

# Effect of Hospital-Wide Active Blood Glucose Management Model on Glycemic Control and Clinical Outcomes in Patients with Community-Acquired Pneumonia and Type 2 Diabetes Mellitus: A Retrospective Before-After Controlled Study

Shuhong Tan, Jingying Zhou, Nenghua Tang, Chongrong Long, Sheng Li, Yuting Yin, Xiaoxia Zou, Ying Wang, Linlin Tian, Qirui He, Ting Li, Qun Wu, Yingsha Li\*

Shapingba Hospital Affiliated to Chongqing University (Shapingba District People's Hospital of Chongqing), Chongqing, China  
Email: \*yslimiss@163.com

**How to cite this paper:** Tan, S.H., Zhou, J.Y., Tang, N.H., Long, C.R., Li, S., Yin, Y., Zou, X.X., Wang, Y., Tian, L.L., He, Q.R., Li, T., Wu, Q. and Li, Y.S. (2026) Effect of Hospital-Wide Active Blood Glucose Management Model on Glycemic Control and Clinical Outcomes in Patients with Community-Acquired Pneumonia and Type 2 Diabetes Mellitus: A Retrospective Before-After Controlled Study. *Journal of Biosciences and Medicines*, 14, 559-575.  
<https://doi.org/10.4236/jbm.2026.149035>

**Received:** September 3, 2026

**Accepted:** September 26, 2026

**Published:** September 29, 2026

## Abstract

**Objective:** This paper aims to evaluate the impact of the hospital-wide active blood glucose management model on blood glucose control, clinical outcomes and resource utilization in patients with community-acquired pneumonia (CAP) complicated with type 2 diabetes mellitus (T2DM). **Method:** In this single-center retrospective before-and-after controlled study, patients with CAP combined with T2DM were divided into the traditional consultation management group (n = 229) and the hospital-wide blood glucose management group (n = 218) based on the implementation time of the active management model. The baseline data, primary outcomes (blood glucose control indicators), and secondary outcomes (hard clinical endpoints and resource utilization indicators) of the two groups were compared. Spearman correlation analysis was used to explore the associations among variables. **Result:** There were no statistically significant differences in baseline variables (including age, duration of diabetes, HbA1c, WBC, CRP, PCT, PaO<sub>2</sub>, PaCO<sub>2</sub> and PSI score) between the two groups (all P > 0.05). The rate of reaching the target blood glucose at discharge in the hospital-wide blood glucose management group was significantly higher (73.4% vs 61.6%, P = 0.010), the time to reach the target blood glucose was shorter (P = 0.017), the highest blood glucose was lower (P < 0.001), and the difference in the lowest blood glucose was statistically significant (P = 0.046). There were no statistically significant differences

in the hard clinical endpoints (severe pneumonia, respiratory failure, ICU transfer, and death) and resource utilization indicators (total hospitalization cost, length of hospital stay, length of ICU stay, duration of invasive mechanical ventilation, and days of intensive care) between the two groups (all  $P > 0.05$ ). Relevant analysis shows that the total hospitalization cost is positively correlated with the length of hospital stay and the length of stay in the ICU, the lowest blood glucose is positively correlated with the frequency of hypoglycemia, and there is an aggregated correlation among inflammatory markers. **Conclusion:** The hospital-wide active blood glucose management model can significantly improve the short-term blood glucose control of patients with CAP combined with T2DM without increasing the economic burden, but it has not translated into significant benefits of hard clinical endpoints. Multicenter prospective randomized controlled trials with extended follow-up periods are still needed to fully verify its long-term value.

## Keywords

Active Blood Glucose Management throughout the Hospital  
Community-Acquired Pneumonia Type 2 Diabetes Blood Sugar  
Control Clinical Outcome

---

## 1. Introduction

Community-acquired pneumonia (CAP) combined with type 2 diabetes mellitus (T2DM) is a common comorbidity in clinical practice. The two interact with each other and significantly increase the disease burden of patients. Epidemiological evidence indicates that the risk of CAP in patients with type 2 diabetes mellitus (T2DM) is significantly higher than that in non-diabetic populations [1]. Moreover, CAP patients with diabetes have more severe conditions, are more prone to septic shock and respiratory failure, and have a significantly increased in-hospital mortality rate [2]. This poor prognosis is closely related to the severe insulin resistance, hyperglycemia and sharp fluctuations in blood glucose that occur in diabetic patients under infection stress [3]. Therefore, optimizing the blood glucose management of hospitalized CAP patients with T2DM has significant practical significance for improving clinical outcomes.

In terms of blood glucose management for inpatients, the traditional model mainly relies on passive consultation; that is, only when blood glucose is significantly abnormal will the admitting department invite the endocrinology department for consultation. This model lacks active monitoring and systematic adjustment, often leading to unsatisfactory blood sugar control. In recent years, the hospital-wide active blood glucose management model led by the endocrinology department and involving multidisciplinary teams has gradually attracted attention. This model has shown potential in improving blood glucose control and reducing complications in perioperative and critically ill patients through active, continuous

and individualized blood glucose monitoring and intervention [4]. However, for the specific scenario of CAP, an infectious disease, evidence of its effectiveness remains scarce.

Infection and inflammatory stress in community-acquired pneumonia (CAP) can exacerbate insulin resistance and blood glucose disorders, and hyperglycemia further aggravates the pathological process of pneumonia by promoting oxidative stress and inflammatory responses [5]. Theoretically, achieving stricter blood sugar control through an active management model may help reduce systemic inflammatory responses, improve respiratory function and shorten the course of the disease. Although previous studies have explored the risk factors and prognostic prediction models for patients with CAP combined with T2DM [6] [7], interventional research on how to improve prognosis by adjusting blood glucose management strategies is still very limited.

This study adopted a single-center, retrospective before-and-after controlled design. Taking the implementation time point of the hospital-wide active blood glucose management model as the boundary, inpatients with CAP complicated with T2DM were divided into the traditional consultation management group and the hospital-wide blood glucose management group. Retrospective designs can efficiently utilize real-world clinical data, while before-and-after controlled designs help reduce selection bias. Through strict inclusion and exclusion criteria and comparison of baseline data, this study aims to evaluate the differences between the two management models in terms of blood glucose control, clinical outcomes, and utilization of medical resources.

This study aims to explore whether the hospital-wide active blood glucose management model can increase the rate of reaching the blood glucose target at discharge for CAP patients with T2DM, shorten the time to reach the blood glucose target, and evaluate its impact on hard clinical endpoints such as severe pneumonia, respiratory failure, ICU transfer and death, while analyzing its economic feasibility. The research results will provide evidence-based basis for optimizing the inpatient blood glucose management strategy of this complex comorbid patient population and lay the foundation for future prospective, multi-center randomized controlled trials.

