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Design and Development of a Community Health Bank Model to Enhance Body Composition and Quality of Life among Older Adults in Hat Yai Municipality, Songkhla Province

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Abstract

Thailand's transition to a super-aged society presents urban older adults with heightened risks of non-communicable diseases, inactivity, and reduced quality of life from environmental and social constraints. To develop and evaluate a Community Health Bank model's effect on body composition and quality of life among older adults in Hat Yai Municipality, Songkhla Province, this six-month participatory action research was conducted in the Na Rongrian Hat Yai Wittayalai Community. Forty participants (mean age 67.5 ± 3.18 years) completed baseline and follow-up assessments. The Community Health Bank comprised a seven-member committee, health point-based digital platform, monthly activities, environmental modifications, and 14 business partnerships. Outcomes (which were measured at the end of the research) included body composition (bioelectrical impedance analysis, InBody 970s) and quality of life (WHOQOL-BREF-THAI). Data were analyzed through Wilcoxon Signed-Rank Test and descriptive statistics. Data analysis revealed that platform usage reached 82.7% and regular exercise participation increased from 18% to 62%. Body weight decreased significantly (0.71 kg, $p < 0.05$); skeletal muscle mass and body fat showed favorable non-significant trends. Additionally, quality of life improved across all domains ($p < 0.001$): overall (+27.60 points), physical health (+7.96), psychological (+6.97), social relationships (+4.35), and environment (+7.83). The Community Health Bank effectively connected individual, community, and environmental health determinants. Its integration into municipal policy demonstrates scalability potential for health promotion in aging urban populations. These findings demonstrate that the Community Health Bank model offers a viable, community-driven approach to addressing health challenges in aging urban populations, with potential for adaptation and scaling in similar contexts.

Keywords: *Community Health Bank; body composition; quality of life; older adults; health promotion; urban community*

1. Introduction

Thailand has been classified as an 'aged society' with people aged 60 years and older accounting for 10% of the population. The proportion of older adults is expected to increase to 28%, making the country a 'super-aged society' by the next decade (World Health Organization, 2023). This shift has increased the burden of non-communicable diseases (NCDs), disability, and dependency that escalates with population longevity (World Health Organization, 2015). Urban older adults face particular challenges: fast-paced lifestyles, limited green spaces, and environments unsuitable for physical activity (Wornyardphan & Damrongplait, 2025). Consequently, many exhibit low activity levels, lack regular exercise, and face increased risks of sarcopenia, falls, and reduced quality of life (Green & Kreuter, 2005; World Health Organization, 2008).

Despite growing health challenges, healthcare systems continue emphasizing curative over preventive care, creating gaps between health needs and community support (Boonruangsak, 2022). Traditional approaches have proven insufficient for addressing complex health requirements of aging urban populations, particularly in rapidly transitioning middle-income countries.

1.1 Theoretical Framework

The Ottawa Charter for Health Promotion emphasizes that health is determined by social structures, public policies, environmental factors, and community empowerment, not solely individual behaviors (World Health Organization, 1986). Effective health promotion must link individual, community, and health service systems to enable sustainable behavior change (Green & Kreuter, 2005; Wallerstein et al., 2015; McLeroy et al., 1988). This ecological perspective recognizes multiple levels of influence: intrapersonal factors, interpersonal relationships, organizational structures, community contexts, and public policy (McLeroy et al., 1988).

Urban older adults face particular challenges, similar to patterns reported globally where digital exclusion and inadequate community infrastructure limit health engagement among older adults (Money et al., 2024). International studies also highlight the growing use of digital platforms and incentive-based systems to enhance participation in community health programs, although adoption varies widely across aging populations.

The social determinants framework underscores that addressing health challenges requires simultaneous intervention across behavioral, environmental, and social factors (World Health Organization, 2015; World Health Organization, 2008; McCool et al., 2022). This framework acknowledges the critical role of social, economic, and environmental conditions in shaping health outcomes beyond individual responsibility. However, translating this framework into actionable community interventions remains problematic. Systematic reviews indicate that few community-based programs successfully operationalize multi-level intervention strategies, with most defaulting to education and individual counseling due to resource limitations and implementation barriers (Han et al., 2025).

1.2 Local Context and Community Assessment

Na Rongrian Hat Yai Wittayalai Community in Hat Yai Municipality represents an urban mid-sized community with 262 households, 567 residents, and high proportions of pre-elderly and elderly individuals. Preliminary surveys revealed that 30.2% of residents had chronic NCDs and 68.1% experienced muscle and joint pain from insufficient physical activity.

Comprehensive needs assessment among residents aged 50+ years identified five critical gaps:

1. *Healthcare Service Limitations* The healthcare system focuses predominantly on treatment rather than prevention, resulting in limited health awareness among undiagnosed community members. This curative approach lacks early risk assessment and health literacy development, minimizing disease prevention consciousness.

2. *Fragmented Health Promotion Services* Health promotion consists of sporadic, project-based interventions lacking continuity, skill-building components, and systematic follow-up. This episodic approach fails to establish sustainable behaviors or lasting community capacity.

3. *Behavioral and Social Challenges* Urban pre-elderly and elderly residents exhibit high individualism with limited group cohesion. Absent social support networks and insufficient motivation contribute to low exercise participation and social isolation.

4. *Environmental Barriers* The community's location along major roads limits physical activity space, with inadequate and unsafe movement surfaces, creating significant exercise barriers, particularly for mobility-concerned older adults.

5. *Absent Local Health Leadership* The community lacks trained leaders capable of organizing, sustaining, and evaluating health initiatives. This leadership vacuum prevents community-driven programs and weakens ownership of health outcomes.

1.3 The Community Health Bank Innovation

Responding to the above identified gaps, we developed the Community Health Bank model as a social innovation for health promotion. This innovation uses motivational health points—participants earn points through wellness activities, exchangeable for health-related goods and services from partner stores. The innovation also integrates local leadership development with multi-sectoral partnerships including Hat Yai Municipality, Hat Yai Hospital, public health units, and local businesses, embedding health into daily life and the community economy.

The Community Health Bank model aligns with the social determinants' framework, recognizing that effective solutions require integrated intervention across behavioral, environmental, and structural dimensions (World Health Organization, 2015; World Health Organization, 2008; Yerrakalva et al., 2019). The model

addresses all three levels: individual behavior through point incentives, environmental modification through space improvements, and structural change through policy integration and multi-sectoral collaboration.

This study represents an innovative approach to community-based health promotion for the following characteristics:

- System level intervention: The model can bring about structural changes in community health infrastructure rather than focusing solely on individual behavior.
- Social entrepreneurship: The health point economy within the model can create sustainable incentive systems linking health behaviors to local economic benefits.
- Digital integration: The model can bridge traditional community with technology, enhancing accessibility and accountability.
- Scalability potential: The model can be adapted to various urban contexts facing similar demographic and health challenges.

Theaforesaid characteristics can contribute to the evidence-based project for community-driven health promotion in rapidly aging societies, particularly in resource-constrained middle-income countries requiring innovative, cost-effective approaches.

2. Objectives

This study aimed to:

1. Design and develop a health promotion mechanism through a Community Health Bank model in Hat Yai Municipality, Songkhla Province
2. Evaluate the system's effects on body composition and quality of life among older adults

3. Materials and Methods

3.1 Study Design

This six-month participatory action research (PAR) study (June-December 2024) was conducted as a community health service development initiative in collaboration with Hat Yai Municipality and Hat Yai Hospital, following ethical principles of beneficence, respect for persons, and justice. The study integrated Community Health Bank model development with active community participation throughout the situation analysis, design, implementation, and evaluation phases (Wallerstein et al., 2015). PAR's cyclical planning-action-observation-reflection process enabled iterative refinement based on community feedback while ensuring community ownership and sustainability.

