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ORIGINAL RESEARCH

# Unmet Needs of Glycaemic Control and Risk Factors of Residual Hyperglycaemia in a Chinese Population with Type 2 Diabetes Initiating Basal Insulin: A Post Hoc Analysis of the FPG GOAL Study

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## ABSTRACT

***Introduction***: To aim of this analysis was to investigate the extent and evaluate risk factors of residual hyperglycaemia in Chinese individuals with type 2 diabetes (T2D) initiating basal insulin.

***Methods***: FPG GOAL was a 24-week, open-label, treat-to-target randomised controlled trial in Chinese individuals with T2D inadequately controlled with oral anti-hyperglycaemic drugs initiating treatment with basal insulin. This analysis categorised participants into the following glycaemic control categories: hyperglycaemia [glycated haemoglobin (HbA1c) $\geq$ 53 mmol/mol ($\geq$ 7%), fasting plasma glucose (FPG) $\geq$ 7.0 mmol/L], residual hyperglycaemia [HbA1c $\geq$ 53 mmol/mol ($\geq$ 7%), FPG $<$ 7.0 mmol/L], discordant [HbA1c $<$ 53 mmol/mol ($<$ 7%), FPG $\geq$ 7.0 mmol/L] and at target [HbA1c $<$ 53 mmol/mol ($<$ 7%), FPG $<$ 7.0 mmol/L]. The proportion of participants in each glycaemic control category was assessed at weeks 12 and 24. Multivariable regression analyses were conducted to evaluate risk factors for residual hyperglycaemia.

***Results***: Of the 914 participants included, 22.1% had residual hyperglycaemia, 31.9% had hyperglycaemia, 11.1% were discordant and 29.3% were at target at week 24. More participants who were randomised to a fasting blood glucose (FBG) target of $>$ 3.9 to $\leq$ 5.6 mmol/L had residual hyperglycaemia compared with participants randomised to a FBG target of $>$ 3.9 to $\leq$ 6.1 mmol/L or $>$ 3.9 to $\leq$ 7.0 mmol/L. Multivariable analysis indicated that higher HbA1c and lower FPG levels at baseline were associated with greater proportion of residual hyperglycaemia.

***Conclusion***: Some Chinese individuals with T2D may have residual hyperglycaemia 3–6 months after initiating basal insulin treatment and require further intensified treatment. Higher HbA1c and lower FPG levels could be risk factors for residual hyperglycaemia.

***Trial Registration***: ClinicalTrials.gov identifier NCT02545842.

**Keywords:** China; Fasting blood glucose; Glycated haemoglobin; Insulin glargine 100 U/mL; Residual hyperglycaemia; Type 2 diabetes

**Supplementary Information** The online version contains supplementary material available at https://doi.org/10.1007/s12325-022-02128-y.

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**Key Summary Points**

Chinese subjects with type 2 diabetes (T2D) (approx. 30%) still do not achieve target haemoglobin A1c (HbA1c) with basal insulin despite meeting fasting blood glucose (FBG) targets (i.e. have residual hyperglycaemia) because of the influence of both postprandial glucose (PPG) and fasting plasma glucose (FPG) on HbA1c.

Higher baseline HbA1c and lower FPG levels are risk factors for residual hyperglycaemia.

A lower FBG target ($\leq$ 5.6 mmol/L or $\leq$ 6.1 mmol/L compared to $\leq$ 7.0 mmol/L) may not be able to help reduce the incidence of residual hyperglycaemia in Chinese subjects with T2D initiating basal insulin.

Medication with PPG-lowering effect could help to improve residual hyperglycaemia if combined with basal insulin.

## INTRODUCTION

Early intervention to reach and maintain glycaemic control is crucial in people with type 2 diabetes (T2D). While there are various methods used to measure glycaemic control, glycated haemoglobin (HbA1c) remains the standard and preferred marker. HbA1c is an indication of blood glucose exposure from a combination of both postprandial plasma glucose (PPG) and fasting plasma glucose (FPG); however, the influence of both PPG and FPG on HbA1c can vary greatly among individuals [1–5].

