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Original Article

Development of Care Guidelines for Type 2 Diabetes Remission and Prevention of Recurrence in the Mueang District Health Service Network, Surat Thani, Thailand

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Abstract

Background: Achieving type 2 diabetes remission has emerged as a critical therapeutic goal, shifting the focus from mere disease control to reversing the condition. Although remission is clinically achievable through intensive lifestyle modification, the success rates in routine primary care remain low. A significant gap exists regarding context-specific care guidelines suitable for urban health service networks, where socioeconomic constraints make sustaining behavioral changes particularly challenging.

Objectives: To investigate the current situation and barriers to diabetes remission, develop context-specific care guidelines, and evaluate their effectiveness in terms of clinical outcomes and patient satisfaction.

Methods: This study used an action research design conducted in 3 phases. Phase 1 involved a detailed situational assessment of diabetes-related issues within the target population. In Phase 2 practice guidelines were developed by identifying specific areas requiring attention based on Phase 1 findings. Phase 3 evaluated the guidelines by measuring clinical outcomes and patient satisfaction. Participants included 124 medical records and 10 key stakeholders for the situational analysis (Phase 1) and 12 pilot patients for the implementation phase (Phase 2). Instruments included medical record recording forms, semi-structured interview guidelines, clinical follow-up records, and a questionnaire on patient satisfaction.

Results: The situational analysis in Phase 1 identified major diabetes-related challenges, specifically time constraints due to urban employment and a lack of family support, alongside distinct gaps in existing care protocols. Consequently, context-specific guidelines featuring digital monitoring and community support were developed. The implementation of these guidelines demonstrated their effectiveness in practice. Repeated-measures analysis of variance revealed significant reductions in body weight (F = 23.65, P < .001) and finger-prick glucose (F = 21.95, P < .001). Additionally, hemoglobin A_{1c} levels significantly decreased (mean difference = 0.78, P < .001), and patient satisfaction significantly increased (P = .046). Based on these findings, urban health networks should integrate flexible digital tools and community-based support systems to overcome socioeconomic barriers and effectively promote diabetes remission.

Conclusions: This study demonstrates a coherent action research process where context-specific interventions effectively address identified urban barriers, leading to successful outcomes of diabetes remission.

Keywords: Care guidelines, Diabetes remission, Clinical outcomes, Urban health service

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Introduction

Type 2 diabetes mellitus (T2DM) remains a critical global health challenge, imposing a substantial burden on healthcare systems and on individual quality of life. The pathophysiology of diabetes involves reversible β-cell dysfunction, often driven by excess body fat.[1, 2] In Thailand, the prevalence of diabetes continues to rise, necessitating effective management strategies to mitigate long-term complications.[3] Traditionally, diabetes management has focused primarily on glycemic control to prevent complications; however, recent global and national standards have shifted the paradigm toward diabetes remission as an achievable and superior clinical goal.[4, 5]

According to the consensus report by the American Diabetes Association (ADA) and international experts, diabetes remission is defined as maintaining a hemoglobin A_{1c} (HbA_{1c}) level < 6.5% for at least 3 months without the use of glucose-lowering medications.[4] Aligning with this global consensus, Thailand's national health policy driven by the Department of Disease Control and the Diabetes Association of Thailand and has explicitly adopted this definition, emphasizing intensive lifestyle modification as a primary intervention.[3, 6] These national regulations aim to alleviate the economic burden of lifelong medication and improve patient well-being.[7] However, a critical gap remains in translating these broad national policies into practice. The rationale for this study stems from the limitation that existing national guidelines are often generic and do not account for the unique implementation challenges found in specific local contexts, necessitating the development of a localized guideline that bridges the gap between policy and practice.