3.2 Conceptual Framework

This study integrated three different health promotion interventions, as shown in Figure 1. These interventions were delineated below.

- Ottawa Charter Principles

This intervention considered community capacity development, public policy, environmental modification, and service adaptation as key factors in facilitating behavior change. The Community Health Bank model employed participatory approaches, involving residents in planning, decision-making, implementation, and evaluation (Wallerstein et al., 2015). This intervention occurred through identifying causes, designing interventions, extracting lessons, and modifying environments (McLeroy et al., 1988; Baker et al., 2015). Participatory design fostered positive relationships, generating motivation and momentum for successful development (Sujjanan, 2004; Kasemsuk, 2018).

- Social Mechanism and Behavioral Incentives

This intervention involves community participation. In this study, community participation was facilitated through the Community Health Bank system which links local stores, government agencies, and private partners. The system emphasized motivation through health points, driving sustained behavior changes for sustainable outcomes (Putnam, 2000; Thaler & Sunstein, 2008; Wornsrihiran & Jariya, 2022; Naruenatawattana, 2022). The platform functioned as both incentive system and social connector, strengthening community bonds while promoting health-seeking behaviors.

- Physical Therapist Role in Systems Change

This intervention expanded traditional hospital-based health promotion roles toward creating community health systems with shared ownership. This was achieved through connecting community members, healthcare facilities, local businesses, and agencies. It also aligns with ecological models emphasizing simultaneous program design at individual, community, and policy levels (Green & Kreuter, 2005; World Health Organization, 2008; McLeroy et al., 1988).

The conceptual framework recognized that sustainable behavior change requires addressing multiple levels of influence simultaneously. Individual motivation alone is insufficient without supportive networks, enabling environments, and reinforcing policies. The Community Health Bank was designed as a comprehensive system integrating behavioral economics, social capital, environmental modification, and policy engagement.

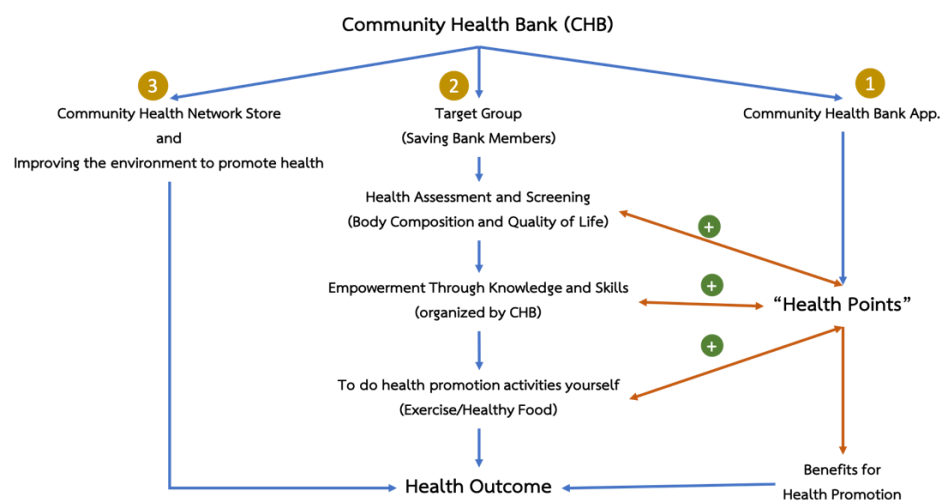


Figure 1 Conceptual Framework of the Community Health Bank System for Health Promotion among Older Adults

3.3 Study Setting

The study was conducted in the Na Rongrian Hat Yai Wittayalai Community, Hat Yai Municipality, Songkhla Province an urban mid-sized community with 262 households and 567 residents. Health surveillance revealed 30.2% of the residents had chronic NCDs and 68.1% reported musculoskeletal pain from insufficient physical activity. The setting presented typical challenges of rapidly urbanizing middle-income contexts: limited exercise facilities, restricted green spaces, and inadequate activity surfaces, balanced by proximity to healthcare services, established commercial networks, and digital connectivity that enables innovative health promotion mechanisms.

3.4 Study Population and Sampling

The target population consisted of pre-elderly adults (50-59 years) and older adults (≥ 60 years) who were permanent residents of the Na Rongrian Hat Yai Wittayalai Community. Including pre-elderly individuals recognized that health promotion is most effective before the onset of age-related functional decline and that this group faces urban lifestyle challenges similar to those of older adults.

Purposive sampling was employed to recruit the participants who met eligibility criteria designed to ensure safety while maximizing the potential for meaningful improvements. Sample size calculation was based on previous community-based intervention studies which examined quality of life changes in older adults. Assuming effect size of $d = 0.5$, $\alpha = 0.05$, and power = 0.80, the minimum required sample was calculated as 36 participants using paired comparison formula. Accounting for an anticipated 20% attrition over six months, the target recruitment was set at 45 participants.

Sample Size Calculation: $n = [(Z\alpha + Z\beta)^2 \times 2\sigma^2] / \delta^2$

Where:

$Z\alpha = 1.96$ (two-tailed $\alpha = 0.05$)

$Z\beta = 0.84$ (power = 0.80)
 $\sigma = 15$ (SD of quality-of-life score)
 $\delta = 10$ points (expected difference)
Minimum $n = 36$ participants

Recruitment began with community-wide information sessions organized in collaboration with community leaders and health volunteers. Sixty-seven community members expressed interest and registered during initial recruitment. Following screening, 50 participants met the eligibility criteria and provided informed consent for comprehensive health assessment. The remaining 17 either did not meet the eligibility criteria or chose to participate only in Community Health Bank activities without formal assessments.

Over six months, 40 participants completed both baseline and follow-up assessments, representing 80% retention. Ten participants discontinued due to relocation ($n = 3$), acute health conditions ($n = 2$), time constraints ($n = 4$), or lost interest ($n = 1$). Baseline characteristics comparison between completers and non-completers examined age, sex, health status, and socioeconomic indicators for attrition bias.

Inclusion criteria: age ≥ 50 years; permanent community residence; functional independence (Barthel Index = 20); cognitive capacity for consent. **Exclusion criteria:** severe cardiovascular conditions (NYHA class >2); musculoskeletal conditions contraindicating activity; mental health disorders affecting participation; functional dependency.

3.5 Intervention Development and Implementation

The Community Health Bank intervention was implemented through four sequential phases over six months (June–December 2024).

Phase 1 Preparation and Situation Analysis: The research team and community members worked together to (i) build a shared understanding of local health challenges through community forums; (ii) conduct comprehensive health and environmental assessments; (iii) establish a seven-member Community Health Bank committee; and (iv) develop community health guidelines which were accompanied by an annual action plan.

Phase 2 System Design and Capacity Building (Months 1-2): The participants underwent baseline health screening by Hat Yai Hospital professionals, including body composition analysis and quality of life assessment. The research team developed an integrated digital platform using LINE Official Account with eight functions: personal health dashboard, point tracking, activity registration, dietary planning, self-reporting, health screening, achievement certificates, and point redemption marketplace. Platform validation by three experts achieved the Index of Item-Objective Congruence of 0.86. The committee was trained in platform management, point verification, activity planning, partnership development, and quality implementation. Monthly educational curriculum covered age-appropriate exercise, nutrition, mental health, and chronic disease self-management.