## 2. Materials and Methods

### 2.1. Study Design

This study is a single-center, retrospective before-and-after controlled study. Patients with community-acquired pneumonia (CAP) complicated with type 2 diabetes mellitus admitted to a certain hospital were continuously included through the electronic medical record system. Taking the implementation time point of the active blood glucose management model throughout the hospital as the boundary, the included patients were divided into two groups: the traditional consultation management group (control group), which adopted the traditional endocrinology department consultation model; The hospital-wide blood glucose

management group (intervention group) adopted the hospital-wide active blood glucose management model. This study was approved by the hospital Ethics Committee (Ethics Approval Number: KY202584).

## **2.2. Study Subjects**

### **2.2.1. Inclusion Criteria**

Age  $\geq$  18 years;

Meeting the diagnostic criteria for community-acquired pneumonia;

Meeting the WHO (or ADA) diagnostic criteria for type 2 diabetes mellitus;

Complete medical records with extractable clinical data.

### **2.2.2. Exclusion Criteria**

Type 1 diabetes mellitus or specific types of diabetes;

Acute metabolic disturbances such as diabetic ketoacidosis or hyperosmolar hyperglycemic state;

Pregnant or lactating women;

Patients with severe immunodeficiency, end-stage malignant tumors, or extremely short expected survival;

Patients discharged from the hospital on their own in violation of medical advice or were transferred to other hospitals during hospitalization, resulting in the inability to obtain outcome data.

A total of 480 patients were ultimately included in the study, among which 240 were in the traditional consultation management group and 240 were in the hospital-wide blood glucose management group. Due to the absence of outcome variables in specific analyses, the actual number of analyzed cases was marked in each corresponding graph (for example, in the analysis of achieving blood glucose at discharge: 229 cases in the traditional group and 218 cases in the intervention group; in the analysis of the time to achieve blood glucose: 141 cases in the traditional group and 160 cases in the intervention group).

## **2.3. Interventions**

### **2.3.1. Traditional Consultation Management Group**

After admission, the department treated the pneumonia and blood sugar issues according to the conventional plan. When blood sugar levels are significantly abnormal, the attending physician submits a consultation application to the endocrinology department. The endocrinology physician conducts a bedside consultation and provides suggestions for blood sugar adjustment, but does not participate in daily blood sugar monitoring or follow-up management.

### **2.3.2. Hospital-Wide Glycemic Management Group**

The endocrinology department actively monitors the blood glucose levels throughout the hospital through the hospital-wide blood glucose management system. This system sets the threshold for reaching the blood glucose target (fasting blood glucose  $> 7.0$  mmol/L or 2-hour postprandial blood glucose  $> 10.0$

mmol/L is considered non-compliant). Upon receiving the consultation application or notice, the consulting physician shall complete the first consultation within 6 hours and formulate an individualized hypoglycemic plan (including medication, diet and exercise). For those using glucocorticoids, individualized monitoring plans should be formulated and the monitoring frequency should be increased (once every 2 to 4 hours). Check the blood sugar status through the system every day and adjust the plan in a timely manner (within 8 hours). For those with poor dietary control, the clinical nutrition department should be requested to intervene within 24 hours.

## 2.4. Data Collection and Outcome Measures

### 2.4.1. Data Collection

General demographic information, past medical history, vital signs upon admission, laboratory tests, clinical treatment process and hospitalization outcomes were all extracted from the hospital's electronic medical record system. All data were independently verified by two researchers, and in case of any discrepancy, a third party made the determination.

### 2.4.2. Baseline Data

Nine continuous variables were included: age, duration of diabetes, glycated hemoglobin (HbA1c), white blood cell count (WBC), C-reactive protein (CRP), procalcitonin (PCT), arterial partial pressure of oxygen (PaO<sub>2</sub>), arterial partial pressure of carbon dioxide (PaCO<sub>2</sub>), and pneumonia severity index (PSI) score.

### 2.4.3. Primary Outcome Measures

Blood glucose control: Fasting blood glucose should be controlled between 3.9 and 7.0 mmol/L, and blood glucose 2 hours after meals should be below 10.0 mmol/L.

The rate of achieving the target blood glucose control at discharge: the number of days required for blood glucose to remain stable within the target range (or the time from the start of hospitalization until blood glucose remains within the target range).

The time to reach the target blood glucose level: the number of days from admission to when blood glucose first reaches the target range.

The highest and lowest blood glucose levels during hospitalization: The maximum and minimum blood glucose levels monitored during hospitalization.

### 2.4.4. Secondary Outcome Measures

Binary clinical outcomes: incidence of severe pneumonia, incidence of respiratory failure, ICU transfer rate, mortality during hospitalization;

Total hospitalization costs;

Actual length of hospital stay;

Total ICU duration;

Duration of invasive mechanical ventilation;

Days of special-level nursing care.

### 2.4.5. Correlation Analysis Variables

Seventeen major continuous variables were included: Blood glucose indicators (maximum blood glucose, minimum blood glucose), inflammatory indicators (WBC, CRP, PCT), respiratory function indicators (SpO<sub>2</sub>, PaO<sub>2</sub>, PaCO<sub>2</sub>), metabolic indicators (HbA1c), clinical assessment indicators (age, PSI score, duration of diabetes) and prognostic indicators (frequency of hypoglycemia, time to reach the blood glucose target, length of stay in ICU, Actual length of hospital stay, total hospitalization expenses).

### 2.5. Statistical Methods

All statistical analyses were performed using R software (version 4.x) or SPSS 26.0, and the ggplot2 package was used for plotting. A difference was considered statistically significant when a bilateral P value < 0.05. Continuous variables are first tested for normality using the Shapiro-Wilk test. Normal distribution variables were described as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), and the two independent samples t-test was used for comparison between groups. Non-normal distribution variables were described as median (interquartile range) [M (P<sub>25</sub>, P<sub>75</sub>)], and the Wilcoxon rank sum test was used for comparison between groups. A box plot was drawn to show the distribution characteristics of the two groups. Red represents the traditional consultation management group, blue represents the hospital-wide blood glucose management group, and the rhombus marks indicate the mean values. The rate of achieving the standard blood glucose at discharge was a binary variable, expressed as frequency (percentage), and the Pearson chi-square test was used for comparison between groups. The time to reach the target blood glucose level showed a non-normal distribution and was described as M (P<sub>25</sub>, P<sub>75</sub>). The Wilcoxon rank sum test was used for comparison between groups, and the box plot was presented. During hospitalization, the highest and lowest blood glucose levels were compared within the group using the paired Wilcoxon signed-rank test to assess whether the blood glucose fluctuations during hospitalization were significant. The Wilcoxon rank sum test was used for comparison between groups (the t-test was used if the normal distribution was followed). Draw a multi-faceted paired scatter plot for display. The binary clinical outcomes (severe pneumonia, respiratory failure, ICU transfer, and death) were described by incidence rate (%) and 95% confidence interval (CI). Chi-square test or Fisher's exact test was used for comparison between groups (when the expected frequency was less than 5). Draw a bar chart with confidence intervals to show the incidence rate.

