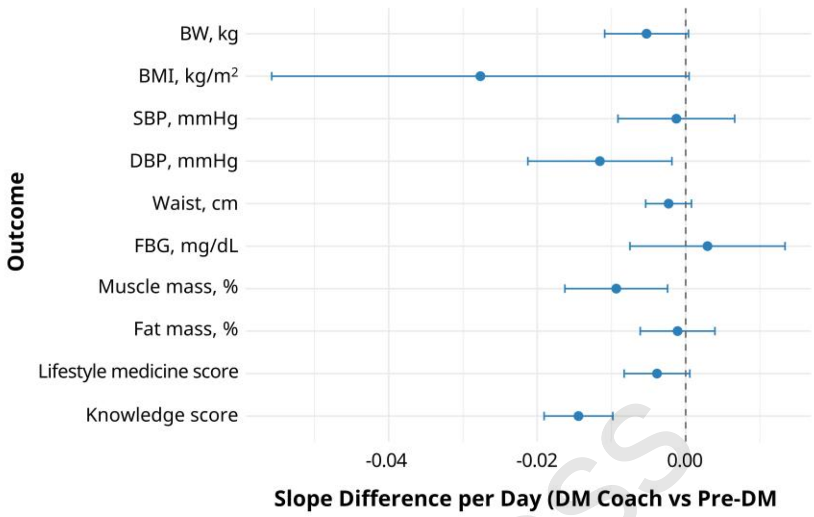
* Adjusted between-group differences in daily change rates (DM coach - pre-DM) from baseline through 3-month follow-up. Models included fixed effects (group, time, group × time interaction) and random intercepts for participants and clusters. Estimate represents the differential daily change rate between groups.

Figure 3. Estimated Daily Slopes (±95% CI) for Clinical and Anthropometric Outcomes in DM Coach and Pre-DM Groups



Abbreviations: BMI, body mass index; BW, body weight; DBP, diastolic blood pressure; DM, diabetes mellitus; FBG, fasting blood sugar; SBP, systolic blood pressure.

Figure 4. Differences in Estimated Daily Slopes Between DM Coach and Pre-DM Groups From Linear Mixed Models



Abbreviations: BMI, body mass index; BW, body weight; DBP, diastolic blood pressure; DM, diabetes mellitus; FBG, fasting blood sugar; SBP, systolic blood pressure.

Discussion

This study has demonstrated the effectiveness of an integrated training program for DM coaches in improving prediabetes management outcomes within Thai communities. The program achieved significant improvements across all measured health indices from baseline to postintervention in both groups. These overall favorable changes likely reflected the intensive nature of the lifestyle medicine and health literacy intervention, and they aligned with successful global prevention strategies

Clinical Significance and Comprehensive Cardiometabolic Improvement

The magnitude of the improvements observed in the DM coach represented clinically meaningful progress toward prediabetes reversal and type 2 DM prevention.

Metabolic control: The DM coach group achieved a substantial reduction in FBG (-8.4 mg/dL), which was highly statistically significant ($P < .001$). This reduction was consistent with previous successful lifestyle intervention studies and has suggested a strong potential for preventing progression to type 2 DM.[2, 20] Prediabetes is a reversible state, and regression to normoglycemia is a key goal, often resulting in a lower risk for diabetes incidence and microvascular complications.[6, 21]

Anthropometric and body composition gains: The program successfully promoted weight management, resulting in a significant reduction in body weight (-0.8 kg) and BMI (-0.3 kg/m^2) ($P < .001$ for both). The DM coach group also achieved a reduction in waist circumference (-0.8 cm) and fat mass (-0.7%) ($P < .001$). Furthermore, the DM coach group successfully achieved an increase in muscle mass (0.3%) ($P < .001$). Maintaining lean mass is vital for metabolic health, and the overall body composition profile suggested beneficial adaptation to the lifestyle changes. The superior outcomes observed in the DM coach group specifically achieving greater overall weight loss (-0.8 kg vs -0.3 kg) and substantially higher fat mass reduction (-0.7 kg vs -0.5 kg) indicated a desirable quality of weight loss crucial for enhancing metabolic health and insulin sensitivity in prediabetes management.[22]

Interestingly, the pre-DM group experienced a greater percentage increase in muscle mass (+1.0% vs +0.3%), despite both groups achieving significant gains ($P < .001$). This differential response warrants interpretation. Several mechanisms may explain this pattern including: 1) regression to the mean: the pre-DM group started with substantially lower baseline muscle mass (30.5% vs 35.7%), providing greater potential for muscle gain in individuals further from physiologic ceiling effects; 2) activity patterns: the pre-DM group's higher proportion of agricultural workers (59.2% vs 39.3%) may have engaged in more physically demanding occupational activities which combined with the resistance training recommendations, promoted muscle development; and 3) quality of weight loss: the DM coach group's success in achieving significant weight reduction primarily through fat loss while maintaining relatively stable muscle mass reflected an effective body composition trajectory.

