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Diabetes control in public assistance recipients and free/low-cost medical care program beneficiaries in Japan: a retrospective cross-sectional study

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ABSTRACT

Introduction Previous research has highlighted the association between socioeconomic factors and diabetes management. This study aimed to elucidate the blood glucose control status among individuals with low income (ie, recipients of public assistance (PARs) and free/low-cost medical care (FLCMC) programme beneficiaries) and to investigate the effects of public subsidies for medical expenses on treatment adherence among low-income patients with diabetes.

Methods We conducted a secondary analysis of medical records from 910 outpatients with diabetes who underwent pharmacological treatment for >90 days. Data on predictive variables, such as glycated haemoglobin (HbA1c) level and control variables, including sex, age and insurance type, were obtained retrospectively. The HbA1c levels among public health insurance (PHI)-only beneficiaries, FLCMC programme beneficiaries and PARs were compared using logistic regression analysis.

Results The analysis included 874 individuals, among whom the majority were men (61.7%) and aged≥65 years (58.4%). Logistic regression analysis revealed that among individuals aged <65 years, the adjusted ORs for HbA1c levels above 9% were significantly higher in FLCMC programme beneficiaries (OR=5.37, 95% CI: 2.23 to 12.82) and PARs (OR=5.97, 95% CI: 2.91 to 12.74) than in PHI-only beneficiaries. Among patients aged <65 years with HbA1c levels above 7%, the adjusted OR was significantly higher in FLCMC programme beneficiaries (OR=3.82, 95% CI: 1.65 to 10.43) than in PHI-only beneficiaries. Additionally, the adjusted OR was significantly higher in FLCMC programme beneficiaries aged <65 years (OR=2.57, 95% CI: 1.02 to 7.44) than in PARs.

Conclusions This study highlights the predictive value of public assistance or the FLCMC programme for poor blood glucose control and suggests the inadequacy of current medical expense subsidies to eliminate health disparities in diabetes control.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Low income is a significant social determinant of diabetes management. In Japan, social security systems, such as public assistance and free/low-cost medical care (FLCMC) programmes, reduce medical expenses for individuals with low incomes. Public assistance guarantees minimum living and medical expenses, whereas FLCMC programme beneficiaries are only guaranteed medical expenses. The prevalence of diabetes is higher among recipients of public assistance (PARs) than among individuals with higher incomes. Furthermore, information is lacking regarding the reality of social security systems for low-income groups, whether medical expense coverage is effective and whether additional support for living expenses is necessary.

INTRODUCTION

In Japan, approximately 10 million patients have diabetes, with approximately 16 000 starting dialysis due to diabetic end-stage renal disease annually.[1] 16% of hospitalised patients have diabetes, making appropriate management and prevention of disease exacerbation considerable public health challenges.[2] Diabetes is a multifactorial disease, with obesity, physical inactivity and smoking being the most well-known epidemiological risk factors. However, it has become evident that many social determinants of health contribute to diabetes.[3] Hill-Briggs *et al* reported factors such as education, income, occupation, housing, food insecurity, healthcare affordability and social capital as social determinants of health for diabetes, with income being an important determinant.[3] Diabetes prevalence increases among individuals with low income, leading to poor diabetes control, increased frequency of microvascular and cardiovascular complications and shortened lifespan.[3 4]

Excessive out-of-pocket medical expenses lead to treatment interruptions, worsening treatment outcomes and increased use of emergency medical care.[5] According to

WHAT THIS STUDY ADDS

⇒ What this study addsThis study's findings suggest that among individuals aged 65 years, PARs and FLCMC programme beneficiaries with diabetes have higher glycated haemoglobin (HbA1c) levels than patients with only public health insurance. Additionally, FLCMC programme beneficiaries may exhibit higher HbA1c levels than PARs. This study provides novel insights into the glycaemic control of patients receiving public assistance or FLCMC in Japan.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ In Japan, information on the utilisation of social security systems is valuable for understanding a patient's economic status and is readily accessible in clinical settings. This study demonstrates the value of using public assistance or the FLCMC programme as predictive factors for identifying patients who require additional support to improve blood glucose control. To maintain the health of individuals with low income, social security systems should be reformed to guarantee both essential medical and living expenses. Additional support measures should be considered to effectively address the needs of these populations.