The total hospitalization cost, actual length of hospital stay, total length of stay in the ICU, duration of invasive mechanical ventilation and days of top-level care all showed a skewed distribution, described as M (P<sub>25</sub>, P<sub>75</sub>). The Wilcoxon rank sum test was used for comparison between groups, and the box plot or scatter plot was presented. Simple linear regression was used to evaluate the association between the actual length of hospital stay and the total ICU duration, and scatter plots and fitting lines were plotted. Spearman rank correlation analysis was used

to analyze the correlations among 17 major continuous variables, and a heat map of the correlation coefficients was drawn. The significance levels marked in the heat map are: \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ . For cases with missing key outcome variables, the missing values were directly excluded from the analysis without supplementation and statistics. The actual sample sizes of each analysis are marked in the figure. No additional sensitivity analysis was conducted.

## 2.6. Ethics and Quality Control

This study was a retrospective one and did not involve any interventional operations. Informed consent is exempted upon approval by the hospital ethics committee. All data extraction and analysis processes follow the principle of anonymization to protect patient privacy. Data entry adopts a two-person input and two-person verification method to ensure accuracy. To control confounding bias, a systematic comparison of the baseline data of the two groups was conducted to verify the comparability of the study samples before and after the intervention.

## 3. Results

### 3.1. Baseline Data Comparison

**Table 1** compared the distribution of nine consecutive baseline variables between the two groups through box plots, including age, duration of diabetes, HbA1c, WBC, CRP, PCT, PaO<sub>2</sub>, PaCO<sub>2</sub> and PSI score. In the box plot, red represents the traditional consultation management group, blue represents the hospital-wide blood glucose management group, and the rhombus marks indicate the mean values. The median and mean positions of each variable between the two groups were relatively close, and there was no obvious pattern in the distribution of outliers. The Wilcoxon rank sum test (t-test for small samples) was used for intergroup comparison. The results showed that there were no statistically significant differences in the 9 baseline variables between the two groups (all  $P > 0.05$ ), indicating

**Table 1.** Between-group comparison results for the nine baseline continuous variables.

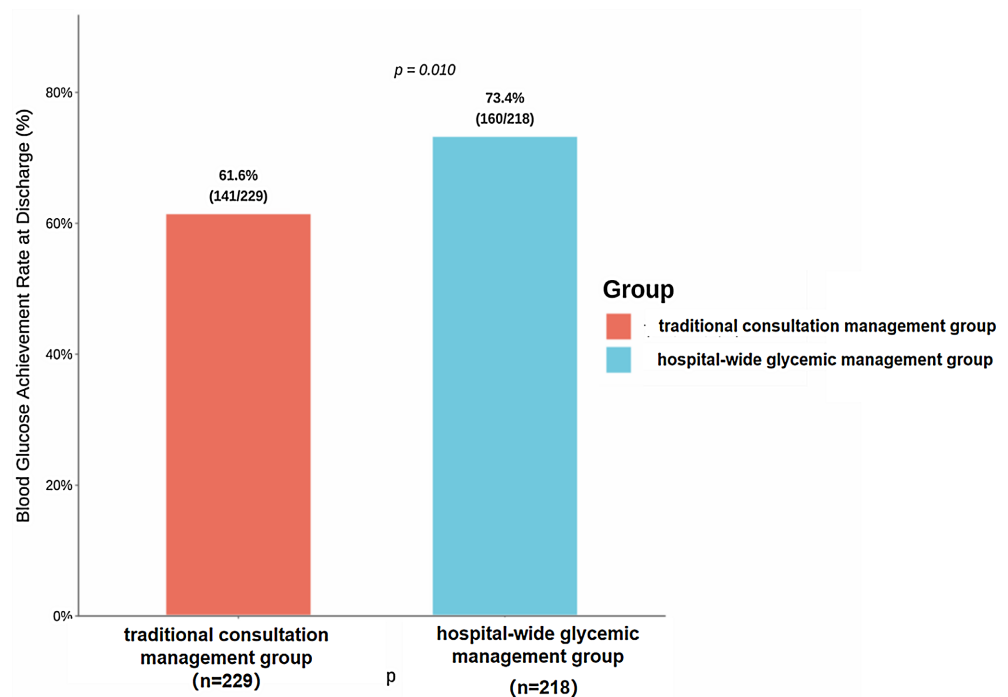
| No. | Baseline variable (unit)  | P-value | Between-group difference      | Baseline balance |
|-----|---------------------------|---------|-------------------------------|------------------|
| 1   | Age (years)               | 0.217   | Not statistically significant | Balanced         |
| 2   | Diabetes duration (years) | 0.624   | Not statistically significant | Balanced         |
| 3   | HbA1c (%)                 | 0.318   | Not statistically significant | Balanced         |
| 4   | WBC (10 <sup>9</sup> /L)  | 0.182   | Not statistically significant | Balanced         |
| 5   | CRP (mg/L)                | 0.421   | Not statistically significant | Balanced         |
| 6   | PCT (ng/ml)               | 0.233   | Not statistically significant | Balanced         |
| 7   | PaO <sub>2</sub> (mmHg)   | 0.646   | Not statistically significant | Balanced         |
| 8   | PaCO <sub>2</sub> (mmHg)  | 0.692   | Not statistically significant | Balanced         |
| 9   | PSI score                 | 0.230   | Not statistically significant | Balanced         |

that the baseline characteristics of the two groups were balanced and comparable.

### 3.2. Primary Outcomes

#### 3.2.1. Discharge Blood Glucose Target Achievement Rate

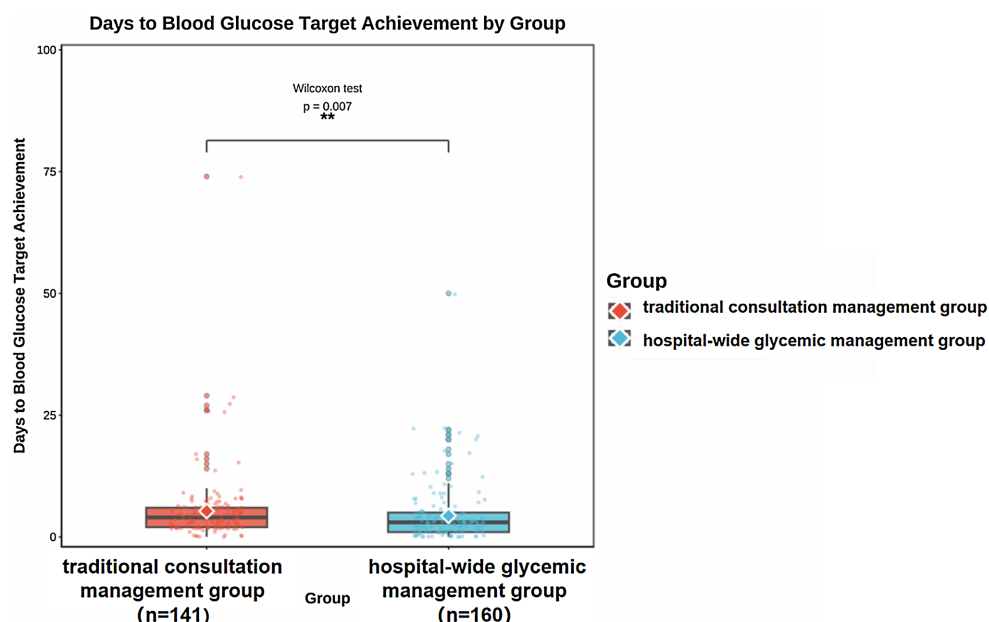
**Figure 1** shows the bar charts of the discharge blood glucose compliance rates of the two groups. The compliance rate of the traditional consultation management group was 61.6% (141/229), while that of the hospital-wide blood glucose management group was 73.4% (160/218), and the intervention group was approximately 11.8 percentage points higher. The chi-square test showed that the difference between the two groups was statistically significant ( $P = 0.010$ ), indicating that the hospital-wide blood glucose management model could significantly increase the rate of reaching the discharge blood glucose target for inpatients.