Phase 3 Intervention and Implementation (Months 2–6): This phase focused on delivering the intervention through environmental modifications, including renovating exercise areas, establishing a community garden, and creating safe walking paths. The participants received individualized mobile application training for registration, activity logging, point accumulation, and point redemption. The committee organized monthly activities such as group exercise sessions, cooking demonstrations, gardening workshops, and well-being programs. The health point system rewarded participation in activities, self-reported health behaviors, screening attendance, and personal goal achievement, with points verified through photos, peer confirmation, device data, and random checks. Points could be redeemed for discounts, exercise equipment, health service vouchers, and community products. Monthly reflection forums were also held to review progress, address challenges, and celebrate achievements.

Phase 4 Evaluation and Synthesis (Month 6): The participants underwent repeat body composition measurements, quality of life assessments, and satisfaction surveys. Qualitative evaluation included three focus groups (8-10 participants each), in-depth interviews with committee members, participant observation, and document analysis. A community forum presented findings, interpreted results, developed sustainability strategies, and planned expansion.

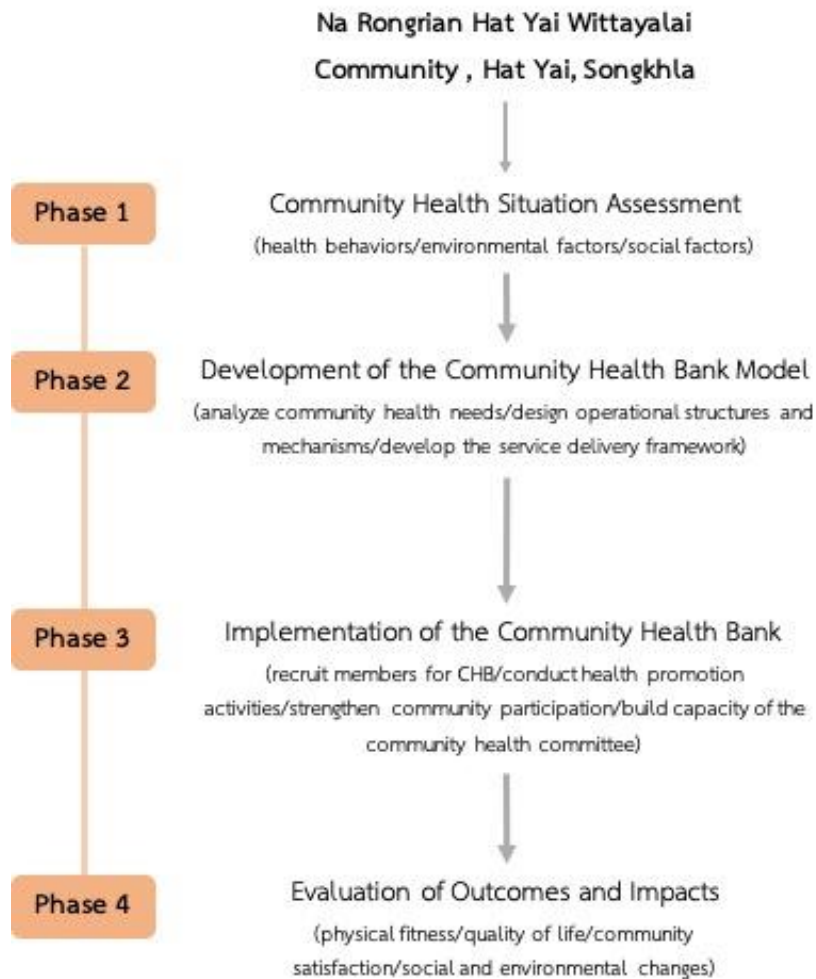


Figure 2 Participatory Action Research Process for Community Health Bank Development and Implementation

3.6 Measurement Instruments

For consistency purposes, pls consider revising the title of each phase in Figure 2 to be the same as the descriptions provided before this Figure. For example, you may revise Phase 1 Community Health Situation Assessment to Phase 1 Preparation and Situation Analysis. Measurements included body weight, skeletal muscle mass, body fat mass, percentage, and visceral fat level. The measurement protocol required two-hour fasting, bladder emptying, removing metal accessories, barefoot platform standing, holding hand electrodes with arms abducted, and remaining still during two-minute measurement. The InBody 970s demonstrates excellent test-retest reliability (ICC = 0.99) and a strong DEXA correlation for muscle mass ($r = 0.98$) and fat mass ($r = 0.97$) (American College of Sports Medicine, 2021).

The participants' quality of life was assessed through the World Health Organization Quality of Life Brief-Thai Version (WHOQOL-BREF-THAI), a 26-item instrument comprising four domains: physical health (7 items), psychological health (6 items), social relationships (3 items), and environment (8 items), plus two general items. Each item used 5-point Likert scales with domain scores transformed to 0-100 scale (higher scores = better quality of life). The instrument demonstrates strong psychometric properties in Thai populations (Cronbach's $\alpha = 0.84$) with concurrent validity of 0.65 (Kangwanrattanakul & Krägeloh, 2024).

A Platform Implementation Purpose-Designed questionnaire was used to assess six dimensions: committee structure/capacity, social mechanism functioning, health behavior change, environmental modifications, community learning/empowerment, and community pride/value. Each dimension contained 2-4

items with a rating scale from 1-5 (minimal to maximal impact). The platform's content validation achieved an IOC of 0.82.

Finally, a Physical Activity Self-reported Logbook was developed. The log categorized the participants into three groups: none (0 days/week), insufficient (1-2 days/week), or sufficient (≥ 3 days/week) based on ACSM guidelines (American College of Sports Medicine, 2021). The participants maintained health logbooks documenting daily exercise, dietary practices, screening attendance, and subjective well-being.

3.7 Data Collection Procedures

Quantitative Data Baseline assessments (Month 1) included demographic/health interviews, body composition measurements, WHOQOL-BREF-THAI administration, and activity behavior assessments. Follow-up assessments (Month 6) replicated baseline measures plus platform satisfaction survey. Quality assurance included trained research assistants following standardized protocols, consistent equipment and environmental conditions, and double data entry with discrepancy checking.

Qualitative Data Continuous collection included participant observation field notes, committee meeting minutes, monthly reflection forum recordings/transcripts, and platform usage analytics. Endpoint collection (Month 6) comprised three focus groups (audio-recorded, transcribed verbatim), in-depth committee interviews, and document review (action plans, partnership agreements). This comprehensive strategy enabled triangulation for rich contextual understanding.

3.8 Data Analysis

Continuous variables underwent normality testing using Shapiro-Wilk test with Q-Q plot inspection. Given non-normal distribution of quality-of-life variables (Shapiro-Wilk $p < 0.05$), Wilcoxon Signed-Rank Test was selected for baseline versus 6-month comparisons (two-tailed $\alpha = 0.05$). Effect sizes were calculated as $r = Z/\sqrt{N}$ with Cohen's interpretation: small ($r = 0.10$), medium ($r = 0.30$), and large ($r = 0.50$). Confidence intervals (95%) derived from paired t-tests were used to provide interval estimates despite non-parametric primary analysis.

Multiple comparisons across seven outcomes (weight, muscle mass, fat mass, and four quality-of-life domains) were reported using both unadjusted p-values ($\alpha = 0.05$) for exploratory interpretation and a Bonferroni-adjusted threshold ($\alpha = 0.007$) for conservative interpretation. Results considered both statistical significance and clinical meaningfulness.