Tanaka *et al*, outpatient medical expenses for diabetes in Japan were ¥390 000 annually.[6] As the average out-of-pocket burden under public health insurance (PHI) in Japan is 30%, this amounts to an average of ¥13 000 per month.[6] Due to the high cost of antidiabetic medications such as insulin, the financial burden is higher for patients with diabetes than for those without, exacerbating economic strain.[5–7] Consequently, excessive out-of-pocket expenses worsen treatment interruptions and compliance among patients with diabetes.[5 7 8] Ngo-Metzger *et al* reported that an increase in out-of-pocket medical expenses is associated with a 1.37-fold increase in the OR for worse adherence to diabetes treatment.[9] Therefore, outpatient treatment for diabetes poses a considerable economic burden on individuals with low income, raising concerns about worsening treatment outcomes.[5 7 10]

In Japan, social security systems such as public assistance and free/low-cost medical care (FLCMC) programmes have been implemented to alleviate the burden of out-of-pocket medical payments for individuals with low income. Public assistance is a public system that provides comprehensive economic support, including housing, meals and medical care, to ensure the minimum necessary standard of living. The Ministry of Health, Labour and Welfare has set the minimum living expenses required for a minimum standard of living, which serves as the poverty line in Japan. Eligibility for public assistance is determined by a rigorous examination conducted by local governments for households whose incomes fall below the poverty line. As of 2022, 2.04 million recipients of public assistance (PARs) were recorded, with a recipient rate of 1.63%. Among the recipients, the proportion of individuals aged ≥65 years is 55%.

Furthermore, the FLCMC programme provides social security for individuals with low income by offering free or reduced out-of-pocket payments for approximately 7.5 million people.[11] Households with incomes approximately below 1.5 times the poverty line are eligible, and eligibility for the programme is determined at the discretion of medical institutions. For patients who do not receive public assistance but have difficulty paying medical expenses, this programme serves as a valuable system to alleviate the economic burden of accessing medical care. However, compared with public assistance, the FLCMC programme only reduces out-of-pocket payments at medical institutions and does not provide support for living expenses. The facilities eligible for the FLCMC programme are medical institutions licensed under the Social Welfare Act, with only 673 medical institutions being licensed among Japan's 180 000 medical institutions in 2018.

Some studies reported high prevalence rates of diabetes and diabetic complications among PARs.[4 12] According to Sengoku *et al*, the prevalence of diabetes among outpatient PARs was 7.5%, compared with 4.1% among the PHI beneficiaries.[12] A survey by the Ministry of Health, Labour and Welfare found that PARs are more likely to be obese, have lesser regular exercise habits and have fewer regular dietary habits, suggesting that adequate support is needed for proper adherence to diabetes treatment.[13] However, reports on diabetes control among PARs are lacking, and the status of treatment adherence among PARs has not been investigated.

Regarding FLCMC programme beneficiaries, no study has examined the prevalence of diabetes or diabetic complications due to the limited availability of facilities. The study by Ono *et al* is the only one that has investigated diabetes control among FLCMC programme beneficiaries.[14] In their study, the glycated haemoglobin (HbA1c) levels of drug-treated patients with diabetes were 7.5%, significantly higher in FLCMC programme beneficiaries than in PHI beneficiaries (7.0%).

Despite the importance of diabetes control for preventing microvascular and macrovascular complications, limited studies have been published on diabetes control among PARs and FLCMC programme beneficiaries.[15] Furthermore, diabetes control has not been compared between PARs, who receive comprehensive public economic support, including living expenses and FLCMC programme beneficiaries, who receive reduced out-of-pocket payments only at medical institutions, despite both being low-income groups.

In clinical settings, healthcare professionals are reluctant to inquire about a patient's economic status, as it is considered sensitive information.[9 16] However, in Japan, the utilisation status of social security systems is valuable information for understanding a patient's economic status, and this information can be easily obtained in clinical settings. If it became apparent that blood glucose control is poor among PARs and FLCMC programme beneficiaries, information on the utilisation of these systems could predict the state of treatment adherence and determine whether patients require more support,

thereby becoming clinically useful information. Furthermore, examining the difference in treatment adherence regarding diabetes between PARs and FLCMC programme beneficiaries could be useful for considering the design of social security systems for individuals with low income.

Therefore, this study aimed to examine the state of diabetes control among PARs and FLCMC programme beneficiaries by investigating the association between the type of medical insurance and HbA1c levels in patients with diabetes.