Despite these advancements in policy and standards, achieving remission in real-world practice remains challenging. Although clinical trials such as the Diabetes Remission Clinical Trial (DiRECT) have demonstrated that significant weight loss can lead to remission,[8, 9] implementing these intensive interventions in routine care is difficult. Recent studies indicate that remission rates in real-world urban populations are often lower than in controlled trials due to environmental complexities.[10] Practical challenges in the urban context include sedentary lifestyles, easy access to high-calorie foods, employment-related time constraints, and limited social support. Therefore, a significant knowledge gap exists regarding how to translate global remission standards into a context-specific care guideline suitable for an urban health service network. Current general guidelines often lack the specificity required to address the unique socioeconomic barriers faced by urban populations in southern Thailand.[11]

This study aimed to investigate the current situation and barriers to diabetes remission, develop context-specific care guidelines, and evaluate the effectiveness of these guidelines in terms of clinical outcomes and patient satisfaction.

Methods

Study Design, Setting, and Participants

This study employed an action research design based on the Kemmis and McTaggart spiral model,[12] which consists of a cyclical process of planning, acting, observing, and reflecting. This methodological framework was selected to foster stakeholder participation and ensure that the developed solutions were contextually appropriate for the urban health service network. The study was conducted from 8 August 2024 to 12 December 2024 at the Urban Health Service Center, Mueang district, Surat Thani province, Thailand.

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The target population included patients with T2DM and healthcare stakeholders:

For the Situational Analysis (Phase 1): A systematic random sampling of 124 medical records (10% of total N = 1239) was conducted to assess the baseline clinical status. Additionally, 10 key informants comprising 3 administrators, 4 healthcare providers, and 3 successful remission patients were purposively selected for in-depth interviews.

For Implementation (Phase 3): A purposive sample of 12 patients with T2DM was selected to pilot the guidelines. The inclusion criteria were: age 18-65 years, body mass index (BMI) of 23 kg/m^2, T2DM diagnosis ≤ 6 years, use of only oral hypoglycemic agents, and effective communication skills. Patients with severe complications were excluded.

Research Procedures

The research process was organized into 3 phases following the action research spiral:

Phase 1 (Planning [Situation Analysis]): This phase aimed to diagnose the problem and identify barriers to remission.

Procedure: Medical records were analyzed to determine the population's clinical profile, and semi-structured interviews were conducted with key informants to uncover context-specific barriers.

Instruments: Medical record forms and semi-structured interview guidelines were used.

Phase 2 (Acting [Guideline Development]): This phase focused on developing the intervention based on the Planning phase findings.

Procedure: A multidisciplinary panel of 7 experts (physician, nurse specialist, nutritionist, pharmacist, and academic) participated in a focus group discussion (FGD). They cocreated the context-specific care guidelines by integrating ADA with solutions for identified local barriers.

Instruments: FGD guide and draft care guidelines.

Phase 3 (Observing and Reflecting [Implementation and Evaluation]): This phase involved implementing the action plan and evaluating its effects.

Procedure: The developed guidelines were implemented in 12 pilot patients over a 6-month period. The intervention included digital monitoring via LINE application and community support via village health volunteers (VHVs).

Data Collection: A repeated measures design was used. Clinical data (body weight, finger-prick blood glucose [DTX]) were collected at baseline, 2 weeks, 1 month, 3 months, and 6 months. HbA_{1c} and patient satisfaction were assessed at baseline and 6 months after the procedure.

Instruments: Clinical follow up record form, nonparticipant observation record form, and patient satisfaction questionnaire (Cronbach α = 0.87).

Data Analysis

Content analysis was employed for data from interviews and FGDs to identify themes related to barriers and guideline feasibility.

Descriptive statistics were used for demographic data. Changes in body weight and blood glucose across multiple time points were used for demographic data. Repeated-measures analysis of variance (ANOVA). A paired *t* test was used to compare HbA_{1c} levels and satisfaction scores between pre and post implementation. Analyses were performed using SPSS, version 23.0 (IBM Corp). Statistical significance was set at $P < .05$.

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Results

The results are presented according to the 3 phases of the action research design, following the Kemmis and McTaggart spiral model (planning, acting, and observing and reflecting), which directly align with the research objectives.

Phase 1 (Situation Analysis and Barrier Identification [Planning])

This phase analyzed 124 medical records and interviewed key informants to identify barriers to remission.

