

Current Status of Clinical Inertia and Its Influencing Factors in Community Patients with Type 2 Diabetes Mellitus: Postprint

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Abstract

Background Although type 2 diabetes mellitus (T2DM) cannot be completely cured, it is widely recognized that timely community management of T2DM patients according to guidelines can achieve satisfactory glycemic control. However, due to the influence of T2DM-related clinical inertia, patients' blood glucose remains poorly controlled for extended periods. Understanding the current status and influencing factors of clinical inertia in community T2DM patients is crucial for improving diabetes control outcomes, yet relevant research remains limited.

Objective To investigate the current status of clinical inertia in community T2DM patients undergoing health management and to analyze its influencing factors.

Methods From January to December 2020, community T2DM patients participating in the National Basic Public Health Service Program in Qingjiangpu District and Huai'an District of Huai'an City, Jiangsu Province were selected as study subjects using a cluster random sampling method. Participants underwent "face-to-face" questionnaire surveys, physical examinations, and laboratory tests. Clinical inertia was defined as the absence of treatment intensification over the past 3 months in T2DM patients with suboptimal HbA1c control ($\text{HbA1c} \geq 7.0\%$). Multivariate stepwise Logistic regression was employed to analyze factors influencing the detection of clinical inertia in community T2DM patients.

Results A total of 3,346 community T2DM patients with uncontrolled HbA1c were included. The overall detection rate of clinical inertia in community T2DM patients was 93.96% (3,144/3,346), with rates of 94.84% (1,139/1,201) in males and 93.47% (2,005/2,145) in females. Statistically significant differences in clinical inertia detection rates were observed among community T2DM patients with

varying dietary control status, physical exercise status, blood glucose monitoring cycle, diabetic complications, as well as histories of dyslipidemia, coronary heart disease, stroke, and tumor ($P < 0.05$). Multivariate stepwise Logistic regression analysis revealed that dietary control [OR (95%CI)=0.585 (0.382, 0.894)], blood glucose monitoring cycle ≤ 1 week [OR (95%CI)=0.470 (0.344, 0.644)], presence of diabetic complications [OR (95%CI)=0.606 (0.423, 0.868)], dyslipidemia [OR (95%CI)=0.725 (0.532, 0.988)], history of coronary heart disease [OR (95%CI)=0.659 (0.458, 0.949)], and history of stroke [OR (95%CI)=0.699 (0.511, 0.955)] were associated with a lower likelihood of clinical inertia in community T2DM patients ($P < 0.05$).

Conclusion Community T2DM patients experience severe clinical inertia during health management, and the occurrence of clinical inertia is associated with dietary control status, blood glucose monitoring cycle, diabetic complications, and comorbidity histories.

Full Text

Analysis on the Current Status and Influencing Factors of Clinical Inertia in Type 2 Diabetes Patients in Community Settings

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Abstract

Background: Although type 2 diabetes mellitus (T2DM) cannot be completely cured, there is a consensus that timely community management of T2DM patients following guidelines can lead to good glycemic control. However, patients' blood glucose remains chronically suboptimal due to T2DM-related clinical inertia. Understanding the current status and influencing factors of clinical inertia in community-dwelling T2DM patients is crucial for improving diabetes control effectiveness, yet relevant research remains limited.

Objective: To investigate the current status and influencing factors of clinical inertia during health management among community T2DM patients.

Methods: From January to December 2020, T2DM patients participating in the National Basic Public Health Services Program in Qingjiangpu and Huai'an districts of Huaian City, Jiangsu Province were recruited using cluster random sampling. Participants underwent face-to-face questionnaire surveys, physical examinations, and laboratory tests. Clinical inertia was defined as the absence of treatment intensification over the past three months among T2DM patients with inadequate HbA1c control (HbA1c \geq 7.0%). Stepwise multiple logistic regression analysis was performed to identify influencing factors of clinical inertia detection.