MATERIALS AND METHODS

Participants and setting

The study population comprised 910 outpatients with diabetes who had received prescriptions for diabetes medications (insulin or oral hypoglycaemic agents) for 90 days or more between 1 July 2021 and December 2021, at Chiyo Clinic in Fukuoka city. Patients who received prescriptions for 90 days or more during the 6-month period were included to target those who continued outpatient treatment. The definition of regular outpatient visits was based on the definition of the Project on the Quality of Medical Care by the Ministry of Health, Labour and Welfare, Japan.[17] Of the initially identified patients, 1 with no PHI but holding an Atomic Bomb Survivor's Certificate, 1 with daily labourers' health insurance and 34 with missing HbA1c test results during the study period were excluded, leaving 874 for analysis. The type of medical insurance did not significantly differ between individuals with missing HbA1c data and those without missing data (p=0.79).

Measures and study design

In this cross-sectional study, data were retrospectively collected from medical records, including age, sex, HbA1c levels, enrolment status in PHI (Employee Health Insurance, National Health Insurance and Late Elderly Medical Insurance), receipt of public assistance and utilisation of the FLCMC programme. The last HbA1c level obtained during the study period was used for analyses. Additionally, all FLCMC programme beneficiaries were enrolled in PHI. Candidates for the FLCMC programme were patients who visited the facility and reported difficulties paying out-of-pocket payments to the administrative or medical staff during consultation. Social workers conducted interviews with these patients, where specific items (income, assets and debt situation) were assessed to determine eligibility for the FLCMC programme. Patients determined to meet the eligibility criteria, with household income generally below 150% of the poverty line, were eligible for the FLCMC programme. The predictive variable was the HbA1c level, and the control variables were sex, age and type of insurance.

Statistical analysis

For basic statistical analysis, we categorised those who used FLCMC among the PHI beneficiaries as FLCMC programme beneficiaries and identified those who used PHI (PHI-only beneficiaries) after excluding the FLCMC programme beneficiaries. The three groups, PHI-only beneficiaries, FLCMC programme beneficiaries and PARs, were compared. We used the χ^2 test for categorical variables and compared the ages between groups using the t-test. Since HbA1c levels were not normally distributed, groups were compared using the Wilcoxon test. Bonferroni correction was applied to the χ^2 test results for the categorical variables to compare the three groups. The Tukey-Kramer Honestly Significant Difference and Steel-Dwass tests were used to analyse age and HbA1c levels, respectively. HbA1c levels of 9% and 7% were set as cut-off points for the categorisation of glycaemic control. HbA1c levels of ≥9%, indicating severely inadequate blood glucose control,[15 16] may require insulin or maximum doses of oral antidiabetic agents, whereas HbA1c levels of ≥7% are associated with an increased risk of microvascular complications.[9]

Multivariate logistic regression analysis was performed with the type of medical insurance as the explanatory variable and HbA1c levels of ≥9% or ≥7% as the objective variable for each comparison of the three groups. The crude ORs, sex-adjusted and age-adjusted ORs and 95% CIs were determined from the analysis. Furthermore, ORs were calculated separately, using PHI-only beneficiaries or PARs as the reference group. Additionally, a similar age-stratified analysis was conducted using a cut-off of 65 years, comparing groups with ages <65 and ≥65 years.

Statistical significance was set at p<0.05. If a Bonferroni correction was applied to the comparison of the three groups, statistical significance was set at 0.017. All statistical analyses were performed using JMP V.14.2.0 (SAS Institute, Cary, North Carolina, USA).

Patient and public involvement

None.

RESULTS

The patients were predominantly male (61.7%) and aged ≥65 years (58.4%; table 1). HbA1c levels of ≥9% and ≥7% were observed in 9.4% and 62.8% of the patients, respectively. Regarding medical insurance, PARs and FLCMC programme beneficiaries accounted for 28.4% and 8.9% of the patients, respectively.

A comparison of the three groups showed that the mean age of FLCMC programme beneficiaries was significantly lower than that of PHI-only beneficiaries (p=0.0003) and that of PARs (p=0.0005; table 2). Moreover, the average HbA1c levels were significantly higher in FLCMC programme beneficiaries (p=0.0012) and PARs (p=0.0061) than in PHI-only beneficiaries. The proportion of individuals with HbA1c levels of ≥9% was significantly higher in FLCMC programme beneficiaries (p=0.0001) and PARs (p<0.0001) than in PHI-only beneficiaries. Additionally, the proportion of