**Figure 1.** Comparison of discharge blood glucose target achievement rates between the two groups.

#### 3.2.2. Time to Blood Glucose Target Achievement

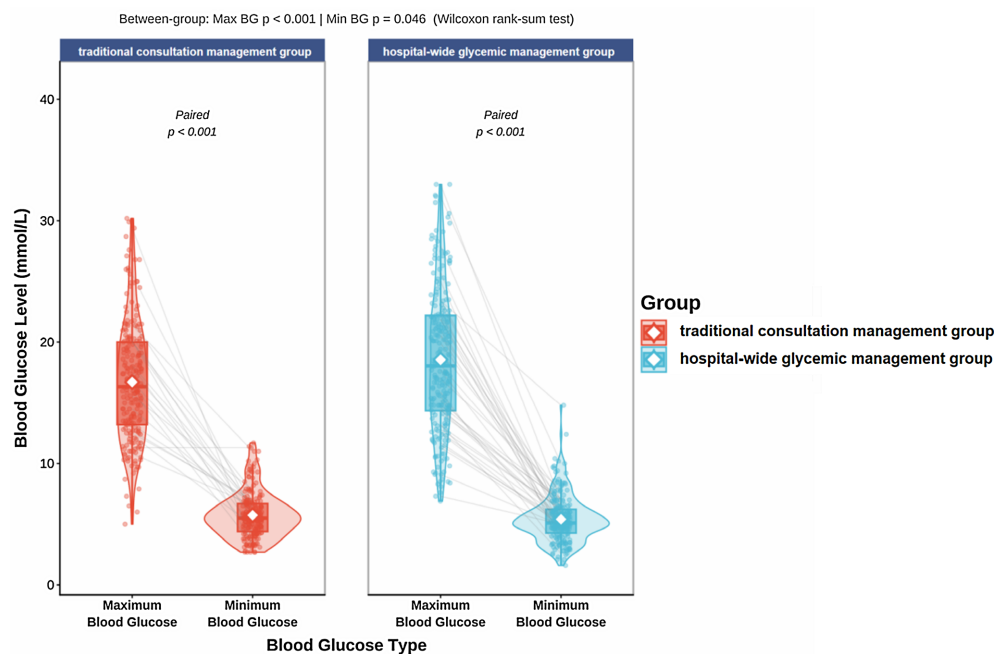
**Figure 2** shows the box plots of the time it takes for the two groups to reach the blood glucose target ( $n = 141$  for the traditional group;  $n = 160$  for the intervention group). Both groups showed a right-skewed distribution, with a relatively low median. However, outliers were present in both groups (the maximum value in the traditional group was approximately 75 days, and that in the intervention group was approximately 50 days). The Wilcoxon rank sum test showed that there was a statistically significant difference in the time to reach the blood glucose target between the two groups ( $P = 0.007$ ), suggesting that the hospital-wide blood glucose management model can shorten the time for inpatients to reach the blood glucose target.



**Figure 2.** Comparison of time to blood glucose target achievement distributions between the two groups.

### 3.2.3. Highest and Lowest Blood Glucose during Hospitalization

**Figure 3** uses a faceted paired scatter plot to show the distribution and pairing relationship of the highest and lowest blood glucose levels within each group. The highest blood glucose in both groups was significantly higher than the lowest blood glucose (paired with Wilcoxon signed-rank test, both  $P < 0.001$ ), indicating significant fluctuations in blood glucose during hospitalization. The comparison



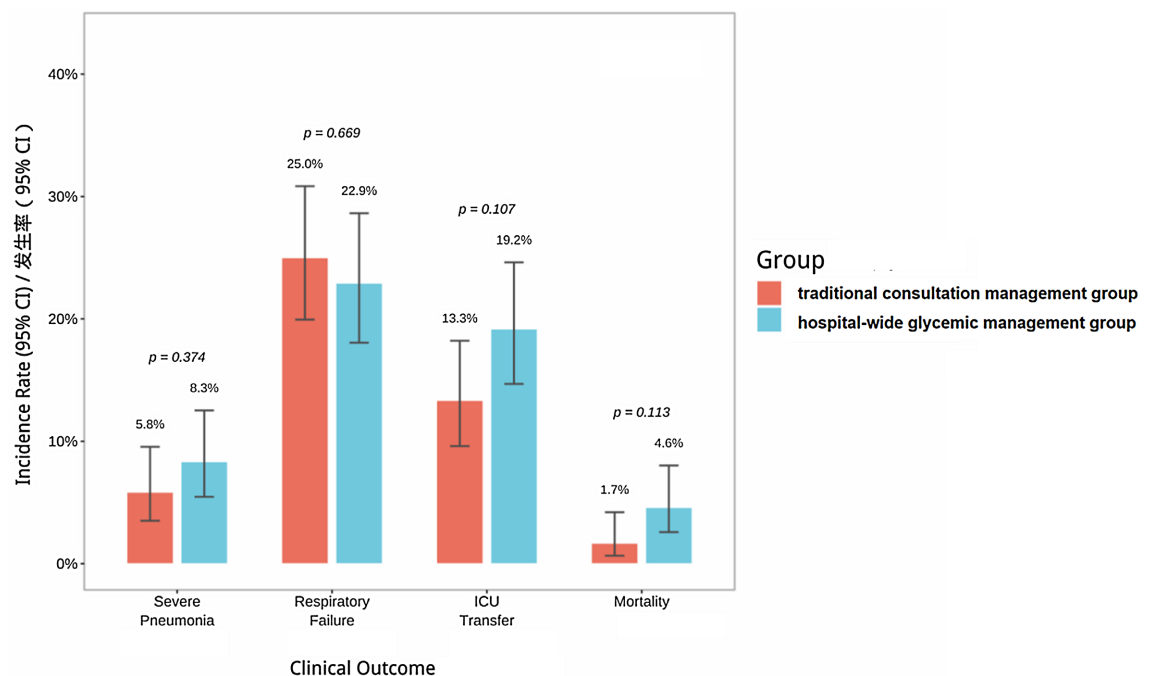
**Figure 3.** Paired scatter plots of highest and lowest blood glucose during hospitalization in the two groups.

between groups showed that the highest blood glucose in the hospital-wide blood glucose management group was significantly lower than that in the traditional consultation management group ( $P < 0.001$ ), and the difference in the lowest blood glucose was also statistically significant ( $P = 0.046$ ), suggesting that the peak blood glucose in the intervention group was lower and the overall blood glucose control was more stable.