Results: A total of 3,346 T2DM patients with inadequate glycemic control (HbA1c \geq 7.0%) were included. The overall detection rate of clinical inertia was 93.96% (3,144/3,346), with rates of 94.84% (1,139/1,201) in men and 93.47% (2,005/2,145) in women. Statistically significant differences in clinical inertia detection rates were observed among patients with different dietary control status, physical activity levels, blood glucose monitoring periods, diabetic complications, and histories of dyslipidemia, coronary heart disease, stroke, and cancer ($P < 0.05$). Stepwise multiple logistic regression revealed that dietary control [OR (95%CI) = 0.585 (0.382, 0.894)], blood glucose monitoring period \geq \$1 week [OR (95%CI) = 0.470 (0.344, 0.644)], presence of diabetic complications [OR (95%CI) = 0.606 (0.423, 0.868)], dyslipidemia [OR (95%CI) = 0.725 (0.532, 0.988)], history of coronary artery disease [OR (95%CI) = 0.659 (0.458, 0.949)], and history of stroke [OR (95%CI) = 0.699 (0.511, 0.955)] were associated with lower likelihood of clinical inertia ($P < 0.05$).

Conclusion: Community T2DM patients undergoing health management exhibit a serious problem of clinical inertia, which is closely associated with dietary control, blood glucose monitoring frequency, presence of diabetic complications, and comorbid disease history.

Keywords: Diabetes mellitus, type 2; Clinical inertia; Treatment intensification; Health management; National essential public health services programs; Community health services; Root cause analysis

Introduction

The prevalence of diabetes among Chinese adults has now exceeded 12.8%, with 130 million patients accounting for one-quarter of the global diabetic population [1]. Diabetes is considered a major preventable disease and health issue for the next 20 years [2]. To alleviate the heavy social and economic burden, China launched the National Basic Public Health Services Program in 2009, which mandates that community health service centers and township hospitals provide health management services for T2DM patients in their jurisdictions. Nevertheless, the overall situation of T2DM prevention and control in China remains severe, with only 50.1% of treated patients achieving the recommended HbA1c target ($< 7.0\%$) [3]. T2DM-related clinical inertia—defined as failure to

timely intensify treatment when glycemic control is inadequate—represents an important contributor to this phenomenon [4-5].

While international scholars have extensively reported on clinical inertia across various healthcare settings [6-9], domestic research remains scarce, with only one study analyzing clinical inertia from the perspective of tertiary medical institutions [5]. The status of clinical inertia among community T2DM patients receiving health management services in China remains unclear. Therefore, this study aims to investigate the current status and influencing factors of clinical inertia in community T2DM patients participating in the National Basic Public Health Services Program, providing evidence for optimizing diabetes management and improving control rates.

Methods

1.1 Study Subjects From January to December 2020 (with survey interruption during February-May due to COVID-19), we employed cluster random sampling to recruit T2DM patients from 26 townships/sub-districts in Qingjiangpu (formerly Qinghe and Qingpu districts) and Huai'an districts of Huaian City, Jiangsu Province, who were enrolled in the National Basic Public Health Services Program. Inclusion criteria were: (1) age ≥ 35 years; (2) meeting T2DM diagnostic criteria [10]; and (3) having established community health records and receiving community health management. Exclusion criteria included: (1) psychiatric disorders or cognitive dysfunction; (2) mobility impairment; and (3) incomplete questionnaire, physical examination, or laboratory data.

Sample size was estimated using the cross-sectional study formula $N = [t^2\alpha/2 \times p(1-p)]/d^2$, with α set at 0.05 ($t_{\alpha/2} = 1.96$). Since inadequate glycemic control is a prerequisite for clinical inertia, and previous research showed a 42.7% control rate among community-managed T2DM patients in Huaian [11], p was set at 0.573. With allowable error d at 0.1 p , the calculated N was 286. Considering an estimated non-response rate of 20%, the minimum required sample size was 344. During sampling, we aimed to include as many eligible subjects as possible beyond this minimum. This study was approved by the Nanjing Medical University Ethics Committee [Approval No.: NMU Ethics Review (2019) 716], and all participants provided informed consent.