Qualitative data underwent directed content analysis combining deductive coding based on conceptual framework with inductive coding for emerging themes. Analysis involved data familiarization, line-by-line coding, organizing codes into categories (individual, interpersonal, community, policy levels), theme development through pattern identification, and validation through member checking. Trustworthiness was enhanced through triangulation, thick description, audit trail maintenance, and reflexive journaling. Final analysis integrated quantitative and qualitative findings for comprehensive understanding of the interventions' effects and mechanisms.

4. Results

4.1 Participant Characteristics and Flow

A total of 67 community members registered for the Community Health Bank system during initial recruitment. Following eligibility screening and informed consent procedures, 50 participants enrolled in comprehensive health assessment. Over six months, 40 participants completed both baseline and follow-up assessments, yielding 80% retention. Ten participants discontinued due to relocation ($n = 3$), acute health conditions ($n = 2$), time constraints ($n = 4$), or lost interest ($n = 1$). Limited baseline data from withdrawals precluded formal statistical comparison between completers and non-completers; however, available registration records indicated no systematic differences in age or sex distribution.

The final analytical sample comprised 40 participants with mean age 67.5 ± 3.18 years (Table 1). The sample included 4 pre-elderly individuals (50–59 years) and 36 older adults (≥ 60 years), with 36 women (90%) and 4 men (10%). Baseline health profiles revealed substantial chronic disease burden: diabetes mellitus ($n = 9$, 22.5%), dyslipidemia ($n = 25$, 62.5%), hypertension ($n = 14$, 35%), and other chronic conditions ($n = 2$, 5%). Physical activity levels were suboptimal, with 20 participants (50%) reporting no regular exercise, 12 (30%)

exercising 1-2 days weekly, and only 8 (20%) meeting recommended guidelines of ≥ 3 days weekly. Most participants engaged in small business or trading occupations, reflecting the community's urban commercial character.

Table 1 Baseline Demographics, Health Characteristics, and Quality of Life of Participants (n = 40)

Characteristic	Value
Demographics	
Age (years), mean \pm SD	67.5 \pm 3.18
Age range (years)	50-75*
Age group, n (%)	
- Pre-elderly (50-59 years)	4 (10.0)
- Older adults (≥ 60 years)	36 (90.0)
Sex, n (%)	
- Male	4 (10.0)
- Female	36 (90.0)
Occupation, n (%)	
- Trading/small business	29 (72.5)
- Retired/unemployed	11 (27.5)
Health Status	
Chronic diseases, n (%)†	
- Diabetes mellitus	9 (22.5)
- Dyslipidemia	25 (62.5)
- Hypertension	14 (35.0)
- Other conditions	2 (5.0)
Physical Activity Level at Baseline, n (%)	
- No regular exercise	20 (50.0)
- Exercise 1-2 days/week	12 (30.0)
- Exercise 3-4 days/week	8 (20.0)
Body Composition at Baseline	
Weight (kg), mean \pm SD	59.76 \pm 9.63
Skeletal muscle mass (kg), mean \pm SD	22.01 \pm 0.44
Body fat mass (kg), mean \pm SD	19.62 \pm 0.91
Quality of Life at Baseline (WHOQOL-BREF-THAI)	
Overall QOL score, mean \pm SD	90.80 \pm 11.88
Physical health domain, mean \pm SD	25.30 \pm 3.52
Psychological health domain, mean \pm SD	20.03 \pm 2.74
Social relationships domain, mean \pm SD	10.38 \pm 1.63
Environment domain, mean \pm SD	24.60 \pm 5.43

*Note: Add actual age range based on collected data. †Participants may have multiple chronic conditions; percentages do not sum to 100%

4.2 Process Outcomes: Community Health Bank Development

The Community Health Bank successfully established structural mechanisms within the community over six months (summarized in Table 2). The seven-member committee, comprising community leaders, health-interested residents, and target population representatives, held monthly planning and monitoring meetings throughout the implementation and developed a comprehensive health plan specifying goals, indicators, and monthly activities. This organizational structure aligned with systems-level health promotion principles which emphasize integrated structure and process components (Green & Kreuter, 2005).

Table 2 Community Health Bank Implementation Outcomes

Indicator	Value
Organizational Structure	
Community Health Bank Committee members	7
Total registered members	67
Target participants enrolled in assessment	50
Participants completing 6-month follow-up	40 (80.0% retention)
Digital Platform Engagement	
Registered platform users	67
Active users (≥ 1 access/month)	43 (82.7% of target group)
Partnership Development	
Health-related partner businesses	14
Institutional partners (hospitals, health centers)	3
Activity Implementation	
Organized health promotion events (6 months)	24
Average participants per event	35 (range: 20-50)
Total health points distributed	45,280
Redemption transactions completed	187
Policy Integration	
Municipal policy adoption	Yes (included in 2027 plan)
Communities planned for expansion	3

The digital platform achieved substantial uptake, with 67 individuals registering, including 50 target participants and 17 family members recruited by the initial participants. Among registered users, 43 accessed the platform at least once a month, representing 82.7% active usage among the original 50 participants. This engagement rate demonstrated effective digital tool utilization by older adults when supported by adequate training and committee assistance. The platform's eight functions personal health dashboard, point tracking, activity registration, dietary planning, self-reporting, health screening, achievement certificates, and redemption marketplace facilitated systematic behavior monitoring and reinforcement.

Partnership development exceeded targets, with 14 local health-related businesses joining as Community Health Bank partners, including health food restaurants, sports equipment retailers, fitness facilities, and wellness providers. The intervention garnered institutional support from Hat Yai Municipality Public Health Service Centers and Hat Yai Hospital, providing integrated health consultation and screening programs. Notably, Hat Yai Municipality incorporated the Community Health Bank concept into its Local Public Health Development Project for fiscal year 2027, planning expansion to three additional communities; this incorporation demonstrates a successful transition from project-based intervention to policy-level integration.

Behavioral and social outcomes reflected substantial positive changes. Regular physical activity (≥ 3 days/week) increased from 18% at baseline to 62% post-intervention, indicating meaningful behavior change consistent with ACSM recommendations (American College of Sports Medicine, 2021). The Healthy Food Classroom and community garden enhanced the participants' nutritional knowledge and skills, with members reporting reduced sodium and sugar consumption while increasing vegetable intake. Social capital strengthened considerably, evidenced by increased group activity participation, neighbor exercise invitations, garden produce sharing, and community volunteering, reflecting growth in both bonding and bridging social capital (Putnam, 2000).

4.3 Body Composition Changes

Body composition analysis revealed selective improvements following intervention (Table 3). Body weight decreased significantly from 59.75 ± 9.63 kg to 59.05 ± 9.38 kg (mean difference -0.70 kg, 95% CI: -1.21 to -0.19 ; $Z = -2.325$, $p = 0.020$, $r = 0.37$), demonstrating medium effect size. Individual-level changes showed 22 participants (55.0%) experienced weight reduction, 5 (12.5%) maintained stable weight, and 13 (32.5%) gained weight. This finding remained significant at $\alpha=0.05$ but not after Bonferroni correction (adjusted $\alpha = 0.007$).

Skeletal muscle mass showed favorable trends, increasing from 22.01 ± 2.81 kg to 22.27 ± 2.87 kg (mean difference $+0.26$ kg, 95% CI: -0.03 to 0.56 ; $Z = -1.855$, $p = 0.063$, $r = 0.29$). Although not statistically significant, 21 participants (52.5%) gained muscle mass compared to 11 (27.5%) who experienced decreases. Body fat mass decreased from 19.62 ± 5.78 kg to 19.35 ± 5.99 kg (mean difference -0.26 kg, 95% CI: -0.67 to 0.14 ; $Z = -1.324$, $p = 0.185$, $r = 0.21$), with 20 participants (50.0%) showing fat reduction.