The superior fat mass reduction in coaches, despite smaller absolute muscle gains, suggested more favorable metabolic adaptation. This resilience against muscle loss during weight reduction might be partially supported by the coaches' higher baseline muscle mass and their deeper understanding of resistance training principles gained through intensive training. This emphasis on strategic fat loss through intensive behavior change, including structured physical activity programming, aligned with substantial evidence that lifestyle modification remains the first-line therapy providing the strongest evidence for reversing prediabetes and reducing type 2 DM risk.[2, 6]

Cardiovascular risk reduction: The program demonstrated a dual benefit on BP in the DM coach, achieving raw reductions in both systolic BP (-1.5 mmHg) and diastolic BP (-2.0 mmHg) ($P < .001$). Crucially, the LMM analysis, which compared the rate of change between groups, revealed that the DM coach group achieved a significantly superior reduction in diastolic BP (adjusted difference, -0.012 mmHg/day; $P = .020$). This LMM result has provided evidence of the comparative strength of the integrated approach in mitigating cardiovascular risk, consistent with literature showing that lifestyle medicine programs reduce CVD mortality risk.[23]

Both systolic and diastolic BPs declined, but only diastolic BP showed significant differences between groups. This may reflect: 1) systolic BP's greater responsiveness to weight loss and sodium reduction, achieved similarly in both groups; and 2) the greater diastolic BP reduction might reflect improved peripheral vascular function and reduced arterial stiffness resulting from lifestyle modifications, weight loss, and improved insulin sensitivity. Research has demonstrated that insulin resistance is significantly associated with both systolic and diastolic BPs, with particularly strong associations observed in individuals with prediabetes and metabolic dysfunction. A large study of over 10 000 Hispanic/Latino adults without diabetes found positive linear associations between insulin resistance (measured by the homeostatic model assessment of insulin resistance [HOMA-IR]) and both systolic and diastolic BPs, with the association being independent of obesity and antihypertensive medication use.[24] This pronounced diastolic BP improvement, confirmed by a significant daily improvement detected via LMM analysis (-0.012 mmHg/day), suggested that the lifestyle intervention effectively improved peripheral vascular function and reduced arterial stiffness. This effect is particularly crucial for younger, metabolically compromised populations, as studies indicate that diastolic BP levels exceeding 80 mmHg significantly increase the risk of cardiovascular disease events in adults younger than 60 years.[25] Therefore, the sustained diastolic BP reduction achieved through the intensive coaching program has underscored its efficacy in delivering a multifactorial intervention that targets critical cardiovascular risk factors, which is considered the cornerstone of comprehensive prediabetes management.[1, 2]

Knowledge and Skills Enhancement for Sustainable Change

The intervention successfully achieved significant improvements in all behavioral and skills-based outcomes, supporting the program's foundation in health literacy and community coaching.

Knowledge and self-management: Participants in the DM coach group showed substantial improvements in knowledge score (increase of 4.5 points) and lifestyle medicine score (increase of 4.3 points) ($P < .001$ for both). This indicated successful knowledge transfer and increased adoption of healthy practices. Although the LMM showed a differential rate of change in knowledge favoring the pre-DM group, the absolute success in increasing patient knowledge within the DM coach group was evident and aligned with studies showing that health literacy interventions improve diabetes knowledge and self-care adherence.[26] Such knowledge enhancement is critical, as health literacy plays a substantial role in diabetes knowledge.[17]

Coaching capacity development: A key success specific to the intervention was the development of local leadership skills. The coaching skill score improved significantly by 1.6 points in the DM coach group ($P < .001$). This successful training, rooted in the lifestyle medicine for DM-Coach curriculum, suggested enhanced capacity for peer support and community health promotion. This capacity building is vital, as interventions delivered by community workers can be highly effective in improving diabetes knowledge and self-care behaviors, potentially overcoming barriers of access and literacy common in resource-limited settings.[26]

Community-Based Approach and Promising Strategy

The core value of this study lies in its community-based framework, which leveraged local health personnel and volunteers as peer coaches, embedded within existing healthcare infrastructure.