1.2 Survey Components The survey comprised three parts: (1) **Questionnaire**: A self-designed questionnaire covering basic characteristics (age, gender, education, marital status, annual household income), lifestyle behaviors (current smoking, current alcohol consumption, dietary control, physical activity, blood glucose monitoring frequency), presence of diabetic complications, disease history (hypertension, dyslipidemia, stroke, coronary heart disease, cancer), and details of the most recent treatment intensification and specific modifications in the past three months. (2) **Physical Examination**: Standardized measurements of height, weight, and blood pressure. (3) **Laboratory Tests**: Fasting venous blood samples were collected to measure HbA1c, high-density lipoprotein

cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), total cholesterol (TC), and triglycerides (TG) using methods described in previously published literature [12].

1.3 Definitions and Diagnostic Criteria (1) T2DM-related clinical inertia:

Defined as no treatment intensification in the past three months among T2DM patients with inadequate HbA1c control ($\text{HbA1c} \geq 7.0\%$) [13]. Treatment intensification included: increasing dosage of existing oral hypoglycemic agents, changing or adding oral hypoglycemic drug classes, initiating insulin therapy, or increasing insulin injection frequency/dosage as recommended by physicians.

(2) **Current smoking:** Having a smoking habit at the time of survey with cumulative lifetime consumption exceeding 100 cigarettes.

(3) **Current alcohol consumption:** Alcohol intake within the past month.

(4) **Dietary control:** Implementation of measures within the past year such as reducing staple food intake, increasing vegetable and fruit consumption, and limiting high-fat foods.

(5) **BMI:** Calculated as $\text{weight (kg)}/\text{height (m)}^2$, categorized as $<24.0 \text{ kg/m}^2$, $24.0\text{-}27.9 \text{ kg/m}^2$, and $\geq 28.0 \text{ kg/m}^2$ [14].

(6) **Hypertension (history):** Diagnosed by township/community-level or higher medical institutions, or having mean systolic blood pressure ≥ 140 mmHg and/or mean diastolic blood pressure ≥ 90 mmHg during this survey ($1 \text{ mmHg} = 0.133 \text{ kPa}$) [15].

(7) **Dyslipidemia (history):** Meeting any of the following criteria: $\text{TG} \geq 2.26 \text{ mmol/L}$, $\text{TC} \geq 6.22 \text{ mmol/L}$, $\text{HDL-C} < 1.04 \text{ mmol/L}$, $\text{LDL-C} \geq 4.14 \text{ mmol/L}$, or having a physician diagnosis of dyslipidemia [16].

(8) **Diabetic complications:** Including diabetic nephropathy, retinopathy, neuropathy, lower extremity arterial disease, and diabetic foot.

(9) **History of stroke/coronary heart disease/cancer:** Previous diagnosis by township/community-level or higher medical institutions.

1.4 Quality Control Community health practitioners served as surveyors and received centralized training with practice sessions before the survey. During questionnaire administration, surveyors obtained informed consent, conducted face-to-face interviews using tablet computers, and recorded the entire process. Completed questionnaires underwent comprehensive validation through the survey system to check for missing items, incorrect entries, and logical errors, with timely corrections made when issues were identified. Survey site quality control officers verified 10% of interview recordings and provided feedback to surveyors. Physical examinations were performed by two surveyors working collaboratively, and blood samples were processed, aliquoted, and

stored strictly according to laboratory protocols. Project team quality control officers conducted regular on-site inspections to ensure adequate facilities and conditions for blood collection, questionnaires, and physical examinations.

1.5 Statistical Analysis Data were analyzed using SAS 9.4 software. Categorical data were described using frequencies and percentages, with between-group comparisons performed using χ^2 tests. Continuous data were presented as $(\bar{x} \pm s)$. Stepwise multiple logistic regression ($\alpha_{\text{entry}} = 0.05$, $\alpha_{\text{exit}} = 0.10$) was used to analyze influencing factors of clinical inertia detection. All tests were two-tailed, with $P < 0.05$ considered statistically significant.