The pattern of significant weight loss combined with favorable muscle gain and fat loss trends suggests healthy body recomposition. Non-significant findings for muscle and fat mass likely reflect the six-month intervention period, modest sample size ($n = 40$), and moderate intensity appropriate for community-based health promotion. These results align with gradual, sustainable approaches to body composition improvement in older adults (Schumacher et al., 2020).

Table 3 Changes in Body Composition from Baseline to 6 Months ($n=40$)

Parameter	Baseline Mean \pm SD	6-Month Mean \pm SD	Mean Difference	95% CI*	Z†	p-value	Effect Size‡ (r)	Individual Changes (Decrease/No change/Increase)
Body weight (kg)	59.75 ± 9.63	59.05 ± 9.38	-0.70	$(-1.21, -0.19)$	-2.325	$0.020§$	0.37	22 (55.0%) / 5 (12.5%) / 13 (32.5%)
Skeletal muscle mass (kg)	22.01 ± 2.81	22.27 ± 2.87	$+0.27$	$(-0.03, 0.56)$	-1.855	0.063	0.29	11 (27.5%) / 8 (20.0%) / 21 (52.5%)
Body fat mass (kg)	19.62 ± 5.78	19.35 ± 5.99	-0.26	$(-0.67, 0.14)$	-1.324	0.185	0.21	20 (50.0%) / 5 (12.5%) / 15 (37.5%)

*95% Confidence Intervals derived from paired t-test to provide interval estimates

†Wilcoxon Signed-Rank Test (Z-statistics); primary analysis selected due to non-normal distribution of body weight data (Shapiro-Wilk $p < 0.05$)

‡Effect size $r = |Z|/\sqrt{N}$; interpretation: small (0.10), medium (0.30), large (0.50) per Cohen (1988)

§Statistically significant at $\alpha = 0.05$; does not remain significant with Bonferroni correction ($\alpha = 0.007$ for 7 total outcome comparisons)

4.4 Quality of Life Improvements

Quality of life assessments using WHOQOL-BREF-THAI revealed statistically significant and clinically meaningful improvements across all domains (Table 4). Overall, quality of life scores increased substantially from baseline mean 90.80 ± 11.88 to 118.40 ± 8.68 at six months, representing mean improvement of 27.60 points (95% CI: 24.32 – 30.88 ; $Z = -5.512$, $p < 0.001$, $r = 0.87$). This magnitude exceeded typical minimal clinically important difference thresholds with a very large effect size.

Domain-specific analyses demonstrated consistent large effects. Physical health domain scores increased from 25.30 ± 3.52 to 33.20 ± 2.37 (mean difference 7.90 points, 95% CI: 6.81 – 8.99 ; $Z = -5.451$, $p < 0.001$, $r = 0.86$). Psychological health improved from 20.03 ± 2.74 to 27.00 ± 2.53 (mean difference 6.97 points, 95% CI: 5.93 – 8.02 ; $Z = -5.383$, $p < 0.001$, $r = 0.85$). Social relationships domain showed substantial gains from 10.38 ± 1.63 to 14.73 ± 0.91 (mean difference 4.35 points, 95% CI: 3.82 – 4.88 ; $Z = -5.475$, $p < 0.001$, $r = 0.87$). Environmental domain advanced from 24.60 ± 5.43 to 32.43 ± 4.62 (mean difference 7.83 points, 95% CI: 5.84 – 9.81 ; $Z = -4.906$, $p < 0.001$, $r = 0.78$).

All quality-of-life improvements remained statistically significant after Bonferroni correction (adjusted $\alpha=0.007$), with all effect sizes exceeding a large effect threshold ($r>0.50$), indicating robust and clinically meaningful improvements across all well-being domains.

Table 4 Changes in Quality-of-Life Domains from Baseline to 6 Months (n = 40)

Domain	Baseline Mean \pm SD	6-Month Mean \pm SD	Mean Difference (95% CI)*	Z†	p-value	Effect Size (r)‡
Physical health	25.30 \pm 3.52	33.20 \pm 2.37	+7.90 (6.81, 8.99)	-5.451	<.001	0.86
Psychological health	20.03 \pm 2.74	27.00 \pm 2.53	+6.98 (5.93, 8.02)	-5.383	<.001	0.85
Social relationships	10.38 \pm 1.63	14.73 \pm 0.91	+4.35 (3.82, 4.88)	-5.475	<.001	0.87
Environment	24.60 \pm 5.43	32.43 \pm 4.62	+7.83 (5.84, 9.81)	-4.906	<.001	0.78
Overall QOL score	90.80 \pm 11.88	118.40 \pm 8.68	+27.60 (24.32, 30.88)	-5.512	<.001	0.87

*95% Confidence Intervals derived from paired t-test †Wilcoxon Signed-Rank Test (Z-statistic); primary analysis given non-normal distribution ‡Effect size $r = |Z|/\sqrt{N}$; interpretation: small (0.10), medium (0.30), large (0.50) All differences were deemed statistically significant at $\alpha = 0.05$; remain significant with Bonferroni correction ($\alpha = 0.007$ for 7 comparisons)
CI, confidence interval; QOL, quality of life; SD, standard deviation

4.5 Community Health Bank Platform Implementation Assessment

Systematic evaluation revealed strong performance across six dimensions (Table 5).

Committee effectiveness: 66.7% rated committee structure as maximally effective, with all members reporting high-to-maximum platform usage (80% high/maximum) and active participation (100% high/maximum).

Social mechanisms: The health point system substantially enhanced motivation (93.4% high/maximum), social cohesion (100% high/maximum), self-worth (100% high/maximum), and mutual support behaviors (100% high/maximum), with 60-73.3% reporting maximal impact across these domains.

Health behaviors: All participants reported improved exercise frequency (60% maximal), healthy eating (53.3% maximal), and overall health commitment (60% maximal), with remaining participants reporting high improvements.

Environmental modifications: The participants widely recognized improvements in health spaces (100% high/maximum), partner business expansion (78.6% high/maximum), and community cleanliness/safety (100% high/maximum).

Community empowerment: Strong gains were observed in self-care knowledge (100% high/maximum), happiness/life satisfaction (100% high/maximum), community pride (53.3% maximal), and perceived health improvements (100% high/maximum). System satisfaction was exceptionally high (86.7% maximal).

Table 5 Community Health Bank Platform Performance Assessment (n = 40)

Dimension / Item	Rating Level, n (%)				
	Minimal (1)	Low (2)	Moderate (3)	High (4)	Maximal (5)
1. Committee Structure					
Committee strength/effectiveness	0 (0)	0 (0)	0 (0)	10 (33.3)	20 (66.7)
Platform usage by committee	0 (0)	0 (0)	6 (20.0)	14 (46.7)	10 (33.3)
Member participation	0 (0)	0 (0)	0 (0)	14 (46.7)	16 (53.3)
2. Social Mechanisms					
Health points motivational impact	0 (0)	0 (0)	2 (6.7)	14 (46.7)	14 (46.7)
Social cohesion strengthening	0 (0)	0 (0)	0 (0)	12 (40.0)	18 (60.0)
Enhanced self-worth/dignity	0 (0)	0 (0)	0 (0)	10 (33.3)	20 (66.7)
Mutual support behaviors	0 (0)	0 (0)	0 (0)	8 (26.7)	22 (73.3)
3. Health Behavior Change					
Exercise frequency increase	0 (0)	0 (0)	0 (0)	16 (40.0)	24 (60.0)
Healthy eating improvement	0 (0)	0 (0)	0 (0)	19 (47.5)	21 (52.5)
Health behavior commitment	0 (0)	0 (0)	0 (0)	16 (40.0)	24 (60.0)
4. Environmental Modifications					
Health space development	0 (0)	0 (0)	0 (0)	22 (73.3)	8 (26.7)
Partner business expansion	0 (0)	0 (0)	6 (21.4)	12 (42.9)	10 (35.7)
Community cleanliness/safety	0 (0)	0 (0)	0 (0)	12 (40.0)	18 (60.0)

Table 5 Cont.