Most T2D treatment guidelines recommend that HbA1c is kept below a certain target, typically 53 mmol/mol (7%) [6–9]. For people who fail to meet HbA1c targets despite treatment with oral anti-hyperglycaemic drugs (OADs), basal insulin titrated by FPG is widely used [7–10]. However, some individuals with T2D are not successful in achieving target HbA1c with basal insulin despite meeting FPG targets because of the aforementioned influence of both PPG and FPG on HbA1c. Guidelines from the Chinese Diabetes Society recommend to change the insulin regimen an individual is receiving if their FPG is well controlled but HbA1c is not at target after 3 months [11]. The identification of these people is important to ensure that treatment can be adjusted promptly as additional treatment may be required to address residual hyperglycaemia associated with PPG excursions [1, 2, 12, 13].

There are many differences in the development and progression of T2D in Asian and non-Asian individuals [14–18]. While Asian adults generally have a lower body mass index (BMI), an Asian person is more likely to have greater visceral adiposity than a non-Asian person of the same age and sex [14]. Compared with non-Asian individuals with T2D, Asian people tend to have a more rapid deterioration in β cell function and a greater insulin resistance [15–18]. Furthermore, Asian individuals typically have a carbohydrate-rich diet, which leads to more pronounced PPG excursions [19] due to the high glycaemic load associated with these diets [20–22]. As a result of these unique genetic, clinical and dietary characteristics, customised treatment strategies are recommended for Asian individuals with T2D.

FPG GOAL was a 24-week open-label, treat-to-target randomised controlled trial (RCT) in Chinese individuals with T2D initiating treatment with basal insulin [23]. This study demonstrated that a self-monitored fasting blood glucose (FBG) of 3.9–6.1 mmol/L may be the optimal target range to achieve an HbA1c < 53 mmol/mol (< 7%) after the initiation of basal insulin treatment while minimizing the risk of hypoglycaemia [23]. The aim of this analysis was to investigate the extent of residual hyperglycaemia during the FPG GOAL study and to evaluate the risk factors of residual hyperglycaemia in Chinese patients with T2D initiating basal insulin therapy.

# METHODS

## Study Design

The study design and methods for the FPG GOAL study (ClinicalTrials.gov identifier NCT02545842) have been reported previously [23, 24]. Briefly, FPG GOAL enrolled individuals with T2D and an HbA1c > 53 mmol/mol (> 7.0%) to ≤ 91 mmol/mol (≤ 10.5%) and FPG > 7 mmol/L despite receiving stable doses of 1–3 OADs for at least 3 months. Participants were randomly assigned (1:3:3) to one of three self-monitored FBG target groups: > 3.9 to ≤ 5.6 mmol/L, > 3.9 to ≤ 6.1 mmol/L, or > 3.9 to ≤ 7.0 mmol/L. Subcutaneous once-daily insulin glargine 100 U/mL (Lantus® SoloSTAR®, Sanofi-Aventis Deutschland GmbH, Frankfurt, Germany) was initiated at a dose of 0.2 U/kg and was titrated over the 24-week treatment period using a pre-defined titration algorithm.

The study was conducted in accordance with the principles stated in the Declaration of Helsinki and in line with the International Conference on Harmonization guidelines for good clinical practice. An institutional review board at each site approved the study, and all participants gave written informed consent.

## Assessments

The primary endpoint of FPG GOAL study was the proportion of participants achieving an HbA1c < 53 mmol/mol (< 7%) at 24 weeks [23, 24]. Secondary endpoints included the change from baseline in HbA1c, FPG, PPG and PPG excursions, body weight and BMI at 24 weeks.

In this analysis, participants were categorised according to four glycaemic control categories: (1) hyperglycaemia—defined as an HbA1c ≥ 53 mmol/mol (≥ 7%) and a FPG ≥ 7.0 mmol/L; (2) residual hyperglycaemia—defined as an HbA1c ≥ 53 mmol/mol (≥ 7%) and a FPG < 7.0 mmol/L; (3) discordant—defined as an HbA1c < 53 mmol/mol (< 7%) and a FPG ≥ 7.0 mmol/L; and (4) at target—defined as an HbA1c < 53 mmol/mol (< 7%) and a FPG < 7.0 mmol/L.

The proportion of study participants in each glycaemic control category was assessed at weeks 12 and 24. Differences in baseline characteristics between them were also assessed. Finally, risk factors for participants who will have residual hyperglycaemia after basal insulin titration were also evaluated.