### 3.3. Secondary Outcomes

#### 3.3.1. Binary Clinical Outcomes

**Figure 4** shows the incidence rates of severe pneumonia, respiratory failure, ICU transfer and death, as well as their 95% confidence intervals. By comparing the two groups, the incidence of severe pneumonia (8.3% vs. 5.8%), the rate of ICU transfer (19.2% vs. 13.3%), and the mortality rate (4.6% vs. 1.7%) in the hospital-wide blood glucose management group were slightly higher than those in the traditional consultation management group, while the incidence of respiratory failure was slightly lower (22.9% vs. 25.0%). Fisher's exact test showed that there were no statistically significant differences between the two groups in the four-item binary classification outcomes (severe pneumonia  $P = 0.374$ ; respiratory failure  $P = 0.669$ ; ICU transfer  $P = 0.107$ ; Death  $P = 0.113$ ), suggesting that the two management models have not shown significant differences in hard clinical endpoints such as severe pneumonia, respiratory failure, ICU transfer and death.

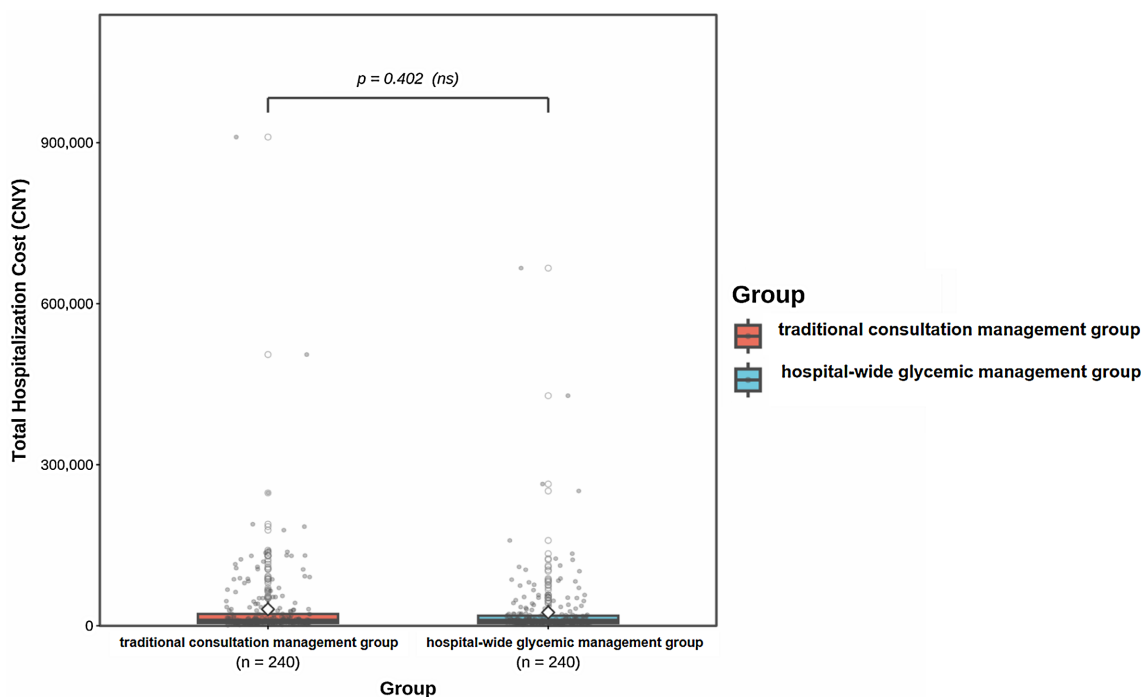


**Figure 4.** Comparison of incidence rates of binary clinical outcomes between the two groups.

#### 3.3.2. Total Hospitalization Costs

**Figure 5** shows the box plots of the total hospitalization expenses of the two groups of patients ( $n = 240$  for each group). The distribution of costs in both

groups was significantly skewed to the right. The highest cost of the traditional group was close to 900,000 yuan, while the outliers of the intervention group were concentrated below 650,000 yuan. The Wilcoxon rank sum test indicated that there was no statistically significant difference in the total hospitalization cost between the two groups ( $P = 0.402$ ), suggesting that the intervention measures did not significantly increase the economic burden of hospitalization.



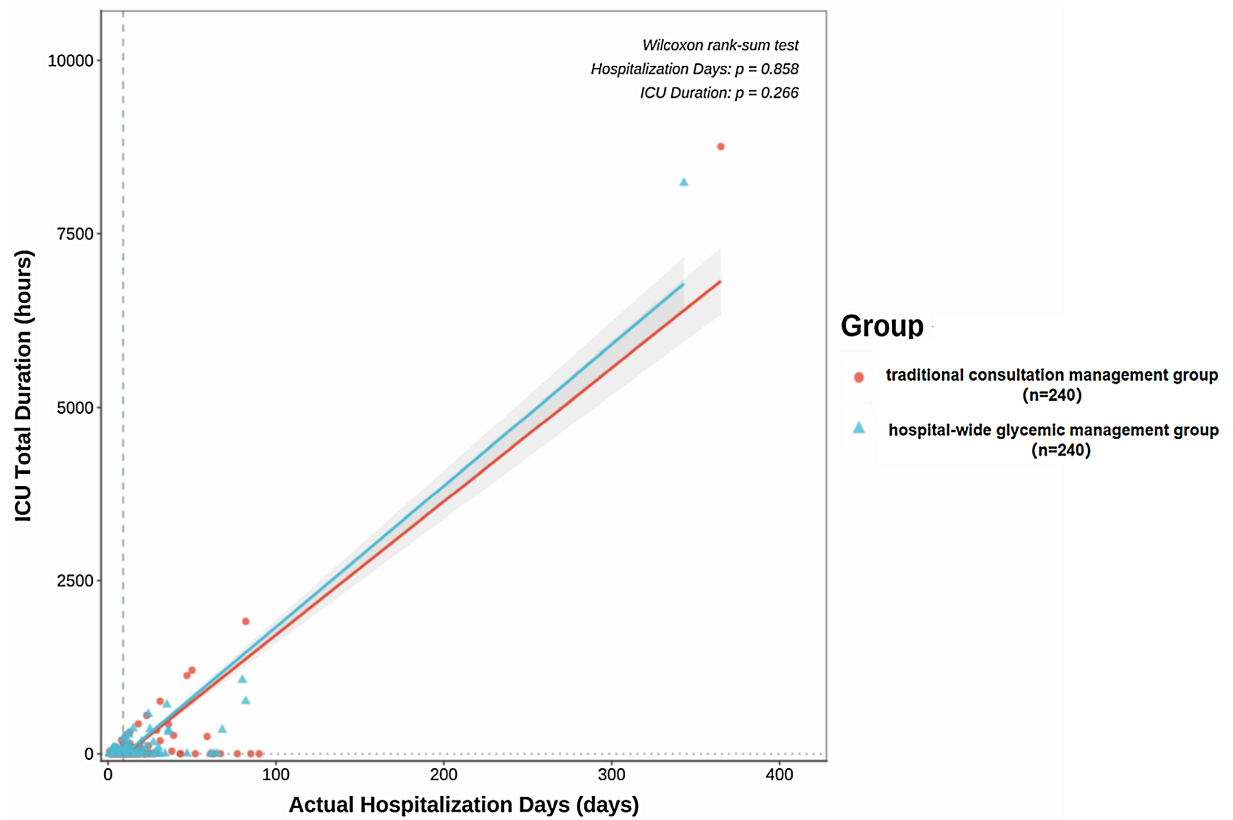
**Figure 5.** Box plots of total hospitalization cost distributions in the two groups.