Dimension / Item	Rating Level, n (%)				
	Minimal (1)	Low (2)	Moderate (3)	High (4)	Maximal (5)
5. Learning & Empowerment					
Self-care knowledge gain	0 (0)	0 (0)	0 (0)	10 (33.3)	20 (66.7)
Life satisfaction/happiness	0 (0)	0 (0)	0 (0)	10 (33.3)	20 (66.7)
6. Community Pride & Value					
Community pride	0 (0)	0 (0)	0 (0)	14 (46.7)	16 (53.3)
Satisfaction with CHB system	0 (0)	0 (0)	0 (0)	4 (13.3)	26 (86.7)
Perceived health improvement	0 (0)	0 (0)	0 (0)	10 (33.3)	20 (66.7)

CHB, Community Health Bank

Note: Some percentages were calculated from varying denominators based on respondent applicability **Interpretation:** Higher ratings (4-5) indicate strong positive perceptions across all dimensions

Rationale: Provides detailed breakdown of platform satisfaction and perceived impacts across multiple dimensions.

4.6 Qualitative Findings: Mechanisms of Change

Focus group discussions and interviews revealed four key themes explaining intervention success (Figure 3). First, the health point system created tangible value for health behaviors, with the participants describing points as "making (good) health feel like an achievement" and providing "immediate rewards for good choices." Second, committee leadership fostered community ownership, with members noting "our own people understanding our needs" and "trusted neighbors showing the way." Third, digital platform accessibility surprised the participants, who reported "easier than expected" usage and appreciated "seeing progress on my phone." Fourth, multi-level integration connecting individual actions, community activities, and municipal support created comprehensive change environment, as supported by the participant's feedback of "health becoming part of daily community life."



Figure 3 Community Health Bank Digital Platform Interface and Health Point Economy

These qualitative findings triangulated with quantitative outcomes, confirming that the Community Health Bank functioned as an effective social mechanism linking individual behavior change, community social capital, and environmental modifications; all of which are consistent with ecological health promotion models (McLeroy et al., 1988; World Health Organization, 2015).

5. Discussion

This participatory action research study successfully developed and implemented a Community Health Bank system as a novel social mechanism for health promotion among older adults in an urban Thai community. The intervention achieved significant improvements in body weight (mean reduction 0.71 kg, $p < 0.05$) and dramatic enhancements across all quality-of-life domains (overall mean increase 27.60 points, $p < 0.001$), while establishing sustainable community structures including a functioning committee, digital platform with 82.7% active usage, and partnerships with 14 local businesses. These findings demonstrate that community-driven health promotion systems integrating behavioral incentives, social connectivity, and environmental modifications can generate meaningful health improvements in aging urban populations.

5.1 Community Health Bank as a Social Mechanism

The Community Health Bank functioned effectively as a "social mechanism" connecting the individual, community, and the health system levels, consistent with the socio-ecological models of health promotion (McLeroy et al., 1988; World Health Organization, 2015). These models emphasize the reciprocal relationships between individuals and their physical and social environments. The establishment of a seven-member committee comprising community leaders and engaged residents created an organizational structure with clear ownership, decision-making authority, and accountability. This finding aligns with research demonstrating that empowering community leaders, supporting collective commitment, and enabling sustained community action enhance health promotion outcomes (Kotthong, 2017; Naina, 2000). Similarly, Phrompanjai (2018) emphasized that community leaders are critical for health, social, economic, and political development because they command trust and followership from community members, making them essential catalysts for effective community mobilization.

The health point incentive system operated as a practical application of motivational theory and social support theory, where social reinforcement serves as a critical driver of behavior change through positive interpersonal interactions affecting both physical and psychological well-being (Yerrakalva et al., 2019). This mechanism proved particularly effective in our study, with 93.4% of the participants reporting high or maximal motivational impact from the point system. These findings mirror the work by Worasirirun and Jariya (2022), who demonstrated that motivation enhancement programs combined with social support significantly improved disease prevention behaviors among diabetic patients in Phitsanulok Province. In the aforesaid study, there was an increase in perceived disease severity, risk awareness, self-efficacy, outcome expectations, and preventive behaviors, compared to control groups. Similarly, Naruenatwatthana (2022) applied social support theory to stress management among university students through emotional support, appraisal support, informational support, and instrumental support, and found that the students' psychological stability and stress coping efficacy were significantly improved.

The Community Health Bank Committee's role as "community health coaches" enabled ordinary citizens to become health change leaders, enhancing social capital across both bonding dimensions (trust, cooperation within the community) and bridging dimensions (connections to external resources). This transformation exemplifies community empowerment as conceptualized by Wallerstein et al. (2015) and social capital theory as articulated by Putnam (2000). Our observation that previously isolated older adults began participating in group activities, inviting neighbors to exercise, sharing garden produce, and volunteering demonstrates concrete manifestations of increased social capital. This finding resonates with research by Ratchatawan et al. (2018) who reported that community participation in problem identification, implementation processes, and evaluation enables projects to achieve objectives and sustainability. However, the long-term sustainability of committee-based governance requires attention to succession planning, ongoing training, and mechanisms to prevent volunteer burnout, which should be monitored in future implementations.

The Community Health Bank system was comprehensively designed to address four dimensions of health determinants physical health, mental and social health, physical environment, and economic factors through integrated activities including exercise, mental health support, environmental improvements, and health point-

based economic benefits. This design aligns with the World Health Organization's social determinants of health framework, which emphasizes that health promotion must extend beyond clinical dimensions (Swinburn et al., 1999; World Health Organization, 2015). This holistic approach contributed to improvements across all quality-of-life domains and immensely supports the arguments that good health requires consideration of factors beyond individual characteristics, particularly social and environmental determinants, and that health promotion principles and social determinants of health are intrinsically linked with the shared goal of population well-being.

The integration of the Community Health Bank system concept into Hat Yai Municipality's Local Public Health Development Project for 2027 represents a successful transition from a project-level intervention to the policy-level integration. This policy adoption demonstrates progression along the continuum described in the Ottawa Charter which emphasizes the creation of healthy public policy (World Health Organization, 1986) and suggests the potential for sustained impact beyond the initial research period as well as scalability to additional communities.

5.3 Body Composition Outcomes and Physical Activity Changes

The statistically significant reduction in mean body weight of 0.71 kilograms over six months, while modest in absolute terms, represents a clinically meaningful trend given the study population and intervention intensity. The finding that 22 of 40 participants experienced weight loss while only 13 gained weight indicates that the intervention successfully shifted the overall trajectory toward healthier body composition for the majority of the participants. This outcome is particularly noteworthy considering that weight management in older adults requires careful balance between reducing excess adiposity and preserving lean muscle mass to prevent sarcopenia.