## Statistical Analysis

All statistical analyses were conducted using SAS Enterprise Guide 7.1 (®SAS Institute Inc.). Participant demographics and clinical characteristics were summarised using descriptive statistics. Categorical variables were presented as number of cases (*n*) and percentages. Continuous variables were presented as median with interquartile range (IQR), depending on the skew distribution.

Odds ratio (ORs) and 95% confidence intervals (CIs) were calculated to evaluate risk factors of residual hyperglycaemia at week 24 in all included study participants. Multivariable analysis was conducted by using a logistic regression model to account for the relationship of binary outcome (with versus without residual hyperglycaemia at week 24). The risk factors, based on literature reviews and clinical knowledge, included demographic and baseline characteristics age, sex, BMI, duration of diabetes, OAD category, medical history, as well as baseline HbA1c, FPG, PPG, PPG excursion values and FBG target group. For all tests, a $p$ value less than 0.05 was considered statistically significant.

# RESULTS

## Participants

Of the 947 participants randomised in FPG GOAL, 914 were included in this analysis. The demographics and characteristics of the individuals included in FPG GOAL have been published in full [23], but briefly participants had a median age of 55 (IQR 49–60) years and a median duration of diabetes of 7 (IQR 4–10)

**Table 1** Baseline characteristics in overall population and by glycaemic control category at week 24

| | Overall | Week-24 glycaemic control category | | | |
|---|---|---|---|---|---|
| | | Hyperglycaemia | Residual hyperglycaemia | At target | Discordant |
| | (*N* = 914) | (*N* = 292) | (*N* = 202) | (*N* = 268) | (*N* = 101) |
| Age, years | 55.0 (49.0–60.0) | 54.0 (49.0–60.0) | 56.0 (51.0–61.0) | 55.0 (49.0–59.0) | 54.0 (47.0–60.0) |
| Men, *n* (%) | 514 (56.2) | 157 (53.8) | 108 (53.5) | 158 (59.0) | 61 (60.4) |
| Body weight, kg | 70.0 (62.1–77.2) | 69.0 (61.0–76.3) | 70.0 (61.0–76.6) | 69.5 (63.0–78.0) | 70.5 (63.0–76.5) |
| BMI, kg/m$^2$ | 25.3 (23.4–27.5) | 25.1 (23.3–27.5) | 25.3 (23.5–27.0) | 25.4 (23.7–27.8) | 24.8 (23.6–27.2) |
| Duration of diabetes, years | 7.0 (4.0–10.0) | 8.0 (4.0–11.0) | 8.0 (5.0–11.0) | 7.0 (3.0–10.0) | 7.0 (4.0–11.0) |
| Medical history, *n* (%) | 154 (16.8) | 50 (17.1) | 37 (18.3) | 46 (17.2) | 14 (13.9) |
| OAD count, *n* (%)[a] | | | | | |
| 1 | 135 (14.8) | 36 (12.3) | 28 (13.9) | 42 (15.7) | 19 (19.0) |
| 2 | 588 (64.5) | 188 (64.4) | 139 (68.8) | 165 (61.8) | 64 (64.0) |
| 3 | 189 (20.7) | 68 (23.3) | 35 (17.3) | 60 (22.5) | 17 (17.0) |
| AGI use, *n* (%) | 345 (37.7) | 118 (40.4) | 72 (35.6) | 100 (37.3) | 37 (36.6) |
| Biguanides use, *n* (%) | 731 (80.0) | 236 (80.8) | 162 (80.2) | 221 (82.5) | 76 (75.2) |
| DPP4 inhibitors use, *n* (%) | 60 (6.6) | 19 (6.5) | 7 (3.5) | 20 (7.5) | 10 (9.9) |
| Sulfonylureas use, *n* (%) | 568 (62.1) | 185 (63.4) | 130 (64.4) | 158 (59.0) | 64 (63.4) |
| Thiazolidinediones use, *n* (%) | 65 (7.1) | 21 (7.2) | 13 (6.4) | 24 (9.0) | 1 (1.0) |
| Glinides use, *n* (%) | 108 (11.8) | 35 (12.0) | 26 (12.9) | 29 (10.8) | 12 (11.9) |
| HbA1c, % | 8.5 (7.8–9.4) | 8.9 (8.2–9.6) | 8.6 (7.9–9.4) | 8.1 (7.6–9.0) | 8.1 (7.4–8.8) |
| FPG, mmol/L | 10.2 (8.8–11.8) | 10.8 (9.4–12.4) | 10.0 (8.5–11.7) | 9.8 (8.6–11.3) | 9.7 (8.8–12.2) |
| PPG, mmol/L[b] | 13.4 (11.2–16.0) | 13.9 (11.7–16.9) | 13.8 (11.5–15.8) | 12.9 (10.6–15.3) | 13.1 (10.7–16.4) |
| PPG excursion, mmol/L[c] | 4.0 (2.0–6.1) | 4.1 (2.2–6.3) | 4.5 (2.4–6.3) | 3.8 (1.6–5.8) | 3.9 (1.9–6.2) |