Table 1 Basic attributes of the included patients

	Total (n=874)
Sex	
Female	335 (38.3%)
Male	539 (61.7%)
Age (years)	
Mean (SD)	65.0 (13.2)
Median (range)	68 (23–103)
Age group, cut-off 65 years	
<65 years	364 (41.6%)
≥65 years	510 (58.4%)
HbA1c (%)	
Mean (SD)	7.4 (1.2)
Median (range)	7.2 (4.0–14.5)
HbA1c group, cut-off 9%	
<9%	792 (90.6%)
≥9%	82 (9.4%)
HbA1c group, cut-off 7%	
<7%	325 (37.2%)
≥7%	549 (62.8%)
Type of medical insurance	
PHI only	548 (62.7%)
FLCMC	78 (8.9%)
PAR	248 (28.4%)

Data are presented as n (%) unless indicated otherwise.
FLCMC, free/low-cost medical care; HbA1c, glycated haemoglobin; PAR, public assistance recipient; PHI, public health insurance.

individuals with HbA1c levels of ≥7% was significantly higher in FLCMC programme beneficiaries (p=0.003) than in PHI-only beneficiaries.

In multivariate analysis, the adjusted ORs for HbA1c levels of ≥9% using PHI-only beneficiaries as the reference group were significantly higher among individuals aged <65 years who were FLCMC programme beneficiaries (OR=5.37, 95% CI: 2.23 to 12.82) and PARs (OR=5.97, 95% CI: 2.91 to 12.74; table 3). The adjusted OR for HbA1c levels of ≥7%, using PHI-only beneficiaries only as the reference group, was significantly higher among individuals aged <65 years who were FLCMC programme beneficiaries (OR=3.82, 95% CI: 1.65 to 10.43). However, no significant association was observed in individuals aged ≥65 years.

When using PARs as the reference group, no significant association was found for HbA1c levels of ≥9% (table 4). The adjusted OR for HbA1c levels of ≥7%, using PARs as the reference group, was significantly higher among FLCMC programme beneficiaries (OR=2.57, 95% CI: 1.02 to 7.44). However, no significant association was observed in individuals aged ≥65 years.

DISCUSSION

To the best of our knowledge, this study is the first in Japan to elucidate the state of diabetes control among PARs and FLCMC programme beneficiaries. Consequently, two points became apparent. First, among adults aged <65 years, PARs and FLCMC programme beneficiaries had significantly higher HbA1c levels than PHI-only beneficiaries. Second, among low-income groups, HbA1c levels were higher in FLCMC programme beneficiaries than in PARs.

The finding that HbA1c levels were higher in PARs and FLCMC programme beneficiaries, who are individuals with low income, aligns with the results of many previous studies indicating poor diabetes control among this population.[18] According to the meta-analysis by Bijlsma-Rutte *et al*, the mean HbA1c level was increased by 0.20% among individuals with low income.[18] The mechanisms behind the higher prevalence of diabetes and poorer diabetes control among individuals with low income include difficulties in maintaining a balanced diet for diabetes prevention and lower levels of regular physical activity.[19] Additionally, psychological and social stress due to economic hardship may influence stress hormones related to blood glucose levels and insulin sensitivity.[19 20] Therefore, we hypothesised that poor diabetes control among PARs and FLCMC programme beneficiaries may be attributed to similar mechanisms. However, it should be noted that the second most common reason for receiving public assistance is illness. Therefore, some recipients may be impoverished due to severe complications of diabetes, potentially contributing to the observed higher HbA1c levels.

Age-stratified analysis revealed that only adults aged <65 years showed higher HbA1c levels among PARs and FLCMC programme beneficiaries, which is consistent with previous research. Branfield *et al* reported that patients with diabetes living in low-income areas had a 0.21% higher HbA1c level among those aged <65 years compared with those living in high-income areas, with a 0.11% higher level among those aged ≥65 years, indicating a greater disparity in younger individuals.[21] The impact of socioeconomic status on health tends to diminish or remain unchanged regarding mortality with ageing.[22] This may be attributed to increased support from social security systems, reduced social stratification due to retirement and the stronger health effects of biological risk factors in older age.[22] Furthermore, the relatively healthier survival of older individuals may contribute to the attenuation of disparities.[22]

The results of this study suggest that the findings regarding diabetes control among low-income individuals aged <65 years align with those of previous research on the relationship between income and glycaemic control. In Japan, information on the utilisation of social security systems is valuable for understanding patients' economic status and can be easily obtained in clinical settings. Therefore, information on the utilisation of public assistance or the FLCMC programme could serve as predictive factors for identifying patients in need of additional support for improving blood glucose control.[8]

Table 2 Basic attributes of PHI-only beneficiaries, FLCMC programme beneficiaries and PARs