Feasibility and sustainability: The utilization of community members as DM coaches represented a promising strategy for scaling diabetes prevention efforts. This approach builds local capacity for chronic disease management, enabling sustained support through social networks and cultural understanding.[27]

Considerations for broader implementation: A notable characteristic was that 38.2% of DM coaches were government officers or public sector employees, who may have advantages in education, organizational skills, and health system familiarity. This raises questions about scalability to lay community members. However, substantial participation of agricultural workers (39.3%) and excellent clinical outcomes across educational levels suggested feasibility in diverse populations. Future implementation should consider: 1) testing effectiveness with community health volunteers without government employment; 2) providing additional support (ongoing mentorship, simplified materials, mobile technology) for coaches with lower baseline education; and 3) adapting training based on participants' prior health knowledge and teaching experience.

The lifestyle medicine intervention targeted 6 evidence-based pillars including 1) nutrition: low-glycemic index foods, portion control using Thai hand measurements, and reduced refined carbohydrates; 2) physical activity: 150 minutes/week moderate-intensity exercise through daily activities and resistance training; 3) sleep: 7-8 hours/night with good sleep hygiene; 4) stress management: Buddhist meditation-adapted mindfulness and breathing exercises; 5) social connections: peer support and community engagement; and 6) avoidance of risky substances: alcohol reduction and tobacco cessation. Health literacy was reinforced through teach-back methods for glucose monitoring and self-care. These culturally adapted components have made the intervention replicable in similar resource-limited settings throughout Thailand and Southeast Asia.

Model alignment: The design of the program, incorporating awareness activities, group learning, and goal setting based on the stages of change and peer professional concepts, aligned with successful LSM models.[7, 28] The successful implementation across 7 provinces demonstrated the feasibility of integrating this approach into existing Thai healthcare infrastructure, making it a promising strategy for diabetes prevention which could be adapted and scaled within similar resource settings.

Validity and Informative Value of the Design

Although baseline differences represented a methodological limitation, the pragmatic design directly addressed key questions of real-world implementation: 1) whether trained peer coaches could deliver effective interventions to community members, as evidenced by equivalent FBG outcomes; 2) whether intensive training combined with self-application provided additional benefits beyond peer coaching, which was demonstrated by superior diastolic BP control; and 3) whether the approach was feasible within existing community health infrastructure, confirmed by successful multi-provincial implementation.

While a fully randomized design with balanced baseline characteristics would enhance causal inference, such an approach would reduce external validity by failing to reflect the conditions under which programs are deployed in community health systems. The purposive design employed here aligned with real-world practice, wherein health volunteers and staff are trained as coaches to support community members.

Limitations

Several limitations should be considered when interpreting these results:

Nonrandomized design: The purposive selection of participants based on community roles limited causal inference. While this study’s LMM analysis adjusted for baseline demographic and clinical differences, residual confounding could not be entirely excluded. The DM coach group's higher baseline education, health literacy, and health system involvement might have contributed to differential engagement with lifestyle modifications, although this also reflects the reality of community health leadership capacity. Future randomized controlled trials with balanced baseline characteristics through random assignment would strengthen causal inference.

Baseline group differences: Significant differences in education, occupation, health insurance, and baseline knowledge/lifestyle medicine scores between groups arose from purposive selection. Although the LMM adjusted for these factors, the differential socioeconomic profiles might have influenced intervention responsiveness beyond measured confounders. This limitation was recognized, and findings have been interpreted with caution, emphasizing that observed differences might reflect both intervention effects and baseline group characteristics.

Short follow-up period: The 3-month active intervention and immediate post-assessment precluded evaluation of long-term sustainability. Diabetes prevention requires sustained behavior change over years, and whether the observed improvements persist 6-12 months postintervention remains unknown. The brief timeline also limited this study's ability to detect outcomes requiring longer observation periods, such as diabetes incidence or longer-term cardiovascular events.

Limited generalizability: The study was conducted in 7 provinces of northeastern Thailand with specific cultural, linguistic, and healthcare system characteristics. Generalizability to urban populations, other regions of Thailand, or other countries requires cautious consideration. The agricultural economy, Buddhist cultural context, and existing community health volunteer infrastructure all influenced intervention design and implementation.

Recommendations for Future Research and Studies in Thailand

Future research should extend follow-up periods to evaluate the long-term sustainability of behavior changes and the prevention of diabetes incidence. In addition, cost-effectiveness analyses are needed to provide robust evidence for decision-makers regarding the scalability of this model. Comparative studies across diverse community contexts, including rural and urban populations, would further clarify the adaptability and generalizability of the intervention.