All values are given as median (interquartile range) unless otherwise stated
*AGI* alpha-glucosidase inhibitors, *BMI* body mass index, *DDP4* dipeptidyl peptidase 4, *FPG* fasting plasma glucose, *HbA1c* glycated haemoglobin, *OAD* oral anti-hyperglycaemic drugs, *PPG* postprandial glucose
[a]Overall $N = 912$, at target $N = 267$, discordant $N = 100$
[b]Overall $N = 866$, hyperglycaemia $N = 278$, residual hyperglycaemia $N = 192$, at target $N = 254$, discordant $N = 94$
[c]Overall $N = 843$, hyperglycaemia $N = 267$, residual hyperglycaemia $N = 189$, at target $N = 250$, discordant $N = 92$

years (Table 1). Fifty-six percent of participants were men.

After 24 weeks of treatment, significant changes from baseline in HbA1c, FPG and PPG were observed in the overall population [23].

The baseline characteristics and demographics by 24-week glycaemic control categories are also presented in Table 1. All participants had hyperglycaemia at baseline. Participants who had residual hyperglycaemia or hyperglycaemia at week 24 typically had higher baseline HbA1c levels than those who were at target (median [IQR] HbA1c at week 24, 71 [63–79] mmol/mol (8.6% [7.9–9.4]) and 74 [66–81] mmol/mol (8.9% [8.2–9.6]) vs 65 [60–75] mmol/mol (8.1% [7.6–9.0]), respectively; Table 1). Furthermore, baseline FPG (10.0 [8.5–11.7] mmol/L and 10.8 [9.4–12.4] mmol/L vs 9.8 [8.6–11.3] mmol/L) and PPG (13.8 [11.5–15.8] mmol/L and 13.9 [11.7–16.9] mmol/L vs 12.9 [10.6–15.3] mmol/L) levels were also higher in participants with hyperglycaemia and residual hyperglycaemia at week 24 compared with participants who were at target at week 24.

## Glycaemic Control Categories at Weeks 12 and 24

At week 12, 264 (28.9%) participants had residual hyperglycaemia, 267 (29.2%) had hyperglycaemia, 84 (9.2%) had discordant HbA1c and FPG levels and 247 (27.0%) had both HbA1c and FPG levels at target (Fig. 1). At week 24, the number of participants with residual hyperglycaemia reduced to 202 (22.1%), while the number of participants with hyperglycaemia increased to 292 (31.9%; Fig. 1).

As reported in the original publication, an optimal FBG target to reach HbA1c target for most Chinese patients initiating basal insulin appears to be 3.9–6.1 mmol/L [23]. This conclusion was also confirmed in this analysis with the highest proportion of participants (33.8%) reaching both HbA1c and FPG target at week 24 (Supplementary Fig. 1).

In line with the results observed in the overall population, the proportion of participants with residual hyperglycaemia decreased from week 12 to week 24, irrespective of their FBG target (Supplementary Fig. 1A, B, C).