	PHI only	FLCMC	PAR	P value		
	N=548 (62.7%)	N=78 (8.9%)	N=248 (28.4%)	#2 vs #1	#3 vs #1	#3 vs #2
Sex						
Female	225 (41.1%)	30 (38.5%)	80 (32.3%)	0.6623	0.018	0.3122
Male	323 (58.9%)	48 (61.5%)	168 (67.7%)			
Age						
Mean (SD)	65.5 (13.8)	59.3 (14.1)	65.7 (10.9)	0.0003	0.9735	0.0005
Median (range)	68 (23–103)	61.5 (26–88)	67.5 (26–90)			
Age, cut-off 65 years						
<65 years	227 (41.4%)	43 (55.1%)	94 (37.9%)	0.0222	0.3484	0.0072
≥65 years	321 (58.6%)	35 (44.9%)	154 (62.1%)			
HbA1c (%)						
Mean (SD)	7.3 (1.0)	7.8 (1.3)	7.6 (1.4)	0.0012	0.0061	0.2951
Median (range)	7.1 (4–12.6)	7.6 (5.6–12.5)	7.3 (5.1–14.5)			
HbA1c, cut-off 9%						
<9%	516 (94.2%)	64 (82.1%)	212 (85.5%)	0.0001	<0.0001	0.4631
≥9%	32 (5.8%)	14 (17.9%)	36 (14.5%)			
HbA1c, cut-off 7%						
<7%	222 (40.5%)	18 (23.1%)	85 (34.3%)	0.003	0.0941	0.0635
≥7%	326 (59.5%)	60 (76.9%)	163 (65.7%)			

Data are presented as N (%) unless indicated otherwise.
FLCMC, free/low-cost medical care; HbA1c, glycated haemoglobin; PAR, public assistance recipient; PHI, public health insurance.

The finding that FLCMC programme beneficiaries have poorer diabetes control than PARs highlights potential differences in adherence to diabetes treatment and the influence of psychological and social stress between the two groups. Economic burdens associated with out-of-pocket medical payments and diabetes treatment may exacerbate cost-related medication non-adherence and worsen diabetes control.[9] FLCMC programme beneficiaries may avoid prescriptions for insulin or expensive diabetes medications due to the financial burden, leading to treatment interruptions.[11] Furthermore, despite their economic hardship, FLCMC programme beneficiaries do not receive comprehensive public support for living expenses, such as housing, food and education, which may lead to increased psychological and social stress.[23] Additionally, FLCMC programme beneficiaries may experience social isolation, such as limited opportunities to meet friends or acquaintances, which could further worsen adherence to diabetes care and accumulate psychological and social stress, ultimately impeding diabetes control.[20 24] Therefore, it is necessary to provide comprehensive economic and psychosocial support, including reducing out-of-pocket payments at pharmacies and providing living allowances, to FLCMC programme beneficiaries, who have poorer blood glucose control than PARs, who receive comprehensive support.

Public assistance is the most important means of alleviating the adverse health effects of socioeconomic disadvantages.[25] However, a systematic review by Shahidi *et al* investigating the health improvement effects of public assistance reported that PARs are more likely to experience depression and obesity, and despite the provision of medical and living expense support, there is no improvement in their health status.[25] High levels of psychological and social stress among PARs may contribute to worsening diabetes control, indicating that public assistance alone is insufficient to eliminate health disparities, and additional support for individuals with low income is needed.[23]

Strengths and limitations of the study

A strength of this study is that it targeted patients from a single facility, ensuring consistency in the application criteria for the FLCMC programme. The determination of FLCMC programme eligibility varies between facilities, leading to variability in income requirements in multicentre studies, which was not an issue in this study.

However, this study had some limitations. First, information on factors that influence diabetes control, such as patients' medication regimens, weight, diet and exercise habits, was unavailable. It has been reported that individuals with low income tend to be overweight, consume excessive carbohydrates and engage in less physical activity.[26] Therefore, factors such as being overweight, having a high-calorie diet and being physically inactive may mediate the association between income and HbA1c

Table 3 Multivariate analysis of the relationships among the three types of medical insurance and HbA1c levels (PHI only as the reference group)