Policy Recommendation

The positive outcomes of this program support its integration into Thailand's health system, particularly in rural and underserved areas where access to specialized diabetes care remains limited. Policymakers should prioritize investment in community-based DM coach training as a scalable and sustainable strategy for diabetes prevention. Embedding this approach within primary healthcare services, supported by ongoing research and monitoring, can strengthen national efforts to reduce the growing burden of diabetes and serve as a model for other resource-constrained settings.

Conclusions

This study has demonstrated that an integrated DM coach training program, combining lifestyle medicine and health literacy, effectively improved clinical outcomes, knowledge, and lifestyle practices among individuals with prediabetes in Thai communities. By building local coaching capacity, the program not only addressed immediate health needs but also established a sustainable community resource for ongoing diabetes prevention. These findings highlight the feasibility and impact of community-based approaches in reducing diabetes risk in resource-limited settings.

Additional Information

Acknowledgments: The author extends acknowledgment to the participants, community health workers, and healthcare providers who contributed to this research. Special recognition is given to the provincial health offices in Health Region 8 for their collaboration and support throughout the study period.

Ethics Approval: This study was reviewed and approved by the Health Promotion Center 8 Udon Thani Ethics Committee for Human Research (HPC08026 on 26 August 2024). All procedures involving human participants complied with institutional guidelines and followed ethical guidelines for human research.

Clinical Trial Consideration: This study does not report on a clinical trial.

Financial Support: This work was supported by the Promotion and Prevention Area-based (PPA) budget from the National Health Security Office (NHSO), Region 8, Udon Thani, Thailand (No. 68/B/00062, Kridsada Sirichaisit).

Conflict of Interest: The author declares no conflict of interest.

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References

1. Duan D, Kengne AP, Echouffo-Tcheugui JB. Screening for diabetes and prediabetes. *Endocrinol Metab Clin North Am.* 2021;50(3):369-385. doi:10.1016/j.ecl.2021.05.002
2. Echouffo-Tcheugui JB, Perreault L, Ji L, Dagogo-Jack S. Diagnosis and management of prediabetes: a review. *JAMA.* 2023;329(14):1206-1216. doi:10.1001/jama.2023.4063
3. International Diabetes Federation. Members; Diabetes in Thailand (2024). Accessed 29 September 2025. https://idf.org/our-network/regions-and-members/western-pacific/members/thailand
4. Aekplakorn W, Tantayotai V, Numsangkul S, et al. Detecting prediabetes and diabetes: agreement between fasting plasma glucose and oral glucose tolerance test in Thai adults. *J Diabetes Res.* 2015;2015:396505. doi:10.1155/2015/396505
5. Health Data Center, Ministry of Public Health. Standard Health Data Catalog for Non-Communicable Diseases (NCDs: DM, HT, CVD). Accessed 29 September 2025. https://hdc.moph.go.th/center/public/standard-subcatalog/b2b59e64c4e6c92d4b1ec16a599d882b
6. Galaviz KI, Weber MB, Suvada K BS, et al. Interventions for reversing prediabetes: a systematic review and meta-analysis. *Am J Prev Med.* 2022;62(4):614-625. doi:10.1016/j.amepre.2021.10.020
7. Sriyakun D, Lapbenjakul S, Srithamrongsawat S, Sornsrivichai V, Sriratanaban J, Kaewkamjornchai P. Effectiveness of lifestyle modification program on preventing type 2 diabetes among Thai adults with prediabetes. *J Health Syst Res.* 2024;18(1):72-92.
8. Delahanty LM, Nathan DM. Implications of the diabetes prevention program and look AHEAD clinical trials for lifestyle interventions. *J Am Diet Assoc.* 2008;108(4 Suppl 1):S66-S72. doi:10.1016/j.jada.2008.01.026