### 3.3.3. Actual Length of Hospital Stay and ICU Duration

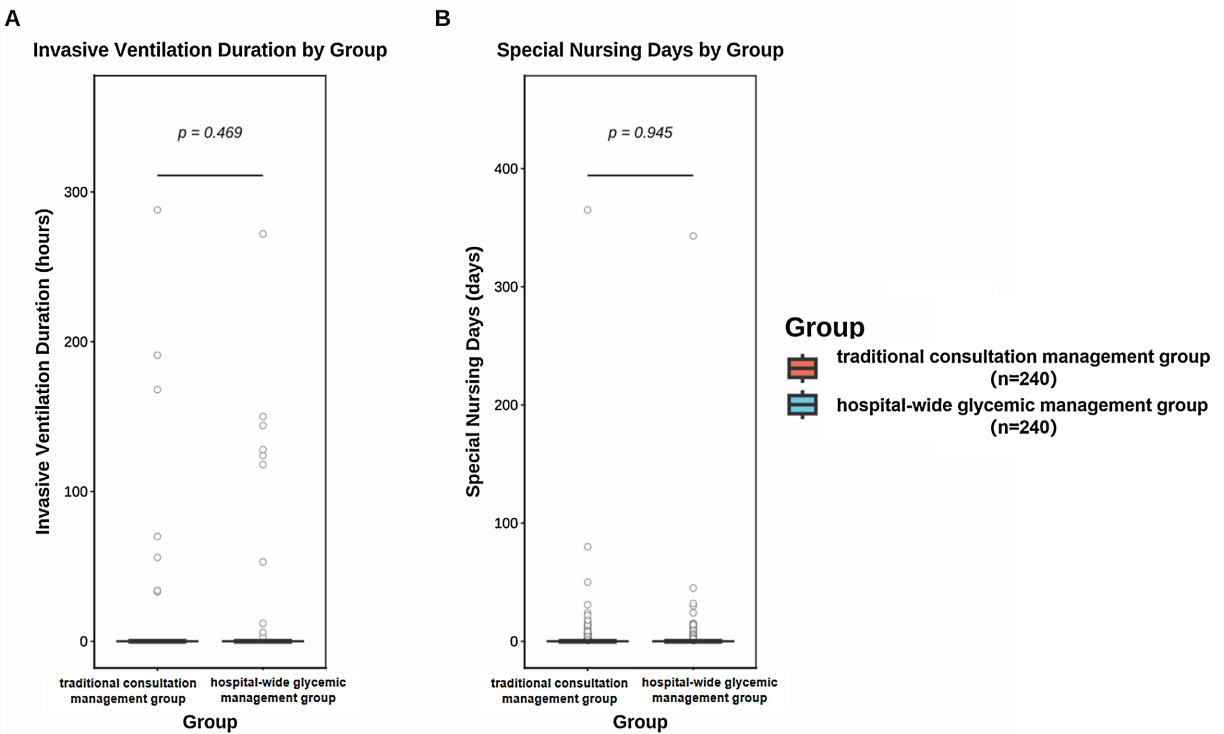
**Figure 6** presents the correlation trend between the actual length of hospital stay (d) and the total length of stay in the ICU (h) of the two groups of patients using a scatter plot. The data points are concentrated in areas with shorter hospital stays and shorter ICU durations, and there are a few extreme values. The linear regression fitting line shows that there is a significant positive correlation between the length of hospital stay and the duration in the ICU, and the trends of the two groups are consistent. Intergroup comparisons showed that there were no statistically significant differences between the two groups in terms of hospital stay ( $P = 0.858$ ) and total ICU duration ( $P = 0.266$ ) (**Figure 6**).

### 3.3.4. Duration of Invasive Mechanical Ventilation and Days of Special-Level Nursing Care

**Figure 7** uses a box plot to show the distribution of the duration of invasive mechanical ventilation (**Figure 7(A)**) and the number of days of top-level care (**Figure 7(B)**) between the two groups. Both groups showed a right-skewed distribution. The majority of patients had low values, while a few patients had high-value outliers. The Wilcoxon rank sum test indicated that there were no statistically