Results

2.1 General Characteristics of Community T2DM Patients A total of 5,701 T2DM patients were surveyed. After excluding 2,355 patients with adequate HbA1c control or missing data, 3,346 patients were included in the analysis. The mean age was (67.1 ± 9.1) years, with 1,375 (41.09%) aged ≥ 70 years; 2,145 (64.11%) were female; 288 (8.61%) had high school/technical secondary education or higher; 544 (16.26%) were single; 563 (16.83%) had annual household income $> 100,000$ RMB. The proportions of current smokers, current drinkers, those practicing dietary control, those exercising regularly, those with blood glucose monitoring period ≥ 1 week, and those with BMI $\geq 28 \text{ kg/m}^2$ (obese) were 20.74% (694/3,346), 15.09% (505/3,346), 78.39% (2,623/3,346), 39.51% (1,322/3,346), 17.72% (593/3,346), and 20.50% (686/3,346), respectively. Diabetic complications were present in 424 (12.67%) patients. Histories of hypertension, dyslipidemia, coronary heart disease, stroke, and cancer were present in 74.18% (2,482/3,346), 58.43% (1,955/3,346), 13.12% (439/3,346), 23.85% (798/3,346), and 3.38% (113/3,346) of patients, respectively. HbA1c $\geq 9.0\%$ was observed in 42.41% (1,419/3,346) of patients. Detailed general data are presented in Table 1.

2.2 Detection of Clinical Inertia in Community T2DM Patients The overall detection rate of clinical inertia was 93.96% (3,144/3,346), with rates of 94.84% (1,139/1,201) in men and 93.47% (2,005/2,145) in women. Statistically significant differences in clinical inertia detection rates were found across different categories of dietary control, physical exercise, blood glucose monitoring period, diabetic complications, and histories of dyslipidemia, coronary heart disease, stroke, and cancer ($P < 0.05$). Compared with patients monitoring blood glucose ≥ 1 weekly, those with monitoring periods > 1 week showed higher clinical inertia detection rates. Conversely, patients with diabetic complications, dyslipidemia, coronary heart disease history, stroke history, or cancer history had lower clinical inertia detection rates compared to those without these conditions ($P < 0.05$). Details are shown in Table 1.

2.3 Influencing Factors of Clinical Inertia: Multivariate Stepwise Logistic Regression Analysis Using clinical inertia occurrence as the depen-

dent variable (absent=0, present=1) and variables showing statistical significance in Table 1 (except HbA1c) as independent variables—including dietary control, blood glucose monitoring period, physical exercise, and presence of diabetic complications, dyslipidemia, coronary heart disease history, stroke history, and cancer history—multivariate stepwise logistic regression analysis was performed. Results showed that dietary control [OR (95%CI) = 0.585 (0.382, 0.894)], blood glucose monitoring period \$ \$1 week [OR (95%CI) = 0.470 (0.344, 0.644)], presence of diabetic complications [OR (95%CI) = 0.606 (0.423, 0.868)], dyslipidemia [OR (95%CI) = 0.725 (0.532, 0.988)], history of coronary artery disease [OR (95%CI) = 0.659 (0.458, 0.949)], and history of stroke [OR (95%CI) = 0.699 (0.511, 0.955)] were associated with significantly lower likelihood of clinical inertia ($P < 0.05$). Results are presented in Table 2 .

2.4 Treatment Intensification Among Community T2DM Patients with Inadequate HbA1c Control Among the 3,346 patients with inadequate HbA1c control, 202 (6.04%) received treatment intensification within the past three months. The most common intensification measure was “increasing the dosage of existing oral hypoglycemic agents” [81 patients (40.10%)], followed by “increasing insulin injection frequency or dosage” [39 patients (19.31%)], and “adding new oral hypoglycemic drug classes” [36 patients (17.82%)]. Details are shown in Table 3 .