9. Rintamäki R, Rautio N, Peltonen M, et al. Long-term outcomes of lifestyle intervention to prevent type 2 diabetes in people at high risk in primary health care. *Prim Care Diabetes.* 2021;15(3):444-450. doi:10.1016/j.pcd.2021.03.002
10. Bharati R, Kovach KA, Bonnet JP, et al. Incorporating lifestyle medicine into primary care practice: perceptions and practices of family physicians. *Am J Lifestyle Med.* 2022;17(5):704-716. doi:10.1177/15598276211072506
11. Keyes D, Patel NI, Correa KA. Overview of Lifestyle Medicine. In: *StatPearls.* StatPearls Publishing. Update 4 February 2023. Accessed 29 September 2025. https://www.ncbi.nlm.nih.gov/books/NBK589672
12. Te Loo LM, Holla JFM, Vrijsen J, et al. Implementation barriers and facilitators for referral from the hospital to community-based lifestyle interventions from the perspective of lifestyle professionals: a qualitative study. *PLoS One.* 2024;19(6):e0304053. doi:10.1371/journal.pone.0304053
13. Meherali S, Punjani NS, Mevawala A. Health literacy interventions to improve health outcomes in low- and middle-income countries. *Health Lit Res Pract.* 2020;4(4):e251-e266. doi:10.3928/24748307-20201118-01
14. Chen S, Bai Q, Zhu J, Liu G. Impact of functional, communicative, critical and distributed health literacy on self-management behaviors in chronic disease patients across socioeconomic groups. *BMC Public Health.* 2025;25(1):1776. doi:10.1186/s12889-025-23003-9
15. Nutbeam D, Lloyd JE. Understanding and responding to health literacy as a social determinant of health. *Annu Rev Public Health.* 2021;42:159-173. doi:10.1146/annurev-publhealth-090419-102529
16. van der Gaag M, Heijmans M, Spoiala C, Rademakers J. The importance of health literacy for self-management: a scoping review of reviews. *Chronic Illn.* 2022;18(2):234-254. doi:10.1177/17423953211035472
17. Marciano L, Camerini AL, Schulz PJ. The role of health literacy in diabetes knowledge, self-care, and glycemic control: a meta-analysis. *J Gen Intern Med.* 2019;34(6):1007-1017. doi:10.1007/s11606-019-04832-y
18. Jitjaiyen A, Roojanavech S, Nimit-arnun N. The effects of a health literacy enhancement program on health literacy and preventive health behavior of prediabetes type 2 in a community in Samut Sakhon province. *J Royal Thai Army Nurses*. 2021;22(1):321-330.
19. Miller WR, Rollnick S. *Motivational Interviewing: Helping People Change*. 3rd ed. The Guilford Press; 2013.
20. Tuso P. Prediabetes and lifestyle modification: time to prevent a preventable disease. *Perm J.* 2014;18(3):88-93. doi:10.7812/TPP/14-002
21. Dove A, Wang J, Huang H, et al. Diabetes, prediabetes, and brain aging: the role of healthy lifestyle. *Diabetes Care*. 2024;47(10):1794-1802. doi:10.2337/dc24-0860
22. Molyoopanao N, Moolsart S, Tipkanjanaraykha K. The effectiveness of an exercise promoting program for prediabetic older adults in Mueang Loei district, Loei province. *J Royal Thai Army Nurses.* 2023;24(3):302-311.
23. Brinkmann C, Hof H, Gysan DB, et al. Lifestyle intervention reduces risk score for cardiovascular mortality in company employees with pre-diabetes or diabetes mellitus - a secondary analysis of the PreFord randomized controlled trial with 3 years of follow-up. *Front Endocrinol (Lausanne).* 2023;14:1106334. doi:10.3389/fendo.2023.1106334
24. Quesada O, Claggett B, Rodriguez F, et al. Associations of insulin resistance with systolic and diastolic blood pressure: a study from the HCHS/SOL. *Hypertension.* 2021;78(3):716-725. doi:10.1161/HYPERTENSIONAHA.120.16905
25. You FF, Zhong WF, Gao YN, et al. Age-specific in the relationship between diastolic blood pressure and the risk of cardiovascular disease: a cohort study of the UK Biobank. *Exp Gerontol.* 2024;198:112635. doi:10.1016/j.exger.2024.112635

26. Butayeva J, Ratan ZA, Downie S, Hosseinzadeh H. The impact of health literacy interventions on glycemic control and self-management outcomes among type 2 diabetes mellitus: a systematic review. *J Diabetes.* 2023;15(9):724-735. doi:10.1111/1753-0407.13436
27. Protheroe J, Rowlands G, Bartlam B, Levin-Zamir D. Health literacy, diabetes prevention, and self-management. *J Diabetes Res.* 2017;2017:1298315. doi:10.1155/2017/1298315
28. Ngamwong M, Utta S, Polbuppha A, Mudpha C, Jampa A. A synthesis of the behavioral change intervention in risky people to diabetes mellitus (DM). *The Office of Disease Prevention and Control 10th Journal.* 2019;17(1):56-71.