Identified Barriers (Themes): Qualitative analysis revealed 3 key factors that hinder remission in the urban context:

1) Lifestyle Constraints: Patients reported a lack of time for exercise due to urban employment.

[Patient]: "*Working regular hours makes it difficult to find time for exercise or prepare healthy meals. By the time I get home, I'm exhausted.*"

2) Environmental Triggers: Easy access to high-calorie street food.

[Patient]: "*Switching to brown rice was very hard at first. The taste was not familiar, it was more expensive than white rice, and I felt hungry very quickly*."

3) Systemic Gaps: Existing care was fragmented, and a specific protocol for remission was lacking.

[Healthcare Provider]: "*Sometimes, the criteria for selecting patients for the remission program are unclear. We tended to focus on quantity over quality, which affected the effectiveness of the program.*"

[Administrator/Nurse]: "*There is a gap in working with VHVs. Some individuals lack specific knowledge about diabetes remission, making community follow-up less effective.*"

General Characteristics (From Medical Records): The analysis of 124 medical records revealed that the average (range) age was 45.98 (18-65) years. The majority were female (59.7%) and were using metformin (99.2%). These data highlight the demographic profile of the target population at the Urban Health Service Center (Table 1).

Phase 2 (Development of Care Guidelines [Acting])

Based on the specific barriers identified in Phase 1, context-specific care guidelines for T2DM remission were developed. The expert panel developed 4 key components to directly address the identified challenges:

Screening Protocol: To address systemic gaps regarding unclear remission criteria, the protocol specifically targets patients with adequate pancreatic reserve diagnosed 6 years ago.

Holistic Lifestyle Modification: The guideline focuses on practical low-calorie dietary adjustments and physical activity strategies adapted specifically for urban lifestyles to counter environmental triggers (eg, street food accessibility).

Community Support: The guideline integrates VHVs to act as health coaches and provide the necessary social scaffolding to overcome the lack of family support identified in Phase 1.

Digital Monitoring: The guideline uses the LINE application for continuous remote follow-up to address lifestyle and time related constraints barriers where patients could not attend frequent hospital visits, ensuring adherence without disrupting employment.

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Phase 3 (Evaluation of Effectiveness [Observing and Reflecting])

The guidelines were implemented with a pilot group of 12 patients who met the inclusion criteria. The effectiveness was evaluated using repeated measures ANOVA and a paired *t* test.

Changes in Clinical Outcomes (Repeated Measures): The repeated measures ANOVA revealed statistically significant differences in body weight across time points (F[2.08,22.85] = 23.65, P < .001), indicating a progressive decrease. Similarly, finger-prick blood glucose levels significantly decreased over the 6-month period (F[2.18,23.97] = 21.95, P < .001) (Table 2).

HbA_{1c} and Satisfaction (Pre-Post Comparison): The comparison before and after implementation was determined (Table 3). HbA_{1c} levels significantly decreased (mean difference = 0.78, P < .001). Furthermore, postintervention patient satisfaction significantly increased (mean difference = -0.58, P = .046).

Table 1. Demographic Characteristics

Characteristic	No. (%)
Gender	
Male	50 (40.3)
Female	74 (59.7)
Age, mean (range),y	45.98 (18-65)
Marital status	
Married	72 (58.1)
Others	52 (41.9)
Occupation	
Laborer	57 (46.0)
Others	67 (54.0)
Education level	
Primary school	76 (61.3)
Others	48 (38.7)
Health insurance	
Universal health coverage	100 (80.6)
Others	24 (19.4)
Clinical characteristic	
BMI, mean (range), kg/m^2	34.21 (25.00-45.65)
Diabetes duration, mean (range),y	5.98 (1-11)
Glycemic control	
Finger-prick blood glucose, mean (range), mg/dL	161.27 (100.00-270.00)
Fasting blood sugar, mean (range), mg/dL	153.68 (118.00-267.00)
HbA_{1c}, mean (range), %	7.09 (6.00-11.60)

Abbreviations: BMI, body mass index; HbA_{1c}, hemoglobin A_{1c}.