Discussion

Although T2DM cannot be completely cured, there is consensus that community-based health management following the National Basic Public Health Services Program can achieve good glycemic control [13]. However, monotherapy alone often fails to achieve sustained glucose reduction. National diabetes guidelines recommend a sequential treatment approach: monotherapy → dual therapy (two oral agents) → triple therapy (three oral agents) → combination with insulin therapy, with timely stepwise intensification when glycemic targets are not met [10]. Clinical inertia contributes to chronically inadequate glycemic control and increases cardiovascular risk [14]. This study, grounded in the practical implementation of the National Basic Public Health Services Program, investigated clinical inertia among community T2DM patients, offering important insights for optimizing community diabetes management and reducing cardiovascular burden.

Our results show that approximately 94.00% of community T2DM patients with inadequate HbA1c control did not receive treatment intensification in the past three months, a figure that differs from previous studies. A Chinese study in tertiary hospitals followed 178 T2DM patients with baseline HbA1c \$ \$7.0% for six months and found a clinical inertia rate of 52.2% [5]. International studies report varying rates: a US real-world study of over 7,000 T2DM patients on dual therapy with HbA1c \$ \$7.0% found a 62.9% inertia rate over six months [6]; a UK retrospective analysis of over 80,000 patients showed intensification

rates of 23.9%, 11.4%, and 5.7% after one year for those on one, two, or three glucose-lowering drugs, respectively [7]; and a Malaysian cohort study of over 7,000 patients (HbA1c $\geq 7.0\%$) found only 45.4% received intensification over a mean 2.6-year follow-up [8]. These discrepancies likely stem from differences in study design and, more importantly, varying definitions of clinical inertia [4], as detection rates are influenced by observation duration—longer observation periods generally yield lower inertia rates [9].

The causes of clinical inertia in community T2DM patients are complex, involving physician, patient, and healthcare system factors [4]. From the patient perspective, our analysis reveals associations between clinical inertia and dietary control, blood glucose monitoring frequency, diabetic complications, and comorbid disease history. Patients practicing dietary control showed lower clinical inertia risk, possibly because those receiving intensification therapy face stricter dietary requirements during treatment escalation [17]. Blood glucose monitoring ≥ 1 weekly reduced clinical inertia risk by 53.00% compared with less frequent monitoring, demonstrating that enhanced monitoring helps community health workers assess metabolic disturbance severity and guide timely treatment adjustments. Additionally, patients with diabetic complications, dyslipidemia, coronary heart disease history, or stroke history exhibited lower clinical inertia risk, likely due to higher medication adherence and more proactive healthcare-seeking behavior among those with poorer health status [18-19], as well as physicians' greater propensity to provide intensification services for high-risk patients [20].

Both domestic and international guidelines recognize HbA1c as reflecting average blood glucose over the previous three months [10,21]. By assessing treatment intensification within three months before HbA1c measurement and defining intensification as dosage increases, drug class additions, insulin initiation, or insulin dose escalation, our study may provide a more accurate assessment of clinical inertia than previous research [5,9]. However, as a cross-sectional study, we cannot establish causal relationships between influencing factors and outcomes. Additionally, since all participants were from a single city, the generalizability of our findings requires validation through further research.

In conclusion, community T2DM patients undergoing health management exhibit severe clinical inertia, which is closely associated with dietary control, blood glucose monitoring frequency, diabetic complications, and comorbid disease history. These findings offer guidance for optimizing community T2DM management, though prospective cohort studies with national representation are needed to better guide treatment intensification for community patients with poor glycemic control.

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Author Contributions: LI Dianjiang conceived the study design and drafted the manuscript; PAN Enchun supervised implementation and coordinated field-work; SUN Zhongming and WEN Jinbo collected and organized data; WANG Miaomiao performed statistical analysis; WU Ming and SHEN Chong designed the survey protocol and conducted feasibility analysis.

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