	All participants		Age≥65 years		Age<65 years	
	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)*†	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)*†	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)*†
HbA1c≥9%						
PHI only	Ref.		Ref.	Ref.	Ref.	Ref.
FLCMC	3.53 (1.74 to 6.85, 0.0007)	2.95 (1.44 to 5.81, 0.004)	1.02 (0.16 to 3.75, 0.98)	1.05 (0.16 to 3.90, 0.95)	5.89 (2.47 to 13.95, 0.0001)	5.37 (2.23 to 12.82, 0.0002)
PAR	2.74 (1.66 to 4.54,<0.0001)	2.93 (1.76 to 4.91,<0.0001)	1.42 (0.65 to 3.00, 0.37)	1.48 (0.67 to 3.19, 0.33)	5.22 (2.59 to 10.87, <0.0001)	5.97 (2.91 to 12.74, <0.0001)
HbA1c≥7%						
PHI only	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
FLCMC	2.27 (1.31 to 3.95, 0.004)	2.19 (1.28 to 3.91, 0.004)	1.36 (0.66 to 2.91, 0.41)	1.41 (0.69 to 3.05, 0.35)	3.98 (1.73 to 10.8, 0.0007)	3.82 (1.65 to 10.43, 0.001)
PAR	1.31 (0.96 to 1.79, 0.09)	1.32 (0.97 to 1.82, 0.08)	1.24 (0.83 to 1.85, 0.29)	1.31 (0.87 to 1.97, 0.19)	1.45 (0.87 to 2.43, 0.15)	1.49 (0.89 to 2.52, 0.13)

*Adjusted for age and sex.
†P value; calculated using the Wald method.
FLCMC, free/low-cost medical care; HbA1c, glycated haemoglobin; PAR, public assistance recipient; PHI, public health insurance.

Table 4 Multivariate analysis of the relationships between three types of medical insurance and HbA1c levels (PAR as the reference group)*

	All participants		Age≥65 years		Age<65 years	
	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)†‡	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)†‡	Crude OR (95% CI, p value)	Adjusted OR (95% CI, p value)†‡
HbA1c≥9%						
FLCMC	1.29 (0.64 to 2.49, 0.47)	1.01 (0.49 to 1.99, 0.98)	0.72 (0.11 to 2.80, 0.66)	0.71 (0.11 to 2.77, 0.65)	1.13 (0.49 to 2.51, 0.77)	0.90 (0.38 to 2.07, 0.81)
PAR	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
HbA1c≥7%						
FLCMC	1.74 (0.97 to 3.13, 0.07)	1.65 (0.93 to 3.05, 0.09)	1.10 (0.51 to 2.43, 0.82)	1.08 (0.51 to 2.40, 0.84)	2.75 (1.11 to 7.88, 0.03)	2.57 (1.02 to 7.44, 0.04)
PAR	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

*The description of the OR for public health insurance only versus PAR is omitted, as it is included in table 3.
†Adjusted for age and sex.
‡P value; calculated using the Wald method.
FLCMC, free/low-cost medical care; HbA1c, glycated haemoglobin; PAR, public assistance recipient.

levels. Furthermore, information regarding multimorbid conditions, medication complexity, family support, other chronic stress and duration of diabetes was unavailable. Moving forward, it is necessary to investigate sex differences in diabetes control among the three groups after adjusting for these factors. Second, this study did not distinguish between types of diabetes. However, type 1 diabetes in adults leads to higher mortality and increased rates of diabetes complications among socioeconomically disadvantaged individuals, similar to type 2 diabetes.[27] Therefore, even if this study were limited to type 2 diabetes, the results would likely remain unchanged. Third, this study was cross-sectional, and reverse causality may occur. For example, if poor diabetes control leads to severe complications and makes employment difficult, individuals may receive public assistance or use the FLCMC programme. Consequently, poor diabetes control may have occurred due to public assistance or enrolment in the FLCMC programme. Future longitudinal studies are needed to verify the factors influencing diabetes control and diabetes type.

In conclusion, among patients undergoing pharmacological treatment for diabetes, PARs and FLCMC programme beneficiaries, particularly young adults, had poorer blood glucose control than PHI-only beneficiaries. Furthermore, among low-income groups, FLCMC programme beneficiaries had poorer blood glucose control than PARs. The utilisation of public assistance or the FLCMC programme could serve as predictive factors for identifying patients in need of additional support for improving blood glucose control. While public assistance and the FLCMC programme are valuable social security systems for economically disadvantaged individuals, they are insufficient to eliminate health disparities in terms of diabetes control.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants. All procedures were in accordance with the ethical standards of Chidoribashi General Hospital and with the 1964 Declaration of Helsinki. The institutional review board of Chidoribashi General Hospital approved the study (approval code CH-2022-13). An opt-out approach was employed following the ethical guidelines of the Japanese government.

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