**Figure 6.** Scatter plots of actual length of hospital stay and total ICU duration in the two groups.

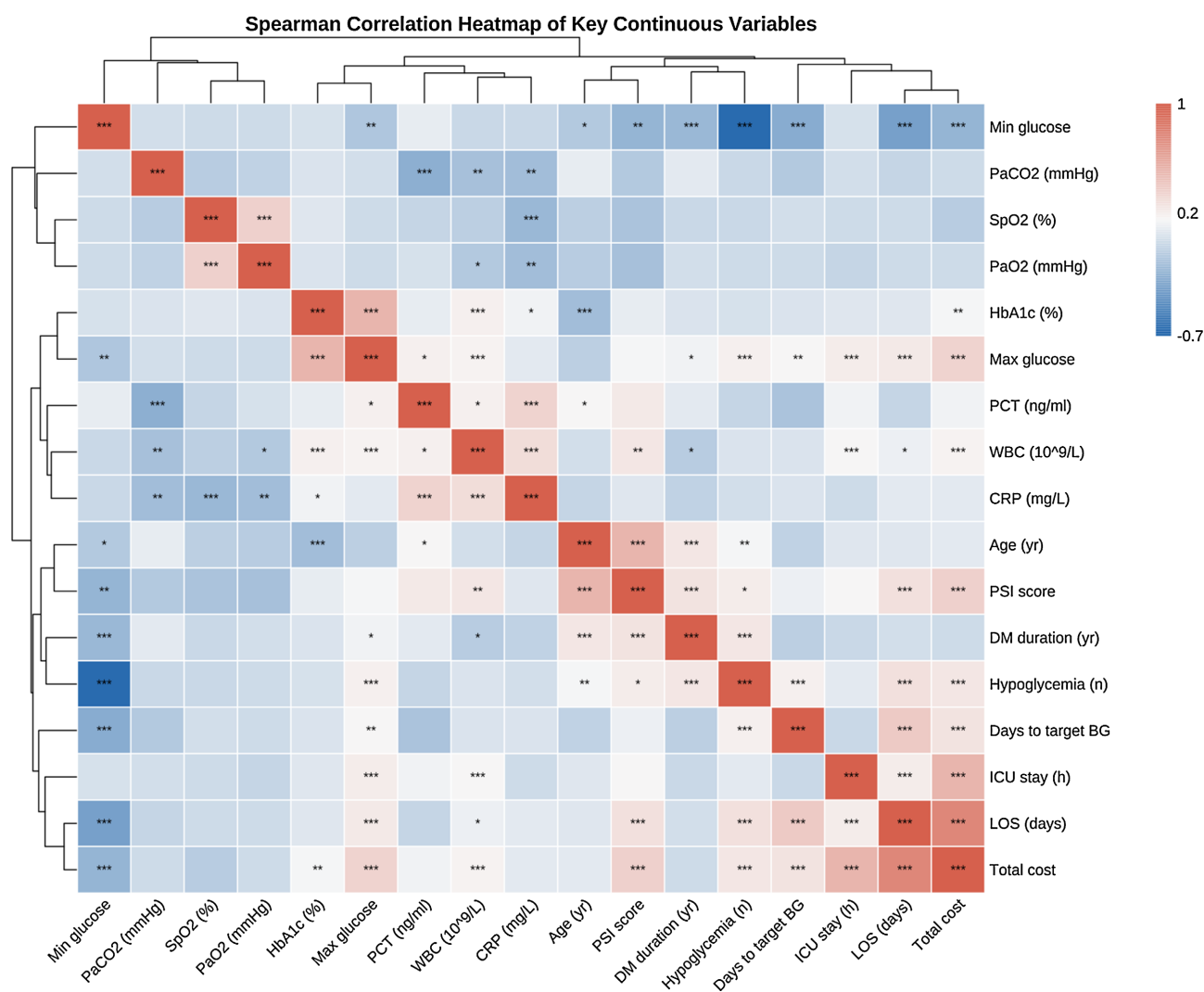


**Figure 7.** Box plots of between-group comparisons of duration of invasive mechanical ventilation and days of special-level nursing care.

significant differences in the duration of invasive mechanical ventilation ( $P = 0.469$ ) and the number of days of premium care ( $P = 0.945$ ) between the two groups, suggesting that the two management models were comparable in terms of the above resource utilization indicators (Figure 7).

### 3.4. Correlation Analysis

Figure 8 shows the heat map of Spearman correlation coefficients for 17 major continuous variables. It covers blood glucose indicators (maximum blood glucose, minimum blood glucose), inflammatory indicators (WBC, CRP, PCT), respiratory function indicators ( $SpO_2$ ,  $PaO_2$ ,  $PaCO_2$ ), metabolic indicators (HbA1c), clinical assessment indicators (age, PSI score, duration of diabetes) and prognostic indicators (frequency of hypoglycemia, time to reach the blood glucose target, duration in ICU). Time, actual length of hospital stay, total hospitalization expenses. The results show that there is a significant positive correlation between the total hospitalization cost, the actual length of hospital stay and the duration



**Figure 8.** Spearman correlation coefficient heatmap of major continuous variables.

of stay in the ICU. The lowest blood glucose was significantly positively correlated with the frequency of hypoglycemia. SpO<sub>2</sub> shows significant clustering associations with PaO<sub>2</sub> and PaCO<sub>2</sub>. There is a positive correlation trend among inflammatory indicators. The significance levels are marked in the figure (\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001) (**Figure 8**).

#### 4. Discussion

Community-acquired pneumonia (CAP) combined with type 2 diabetes mellitus (T2DM) is a common clinical situation. The two diseases promote each other, leading to prolonged hospital stays, increased ICU demand and elevated mortality [2]. T2DM increases the risk of CAP by approximately 64% [1], and once pneumonia occurs, diabetic patients tend to have more complex infections and stronger inflammatory responses [8] [9]. Infection stress can also disrupt the stability of blood glucose control, and the resulting blood glucose fluctuations further deteriorate clinical outcomes [3].

This single-center retrospective study took the hospital-wide implementation of an active blood glucose management program as the natural dividing point and compared it with the conventional consultation model in CAP patients with T2DM. Under the leadership of the endocrinology department, the active management model significantly increased the rate of reaching the discharge blood glucose target (73.4% vs. 61.6%), reached the target value more quickly, and reduced the peak blood glucose during hospitalization—without increasing the total cost. These findings are consistent with previous observations in COVID-19 patients with hyperglycemia [4]. The biological mechanism is reasonable: acute inflammation aggravates insulin resistance, while hyperglycemia intensifies oxidative stress and pulmonary inflammation, forming a self-reinforcing vicious cycle [5] [10]. Previous studies on the active management model have mainly focused on surgical and critically ill patients [4]. Therefore, the results of this study provide direct evidence for its value in CAP patients with diabetes for the first time. Given that early data have associated glucose variability with prolonged hospital stays in CAP patients [3], this improvement is of clinical significance.

Its practical significance is relatively clear. Among this vulnerable group, the traditional passive consultation model often fails to achieve continuous blood glucose control [11]. The proactive intervention model seems to be able to bridge this gap without consuming additional resources, which is particularly important in cost-constrained environments. Correlation analysis also revealed that the length of hospital stay, ICU days and hospitalization expenses changed in the same direction, while the lowest recorded blood glucose value was closely related to hypoglycemic events—this reminds us that stricter blood glucose control should not come at the cost of hypoglycemia [6]. No significant differences were observed in severe pneumonia, respiratory failure, ICU transfer or death, which may reflect the limited sample size and the dominant impact of CAP severity on these endpoint indicators [1] [2].

The values of ICU transfer rate and mortality rate in the intervention group were relatively high. Although they did not reach statistical significance, they still need to be treated with caution. The aggregation of inflammatory markers and their correlation with peak blood glucose support the view of hyperglycemic-inflammation interaction [10]; Theoretically, better blood sugar control should be able to weaken this interaction. However, the observed trend may reflect residual confounding or the J-curve effect, that is, aggressive blood glucose targets increase the risk of hypoglycemia, thereby partially offsetting the gains [5]. These uncertainties, coupled with the single-center retrospective design and the absence of outcome data, indicate the need for larger-scale prospective studies that incorporate propensity score matching, extended follow-up time, and endpoint indicators such as readmission, long-term mortality, and quality of life [11].