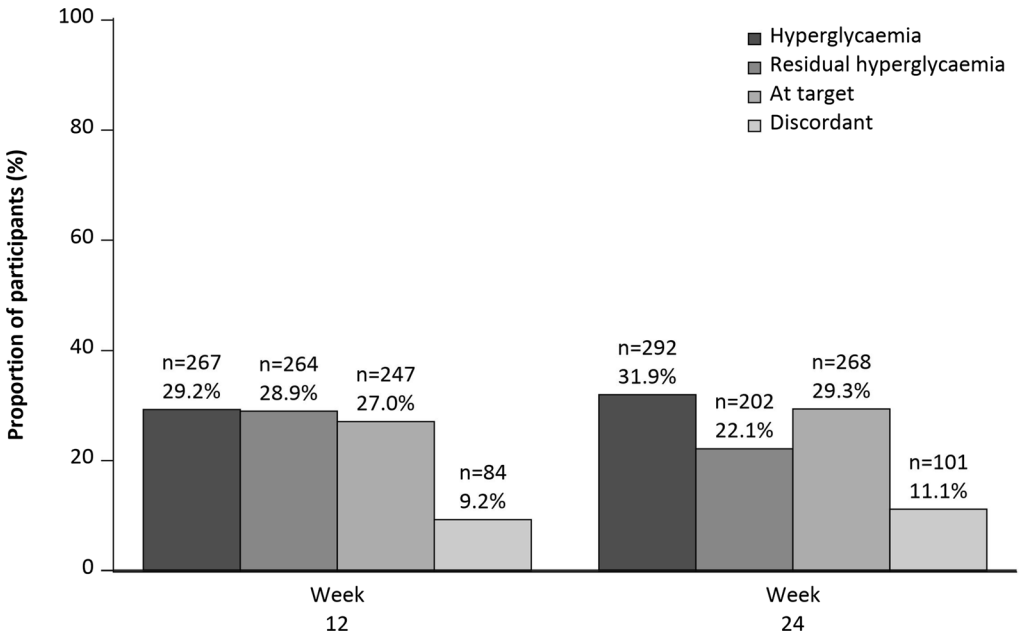


**Fig. 1** Proportion of participants by glycaemic control categories at weeks 12 and 24

**Table 2** Association of baseline characteristics and week-24 residual hyperglycaemia status ($N = 715$[a])

| | Multivariable analysis | | |
|---|---|---|---|
| | **OR** | **(95% CI)** | ***P* value** |
| FBG target, mmol/L | | | |
| ≤ 5.6 vs ≤ 7.0 | 1.20 | (0.71–2.03) | 0.49 |
| ≤ 6.1 vs ≤ 7.0 | 1.06 | (0.73–1.54) | 0.76 |
| Age, years (> 55 vs ≤ 55) | 1.24 | (0.86–1.77) | 0.25 |
| Sex (female vs male) | 1.10 | (0.77–1.56) | 0.61 |
| BMI, kg/m$^2$ | | | |
| 24–27.9 vs < 24 | 1.27 | (0.86–1.89) | 0.23 |
| ≥ 28 vs < 24 | 0.88 | (0.52–1.50) | 0.64 |
| Duration of diabetes, years | | | |
| 5–10 vs ≤ 5 | 1.50 | (0.97–2.30) | 0.07 |
| ≥ 10 vs ≤ 5 | 1.26 | (0.80–1.97) | 0.32 |
| Medical history (yes vs no) | 1.02 | (0.65–1.61) | 0.92 |
| AGI use (yes vs no) | 0.80 | (0.52–1.22) | 0.29 |
| Biguanides use (yes vs no) | 0.81 | (0.49–1.34) | 0.41 |
| DPP4 inhibitors use (yes vs no) | 0.47 | (0.20–1.11) | 0.09 |
| Sulfonylureas use (yes vs no) | 1.08 | (0.71–1.66) | 0.71 |
| Thiazolidinediones use (yes vs no) | 0.61 | (0.28–1.34) | 0.22 |
| Glinides use (yes vs no) | 1.26 | (0.70–2.28) | 0.44 |
| HbA1c, % | 1.39 | (1.11–1.73) | < 0.01 |
| FPG, mmol/L | 0.88 | (0.79–0.97) | < 0.01 |
| PPG, mmol/L | 0.93 | (0.86–1.01) | 0.10 |
| PPG excursion, mmol/L | | | |
| 3–5 vs ≤ 3 | 1.37 | (0.83–2.25) | 0.22 |
| ≥ 5 vs ≤ 3 | 1.74 | (0.95–3.21) | 0.08 |

[a]Excluding participants with missing values ($n = 163$)

*AGI* alpha-glucosidase inhibitors, *BMI* body mass index, *CI* confidence interval, DDP4 dipeptidyl peptidase 4, *FBG* fasting blood glucose, *FPG* fasting plasma glucose, *HbA1c* glycated haemoglobin, *OR* odds ratio, *PPG* postprandial glucose

### Risk Factors for Residual Hyperglycaemia

Descriptive analysis showed that participants were more likely to have residual hyperglycaemia if they were older and had a lower baseline FPG (Supplementary Table 1). Patients treated with DPP4i were less likely to have residual hyperglycaemia at the end of the treatment (Supplementary Table 1). Multivariable analysis showed that only higher baseline HbA1c (OR 1.39, 95% CI [1.11–1.73], $p < 0.01$)

and lower FPG levels (OR 0.88, 95% CI [0.79–0.97], $p < 0.01$) are significant risk factors (Table 2).