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Table 2. Comparison of Body Weight and Finger-Prick Blood Glucose Across Different Time Points Using Repeated-Measures Analysis of Variance

Variable	Mean (SD)				*F*	*P* Value
	Baseline	Month 1	Month 3	Month 6		
Body weight, kg	83.08 (10.16)	80.08 (10.58)	78.34 (10.88)	77.01 (11.60)	23.649	< .001
Finger-prick blood glucose level, mg/dL	138.83 (19.58)	121.42 (17.90)	106.58 (12.30)	102.25 (8.16)	21.954	< .001

Table 3. Comparison of Hemoglobin A_{1c} and Patient Satisfaction Before and After Implementing the Care Guidelines Using Paired *t* Test

Variable	Mean (SD)		Mean Difference (95% CI)	*T*	*P* Value
	Preimplementation	Postimplementation			
HbA_{1c}, %	7.05 (0.61)	6.27 (0.27)	0.78 (0.45 to 1.11)	5.20	< .001
Satisfaction, score	3.67 (0.65)	4.25 (0.75)	-0.58 (-1.16 to -0.01)	-2.24	.046

Abbreviation: HbA_{1c}, hemoglobin A_{1c}.

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Discussion

This study successfully developed and evaluated context-specific care guidelines for T2DM remission in an urban health service network using an action research approach. The findings demonstrate significant improvements in clinical outcomes and patient satisfaction. These results warrant a deeper interpretation of how localized interventions can overcome established barriers.

Interpretation of findings and mechanisms of success:

1) Overcoming Urban Constraints through Digital Adaptation: The significant reduction in HbA_{1c} and body weight observed in this study suggests that the "lifestyle constraint" barrier (identified in Phase 1) was effectively mitigated by the integration of digital monitoring via the LINE application. Unlike traditional care which requires physical presence, this digital approach allowed continuous behavioral modification without disrupting the employment of urban patients. This interpretation aligns with Shamanna et al,[13] who highlighted

that digital tools can bridge the gap between clinical goals and daily realities by providing real-time feedback. The success of this study indicates that in an urban context where time is a scarce resource, flexibility in care delivery is not only an option but also a clinical necessity for remission.

2) Synergizing Social Capital with Clinical Goals: The increase in patient satisfaction and clinical success also reflects the effectiveness of using VHVs to address the “lack of support”. Although the DiRECT trial emphasized professional-led interventions,[8, 9] our findings suggest that in a resource-constrained urban setting, VHVs can effectively serve as “social scaffolding”. The guidelines created a supportive microenvironment that countered the negative influence of environmental triggers by transforming VHVs into health coaches. This confirms the concept that successful diabetes remission is not solely biological but deeply rooted in social dynamics.[11, 14]

3) Bridging Policy and Practice: The study confirms that while national policies set the definition for remission,[4, 6] practical success of remission relies on contextual adaptation. The “systemic gaps” were closed by a cocreated protocol that clarified the remission

pathway for both providers and patients, rather than introducing new medications. This participatory process ensured the feasibility of the guidelines leading to high adherence and positive outcomes.

Limitations

The limitations of this study include the small sample size (n = 12) and short duration, which are common in the pilot cycle of action research. Future cycles should expand the implementation to a broader population to test scalability and long-term sustainability.

Conclusions

The developed care guidelines, which were tailored to the specific context of the Urban Health Service Center in Surat Thani province, were effective in promoting T2DM remission. The implementation resulted in significant reductions in body weight, finger-prick blood glucose, and HbA_{1c} levels, along with a significant increase in patient satisfaction. These positive outcomes were driven by the guideline's integration of evidence-based standards with context-specific components, the use of digital technology (the LINE application) to overcome urban time constraints and the involvement of VHVs to enhance social support. This suggests that a holistic approach that addresses both clinical and psychosocial barriers is required for successful remission in urban primary care. Therefore, this study provides a scalable model for policymakers and healthcare providers to implement proactive nationwide remission services in similar urban settings.

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Additional Information

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Data Curation: All authors
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