## 5. Limitations

This study has several limitations that need to be taken into account when interpreting the results. Firstly, although the retrospective before-and-after controlled design ensured comparability between groups through baseline data comparison, it still could not completely rule out the influence of selection bias and residual confounding factors. For instance, variables not included in the analysis, such as previous hypoglycemic regimens, combined medication, and dietary compliance, may all potentially interfere with the outcome of blood glucose control. Secondly, this study is a single-center design, with samples sourced from a specific diagnosis and treatment process in a single medical institution, which limits the generalizability of the results. The composition of cases and management plans may vary among different regions or hospitals of different grades. Thirdly, there are data omissions for key outcome variables (such as discharge blood glucose). The analysis adopted an exclusion strategy instead of multiple imputation, which may reduce the sample size and statistical power. Furthermore, the follow-up was only limited to the hospitalization period, without assessing the long-term blood glucose control after discharge, readmission rate and long-term mortality rate, making it difficult to comprehensively evaluate the sustained benefits of the intervention measures. Finally, no sensitivity analysis or subgroup analysis was conducted in this study to test the robustness of the results under different missing data processing methods and patient stratification. The reliability of the conclusion remains to be further verified.

## 6. Conclusion

Despite the above limitations, this study still provides valuable evidence-based support for blood glucose management in hospitalized CAP patients with T2DM. The research results show that, compared with the traditional consultation model, the hospital-wide active blood glucose management model can significantly increase the rate of reaching the discharge blood glucose target and shorten the time to reach the target blood glucose, without increasing hospitalization costs or

resource utilization. This suggests that this model is both effective and economically feasible in improving short-term blood glucose control. However, there were no significant differences between the two groups in hard clinical endpoints such as severe pneumonia, respiratory failure, ICU transfer and death. This might be related to the limited sample size, the relatively short intervention window and the dominant role of the severity of CAP itself in prognosis. Correlation analysis revealed the intrinsic connection among blood glucose fluctuations, inflammatory responses and resource consumption, providing clues for identifying high-risk patients in clinical practice. In the future, multi-center, prospective randomized controlled trials should be conducted to extend the follow-up period and incorporate long-term prognostic indicators. At the same time, the appropriate range of blood glucose targets should be further explored to more comprehensively evaluate the clinical value of the hospital-wide active blood glucose management model and promote the optimization and promotion of inpatient blood glucose management strategies.

### Funding

2025 Chronic Disease Management Research Project, Center for Capacity Building and Continuing Education, National Health Commission (Party School of the National Health Commission), Project No.: GWJJMB202510024040.

### Author Contributions

Shuhong Tan: Data curation (equal); formal analysis (equal); investigation (equal); project administration (equal); writing—original draft (lead). Jingying Zhou: Data curation (equal); formal analysis (equal); project administration (equal); writing—original draft (equal). Nenghua Tang, Chongrong Long and Sheng Li: Data curation (equal); project administration (equal). Yuting Yin, Xiaoxia Zou, Ying Wang, Linlin Tian, Qirui He, Ting Li, Qun Wu: Data curation (equal). Yingsha Li: Data curation (equal); formal analysis (equal); investigation (equal); project administration (equal); writing—review and editing (equal).

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

### References

- [1] Brunetti, V.C., Ayele, H.T., Yu, O.H.Y., Ernst, P. and Filion, K.B. (2021) Type 2 Diabetes Mellitus and Risk of Community-Acquired Pneumonia: A Systematic Review and Meta-Analysis of Observational Studies. *CMAJ Open*, **9**, E62-E70. <https://doi.org/10.9778/cmajo.20200013>
- [2] Kong, F., Zhang, L., Wang, R. and Ma, C. (2026) The Effect of Type 2 Diabetes on the Prognosis of Community-Acquired Pneumonia. *Frontiers in Endocrinology*, **17**, Article ID: 1878364. <https://doi.org/10.3389/fendo.2026.1878364>
- [3] Olsen, M.T., Dungu, A.M., Klarskov, C.K., Jensen, A.K., Lindegaard, B. and Kristensen, P.L. (2022) Glycemic Variability Assessed by Continuous Glucose Monitoring in

- Hospitalized Patients with Community-Acquired Pneumonia. *BMC Pulmonary Medicine*, **22**, Article No. 83. <https://doi.org/10.1186/s12890-022-01874-7>
- [4] He, X.D., Li, L.T., Wang, S.Q., Xiao, Y.Z., Ji, C. and Bi, Y. (2024) Role of Clinical Pharmacists in Multidisciplinary Collaborative Management of Blood Glucose in COVID-19 Patients with Hyperglycemia. *Research in Social and Administrative Pharmacy*, **20**, 65-71. <https://doi.org/10.1016/j.sapharm.2024.02.007>
  - [5] Luc, K., Schramm-Luc, A., Guzik, T.J. and Mikolajczyk, T.P. (2019) Oxidative Stress and Inflammatory Markers in Prediabetes and Diabetes. *Journal of Physiology and Pharmacology*, **70**, 809-824.
  - [6] Cheng, S., Hou, G., Liu, Z., Lu, Y., Liang, S., Cang, L., *et al.* (2020) Risk Prediction of In-Hospital Mortality among Patients with Type 2 Diabetes Mellitus and Concomitant Community-Acquired Pneumonia. *Annals of Palliative Medicine*, **9**, 3313-3325. <https://doi.org/10.21037/apm-20-1489>
  - [7] Zhou, H., Zhu, X., Zhang, Y., Xu, W. and Li, S. (2025) The Incremental Value of Aspartate Aminotransferase/Alanine Aminotransferase Ratio Combined with CURB-65 in Predicting Treatment Outcomes in Hospitalized Adult Community-Acquired Pneumonia Patients with Type 2 Diabetes Mellitus. *BMC Pulmonary Medicine*, **25**, Article No. 26. <https://doi.org/10.1186/s12890-025-03488-1>
  - [8] Fang, Y., Wang, M., Wang, H., Xiao, S., Jie, Z., Xiong, W., *et al.* (2026) Pathogens and Clinical Characteristics of Type 2 Diabetes Mellitus in Patients with Community-Acquired Pneumonia via Bronchoalveolar Lavage Fluid (BALF) Metagenomic Next-Generation Sequencing: A Comparative Observational Study. *Journal of Thoracic Disease*, **18**, Article No. 870. <https://doi.org/10.21037/jtd-2026-0909>
  - [9] Liu, B.Y., Zhang, D., Fan, Z., Jin, J., Li, C., Guo, R., *et al.* (2024) Role of Clinical Features, Pathogenic and Etiological Characteristics of Community-Acquired Pneumonia with Type 2 Diabetes Mellitus in Early Diagnosis. *Endocrine, Metabolic & Immune Disorders—Drug Targets*, **24**, 958-966. <https://doi.org/10.2174/0118715303273741231117060753>
  - [10] Gusev, E., Sarapultsev, A. and Zhuravleva, Y. (2026) Insulin Resistance and Inflammation. *International Journal of Molecular Sciences*, **27**, Article No. 1237. <https://doi.org/10.3390/ijms27031237>
  - [11] Yang, H., Yue, R., Zhou, J., Zeng, Z., Wang, L., Long, X., *et al.* (2020) Study on Metabonomics of Chinese Herbal Medicine in the Treatment of Type 2 Diabetes Mellitus Complicated with Community-Acquired Pneumonia. *Medicine (Baltimore)*, **99**, e22160. <https://doi.org/10.1097/md.00000000000022160>