## DISCUSSION

This analysis of the FPG GOAL study revealed that residual hyperglycaemia was present after 12 weeks in 28.9% and after 24 weeks in 22.1% of Chinese individuals with T2D initiating basal insulin glargine 100 U/mL titrated to achieve three different self-monitored FBG targets. In this study, the proportion of individuals with residual hyperglycaemia reduced between weeks 12 and 24, irrespective of the FBG target the individual was randomised to. However, a lower FBG target is not related to the improvement of residual hyperglycaemia. Multivariable analysis evaluated risk factors for residual hyperglycaemia including baseline higher HbA1c and lower FPG levels.

The prevalence of residual hyperglycaemia with insulin treatment in clinical trials in people with T2D has been varied. An analysis conducted by Raccah and colleagues of several RCTs and real-world data found that 42.7–54.4% of clinical trial participants and 23.9–35.6% of individuals from real-world studies had residual hyperglycaemia while receiving basal insulin [25]. The prevalence of residual hyperglycaemia observed in this analysis is in line with that observed by Raccah and colleagues.

In the analysis by Raccah and colleagues, high baseline HbA1c was a consistent risk factor of residual hyperglycaemia in RCTs, with female sex as a risk factor in Europe, Latin populations and in two individual countries (China and Germany), but not in the overall Asian population. The observation of higher HbA1c as a consistent risk factor is confirmed in our study [25]. Female sex is not correlated with residual hyperglycaemia in this study, which differs from the previous study [25]. The relationship of female gender and glycaemic control is also varied in previous studies [26, 27].

HbA1c was more attributable to PPG when HbA1c was closer to normal level while FPG makes a relatively greater contribution to high HbA1c [28], suggesting a patient with high HbA1c should benefit from FPG improvement by basal insulin. However, patients with high baseline HbA1c would need a greater FPG improvement to achieve optimal glycaemic control and thus may lead to more residual hyperglycaemia.

A lower FPG at baseline was a risk factor of residual hyperglycaemia in this analysis, which differs from a previous publication [25]. This may be partly explained by the design of the FPG GOAL study, where participants initiating insulin glargine 100 U/mL were randomised to different target FBG goals. Participants with lower baseline FPG levels would, in theory, require less insulin to achieve their FBG target level, which could explain why their HbA1c did not decrease to < 53 mmol/mol (< 7%).

Previous study comparing residual hyperglycaemia in RCT and electronic medical record (EMR) data showed that residual hyperglycaemia was more frequent while both uncontrolled FPG and HbA1c were less in RCTs compared with real-world settings in patients treated with basal insulin [25], suggesting the better titration of basal insulin in RCTs to meet FPG targets. In our study, a lower FBG target for titration is not related to the improvement of residual hyperglycaemia, reflecting that this approach may be helpful to fully demonstrate the efficacy of basal insulin, but not helpful to improve glycaemic control further in patients with residual hyperglycaemia.

The effect of DPP4i in this study suggests that in individuals who have not achieved glycaemic targets in the 3–6 months after initiating basal insulin, adding glucagon-like peptide 1 (GLP-1)-based therapy may be an appropriate regimen change to achieve these glycaemic targets [29, 30]. This is also consistent with the mechanism of GLP-1 therapy to mainly improve PPG by increasing insulin secretion and delaying gastric empty [31]. This approach of combining basal insulin and GLP-1RA is also supported by a previous study in an Asian population [32]. In an RCT comparing fixed-ratio combination of insulin glargine and lixisenatide (iGlarLixi) versus insulin glargine, in Japanese individuals with insufficiently controlled T2D on basal insulin and OADs [33],

iGlarLixi significantly improved residual hyperglycaemia compared to insulin glargine. Interestingly, the result was analysed in patients treated with or without DPP4i and the reduction in residual hyperglycaemia with iGlarLixi was similar irrespective of prior DPP4i use [32], suggesting the approach of combing basal insulin and GLP-1RA still can be considered even if patients were previously treated with DPP4i.