The non-significant trends toward increased skeletal muscle mass (mean increase 0.27 kg) and reduced fat mass (mean decrease 0.27 kg), while not achieving statistical significance, demonstrate favorable directions of change. The absence of statistical significance likely reflects multiple factors including the relatively brief six-month intervention period, modest sample size of 40 participants yielding limited statistical power for detecting small effect sizes, and the nature of community-based exercise programs which typically involve moderate-intensity activities rather than the high-intensity progressive resistance training protocols which are proved to produce rapid muscle hypertrophy. According to the American College of Sports Medicine guidelines, substantial muscle mass gains in older adults require structured resistance training at 70-80% of one-repetition maximum performed two to three times weekly for several months to years (American College of Sports Medicine, 2021). Our community-based intervention emphasized accessibility and sustainability over intensity, prioritizing activities that older adults could maintain independently rather than supervised high-intensity protocols.

Research by Løe and colleagues (1993) supports our findings, demonstrating that consistent physical activity can facilitate weight reduction independent of daily activity intensity levels (Worasirun & Jariya, 2022). Additionally, Thaler and colleagues found that regular resistance exercise and consistent movement reduce risks of non-communicable diseases and falls in older adults (Thaler & Sunstein, 2008). The dramatic increase in regular exercise participation from 18% at baseline to 62% at six months represents the intervention's most substantial behavioral achievement, as establishing regular physical activity patterns creates a foundation for continued health improvements extending beyond the study period.

Beyond quantitative body composition changes, the Community Health Bank system enhanced health literacy among the participants; this is evident in behavioral modifications toward healthier eating, increased health awareness, and proactive health management. Health literacy directly correlates with health behaviors, as demonstrated by Chamnankit et al. (2022), who found that health literacy positively predicted health behaviors and emphasized developing leadership health literacy before implementing interventions as a pathway toward healthy communities. The health literacy development through the "Healthy Food Classroom," community vegetable garden, and peer learning represent a sustainable capacity built within the community that will continue yielding benefits after formal research activities conclude (Saichamchan et al., 2021; Suwannakhot, 2025).

5.4 Quality of Life Transformations

The comprehensive improvements in the quality of life across all four domains physical health (mean increase 7.96 points), psychological health (6.97 points), social relationships (4.35 points), and environment (7.83 points), with all $p < 0.001$ demonstrate that the Community Health Bank system generated holistic well-being

enhancements, extending far beyond isolated physical health metrics. The overall quality of life improvement of 27.60 points represents approximately a 30% increase from baseline, substantially exceeding minimal clinically important difference thresholds and indicating transformative rather than merely incremental changes in the participants' lived experiences.

These comprehensive quality of life improvements reflect the Community Health Bank's multi-level intervention strategy operating simultaneously at individual, social, and environmental levels, which is consistent with the World Health Organization's social determinants of health framework (World Health Organization, 2015; World Health Organization, 2008). At the individual level, empowerment and behavior change interventions including monthly exercise activities, nutrition education, and health tracking through the digital platform promoted positive health behaviors and self-efficacy. The significant gains in physical and psychological health domain scores validate this individual-level impact, aligning with Ottawa Charter principles which emphasize personal skill development (World Health Organization, 1986) and the American College of Sports Medicine guidelines which state that consistent exercise enhances physical functioning and reduces chronic disease risk in older adults (American College of Sports Medicine, 2021).

At the social level, the formation of the Community Health Bank Committee, group-based activities, and peer support mechanisms fostered trust, bonding, and sense of community ownership. The dramatic 4.35-point improvement in social relationships domain scores provides quantitative evidence of strengthened social capital, which is consistent with Putnam's theory that community relationships and social participation enhance quality of life and happiness among older adults (Putnam, 2000) and Wallerstein et al. (2015) emphasis on community empowerment as fundamental to sustainable well-being (Wallerstein et al., 2015). The transformation of previously isolated older adults into active community participants who organized group exercise, shared resources, and did volunteer activities reflects concrete manifestations of enhanced social capital, bridging individual and collective well-being.

At the environmental level, physical space improvements including renovated exercise areas, community vegetable gardens, and safe walking paths, combined with expanded access to health resources through 14 partner businesses, created a supportive ecosystem, enabling healthy behaviors. The 7.83-point improvement in environment domain scores validates that the participants perceived tangible enhancements in their living conditions, physical safety, and resource access. This finding aligns with ecological models articulated by McLeroy and colleagues, emphasizing that physical and social environments directly influence health behaviors and quality of life (McLeroy et al., 1988).

The health point incentive mechanism operated as a "nudge", facilitating positive health decisions without coercion, and aligning with behavioral economics principles described by Thaler and Sunstein (Thaler & Sunstein, 2008). The high satisfaction rates with the point system (86.7% reporting maximal satisfaction) and its perceived motivational impact (93.4% reporting high or maximal impact) suggest that integrating economic incentives with health behaviors creates sustainable engagement. This approach aligns with Thai research demonstrating that social support combined with motivation can effectively enhance health behaviors (Sujjanan, 2004; Naina, 2000).

The consistency and magnitude of quality-of-life improvements across all domains suggest that the Community Health Bank system successfully created synergistic effects where improvements in one area reinforced gains in others. Enhanced physical functioning enabled greater social participation, which in turn strengthened psychological well-being and motivation for continued health behaviors, creating positive feedback loops characteristic of successful community-based interventions.

5.5 Digital Platform as an Enabling Tool

The 82.7% active monthly usage rate of the Community Health Bank digital platform among older adults challenges common assumptions about technology adoption barriers in this demographic. This high engagement rate demonstrates that when digital tools are designed with user-centered principles, provide tangible benefits through the point system, and are supported by adequate training and ongoing assistance from the committee members, older adults can effectively integrate technology into health management practices. The platform served multiple functions beyond simple activity tracking, operating as a communication hub connecting the participants together, a learning resource providing health information, a recognition system validating achievements, and a marketplace linking health behaviors to economic rewards.

The digital platform's success in this study contrasts with many technology-based health interventions that suffer from declining engagement over time. Several design features are likely to contribute to sustained usage. These features include an integration with the familiar LINE messaging application already used by many participants; simple interface with large buttons and clear navigation which are appropriate for users with limited digital literacy; immediate feedback through automatic point calculation, reinforcing behavior-reward connections, social features which enable the participants to view community activities, and achievements which foster healthy competition and mutual encouragement. Additionally, the committee's role in providing technical support and troubleshooting prevented technology barriers from becoming participation barriers.

5.6 Sustainability and Scalability Considerations

The incorporation of the Community Health Bank model into Hat Yai Municipality's official public health development plan represents a critical transition from research project to institutionalized program, addressing a common limitation of community-based interventions that often end when external funding ceases. This integration provides several sustainability advantages including dedicated budget allocation from municipal resources, formal recognition within local government structures which enhances legitimacy and access to additional resources, potential for systematic expansion to multiple communities with coordinated support, and continuity of services independent of research team involvement.

However, several challenges to long-term sustainability warrant attention. The health point economy requires ongoing participation from partner businesses, which depends on perceiving benefits such as increased customer traffic, positive community relations, and corporate social responsibility recognition. As the initial novelty of the system diminishes, maintaining business engagement may require formalized agreements, periodic renegotiation of incentive structures, and active relationship management by the committee. The digital platform necessitates technical maintenance, updates, and troubleshooting support, creating dependency on either ongoing technical expertise within the community or external support arrangements. Committee member turnover represents another sustainability risk, as the current committee possesses accumulated knowledge, relationships, and operational expertise that may be difficult to transfer to successors without deliberate capacity building and succession planning.