Again, this supports the idea that individuals with T2D and a high baseline HbA1c that is uncontrolled with OADs will benefit from early combination therapy of an insulin and other agent that targets both FPG and PPG levels (such as a GLP-1RA) compared with basal insulin initiation and titration alone [34]. GetGoal-L-C was a randomised, double-blind, placebo-controlled, phase 3 study investigating the efficacy and safety of a short-acting GLP-1RA in Asian individuals receiving basal insulin with or without metformin [30]. In that study, participants underwent an 8-week run-in phase where their existing basal insulin was titrated to achieve a self-monitored plasma glucose (SMPG) level of 4.4 to 5.6 mmol/L. Those who achieved an SMPG < 7.8 mmol/L after the run-in period were then randomised to adjunctive lixisenatide or placebo. At baseline, individuals randomised to lixisenatide had a mean HbA1c of 63 mmol/mol (7.9%) and a mean FPG of 7.1 mmol/L and individuals randomised to placebo had a mean HbA1c of 63 mmol/mol (7.9%) and a mean FPG of 6.9 mmol/L, indicating that the majority of participants included in this study had residual hyperglycaemia [30]. The results of the study showed that adding lixisenatide may be useful in individuals likely to develop residual hyperglycaemia [30]. Another study mainly conducted in Caucasian subjects who are not well controlled with basal insulin showed that the proportion of individuals with residual hyperglycaemia at the end of treatment in the group receiving iGlarLixi (a fixed-ratio combination of basal insulin and GLP-1RA) was decreased to 23.8% from approximately 62% at baseline, indicating that adding GLP-1RA in participants with T2D that is not controlled with basal insulin improves glycaemic control and reduces residual hyperglycaemia.

There are some limitations to this analysis, the main one being that it is post hoc, which limits the generalisability of the results. The generalisability of these results is also limited by the fact that this analysis was conducted in a population of Chinese individuals with T2D, so cannot be extrapolated to individuals of other ethnicities. Furthermore, the FPG GOAL study was powered to detect differences between the randomisation arms in terms of change in HbA1c, rather than in the proportions of individuals with residual hyperglycaemia. For these reasons, the *p* values in this analysis should be considered nominal.

## CONCLUSIONS

This analysis of the FPG GOAL study demonstrated that higher baseline HbA1c and lower baseline FPG levels were risk factors of residual hyperglycaemia in Chinese individuals with T2D initiating treatment with basal insulin. These results indicate that there is an unmet need for more comprehensive and proactive T2D treatment strategies that take both FPG and PPG into consideration in order to achieve target HbA1c levels recommended in clinical guidelines.

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Editors (ICMJE) criteria for authorship for this article, take responsibility for the integrity of the work as a whole, and have given their approval for this version to be published.

***Author Contributions.*** Wenying Yang contributed to the conception and design of the analysis, as well as interpretation of the data. Xin Wang conducted the study and collected the data. Dan Shen performed statistical analysis. Xin Wang and Guangyu Wu drafted the first version of the manuscript. Wenying Yang and Xia Zhang reviewed and critically revised the manuscript. All authors critically reviewed and revised drafts of the manuscript and provided approval for submission.

***Disclosures.*** Xin Wang and Wenying Yang disclose no conflict of interest. Guangyu Wu, Dan Shen and Xia Zhang are employees of Sanofi China and may hold share and/or stock options in the company.

***Compliance with Ethics Guidelines.*** The study was conducted in accordance with the principles stated in the Declaration of Helsinki and in line with the International Conference on Harmonization guidelines for good clinical practice. An institutional review board at each site approved the study, and all participants gave written informed consent.

***Data Availability.*** Qualified researchers may request access to participant level data and related study documents including the clinical study report, study protocol with any amendments, blank case report form, statistical analysis plan, and dataset specifications. Participant level data will be anonymised, and study documents will be redacted to protect the privacy of trial participants. Further details on Sanofi's data sharing criteria, eligible studies, and process for requesting access can be found at https://www.clinicalstudydatarequest.com.



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