Scalability to other urban communities appears feasible given the intervention's relatively modest resource requirements and reliance on existing community structures and commercial partnerships. The model's core components including committee formation, digital platform deployment, partnership development, and activity programming do not require specialized infrastructure or highly technical expertise, making adaptation to diverse contexts realistic. However, successful replication will require attention to local context including community readiness and existing social cohesion, which can affect the ease of committee formation and member engagement; the commercial environment and density of potential partner businesses; digital infrastructure and internet connectivity that enable platform accessibility; and municipal government support and willingness to integrate the model into local health policies.

5.7 Implications for Practice and Policy

The study's findings suggest several practical implications for community health promotion programs. First, the Community Health Bank model demonstrates that digitally-enabled, incentive-based systems can effectively engage older adults in sustained health behaviors when designed with appropriate user support. Health promotion practitioners should consider incorporating behavioral economics principles through point systems, gamification, or other reward structures that provide immediate reinforcement for positive behaviors. Second, the critical role of local leadership highlights the importance of investing in community capacity building rather than relying solely on external health professionals to deliver interventions. Training and empowering community health coaches or champions creates sustainable infrastructure that persists after initial project funding ends.

Third, the success of multi-sectoral partnerships involving local businesses, healthcare facilities, and municipal government illustrates the value of health-in-all-policies approaches that embed health promotion within broader community economic and social systems, rather than isolating health as a separate domain. Practitioners should actively cultivate partnerships across sectors, framing health promotion as mutually beneficial rather than charity or corporate social responsibility. Fourth, the comprehensive quality of life improvements across physical, psychological, social, and environmental domains underscore the importance of holistic

interventions that address multiple determinants of health simultaneously, rather than narrow disease-specific programs.

For policymakers, this research demonstrates that community-based social innovations can complement facility-based healthcare services by addressing upstream determinants of health and preventing disease onset rather than solely managing established conditions. Municipal and provincial governments should consider allocating resources to support community health systems development, potentially yielding long-term cost savings through reduced healthcare utilization. The successful policy integration in Hat Yai Municipality provides a model for institutionalizing evidence-based community programs within local government structures. Policies that enable health promotion organizations to partner with commercial establishments through tax incentives, recognition programs, or simplified regulatory procedures could facilitate the expansion of health point economies and similar innovations.

As physical therapists and public health professionals affiliated with Hat Yai Hospital, our professional backgrounds and institutional affiliations likely influenced both the community's engagement with the program and our interpretation of outcomes. Our clinical perspective may have emphasized biomedical indicators (body composition) over social dimensions of health, potentially shaping how we measured success. The positive relationship we developed with community leaders may have created social desirability bias in qualitative responses. Our assumption that digital platforms would be readily adopted required adjustment when we encountered technology literacy barriers. Future implementations should consider more diverse research teams and explicit mechanisms to challenge researcher assumptions throughout the PAR cycles.

Alternative theoretical frameworks could interpret our intervention differently. From a behavioral economics perspective, critics might question whether extrinsic rewards (health points) could undermine intrinsic motivation for healthy behaviors, though evidence on this 'crowding-out effect' in health contexts remains mixed. Community-based participatory research literature highlights various governance models—our top-down committee structure contrasts with horizontal, consensus-based approaches that may foster different forms of empowerment. Digital divide scholars might critique our technology-centered approach as potentially excluding the most vulnerable older adults. These alternative perspectives remind us that no single model is universally applicable, and adaptations must consider local power dynamics, cultural values, and resource constraints.

5.8 Limitations

The one-group pre-post design limits our ability to establish definitive causal relationships between the intervention and outcomes, as we cannot rule out the influence of external factors or temporal trends. Future studies should consider comparison groups or quasi-experimental designs to strengthen causal inference. However, the PAR approach was essential for ensuring community ownership, iterative refinement, and the co-creation process fundamental to developing a sustainable community-driven system.

5.9 Recommendations for Future Research

Future research should address this study's limitations and extend understanding of community-based health promotion mechanisms. Randomized controlled trials comparing the Community Health Bank model to standard care or alternative interventions would provide stronger causal evidence and enable comparative effectiveness assessment. Studies with longer follow-up periods of two to three years or more could evaluate sustained behavior change, long-term health outcomes, including disease incidence and healthcare utilization, as well as intervention durability after active support concludes. Larger multi-site studies across diverse communities varying in urbanization, socioeconomic status, and cultural contexts would establish generalizability and identify contextual factors moderating intervention effectiveness.

Economic evaluations concerning cost-effectiveness and cost-utility analyses would inform resource allocation decisions and policy prioritization by estimating the investment required per quality-adjusted life year gained. Process evaluations employing implementation science frameworks could systematically identify barriers and facilitators to adoption, fidelity of implementation across different settings, and mechanisms linking intervention components to outcomes. Studies examining dose-response relationships between participation intensity, duration, or specific activity types and health outcomes could optimize intervention design and targeting. Research investigating the Community Health Bank model's applicability to other populations including working-

age adults, individuals with specific chronic diseases such as diabetes or hypertension, or rural communities would expand evidence for broader health promotion applications.

Mechanistic studies using causal mediation analysis could quantify the extent to which improvements in quality of life are mediated through enhanced physical functioning, increased social capital, improved mental health, or environmental modifications, clarifying pathways through which the intervention operates. Studies examining the sustainability of community health committees, business partnerships, and digital platforms beyond research project timelines would provide critical evidence about long-term viability. Finally, research comparing digital versus non-digital implementation models could determine whether the platform is essential to effectiveness or whether simpler paper-based systems could achieve comparable results in settings with limited technological infrastructure.

6. Conclusion

This participatory action research developed and evaluated a Community Health Bank model for health promotion among 40 urban older adults in Songkhla Province, Thailand. The six-month intervention achieved significant quality of life improvements across all domains (+27.60 points, $p < 0.001$), modest weight reduction (0.71 kg, $p < 0.05$), and increased regular exercise participation from 18% to 62%. The intervention established sustainable infrastructure including a seven-member committee, digital platform with 82.7% active usage, and 14 business partnerships. The Community Health Bank model integrated behavioral economics (point incentives), social capital development (committee leadership and peer networks), environmental modifications (exercise spaces and gardens), and policy engagement (municipal adoption). This system-level approach addressed individual, community, and structural determinants simultaneously, demonstrating how embedding health promotion within local social and economic structures creates sustainable change. These findings demonstrate that community-driven health systems emphasizing local ownership, multi-sectoral partnerships, and digital enablement can generate holistic well-being improvements in aging urban populations while creating sustainable structures that persist beyond initial research funding.

Hat Yai Municipality's adoption of the model into its 2027 health development plan, with planned expansion to three additional communities, demonstrates successful transition from research project to institutionalized program. Scalability to diverse urban settings appears feasible given modest resource requirements, though successful replication requires community readiness, commercial partners, digital infrastructure, and sustained municipal support.

Study limitations include single-group pre-post design precluding causal inference, modest sample size ($n = 40$), and brief six-month duration limiting assessment of sustained effects. Future research should employ randomized controlled designs with longer follow-up (2-3 years), conduct economic evaluations, examine implementation across diverse settings, and investigate mechanisms linking intervention components to outcomes through mediation analysis.

The Community Health Bank model represents a viable, scalable model for community-based health promotion, addressing complex health challenges of aging urban populations. By embedding health promotion within community structures, local economies, and municipal policies, this approach offers a sustainable pathway toward healthy aging in rapidly urbanizing middle-income countries facing demographic transitions and rising non-communicable disease burdens.

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