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Non-financial social determinants of diabetes among public assistance recipients in Japan: A cohort study

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ABSTRACT

Aims/Introduction: Poverty is an important social determinant of diabetes. Poverty is a multidimensional concept including non-financial difficulties, such as social isolation and exclusion from communities. Many countries provide financial social assistance programs for those in need. This study aimed to explore non-financial social determinants of diabetes among public assistance recipients in Japan, by using linkage data of two municipal public assistance databases and medical assistance claim data.

Materials and Methods: We carried out a retrospective cohort study. Public assistance is provided to households below the poverty line to ensure their income security. We extracted recipients' sociodemographic factors of January 2016 (household number and employment status as non-financial social determinants of diabetes) and identified the incidence of diabetes diagnosis until December 2016 as the outcome.

Results: We included the data of 2,698 younger individuals (aged <65 years) and 3,019 older individuals (aged >65 years). A multivariable Poisson regression, with a robust standard error estimator, showed that among 2,144 younger recipients at risk, unemployment and living alone were slightly associated with 1-year cumulative incidence of diabetes diagnosis (adjusted incidence ratio 1.20, 95% confidence interval 0.93–1.54 and adjusted incidence ratio 1.15, 95% confidence interval 0.89–1.48, respectively). Among 2,181 older recipients at risk, there was no strong association between their sociodemographic factors and incidence of diabetes diagnosis.

Conclusions: Unemployment and living alone might be additional risk factors for diabetes among younger public assistance recipients. Multidimensional supports assuring financial and non-financial securities are required to prevent diabetes among people living in poverty.

INTRODUCTION

Poverty is known to be a major social determinant of health[1,2]. People living in poverty tend to endure a higher prevalence of chronic diseases; specifically, diabetes is a chronic disease that is more prevalent in a socioeconomically vulnerable population[3–6]. Therefore, advocating for the maintenance of a healthy life among people living in poverty is an important role in society. Conventionally, the concept of poverty has been associated with an economic problem, such as lack of income; governments in many countries have aided people in poverty by ensuring income and financial healthcare access with social assistance entitlement[7]. The Japanese government, likewise, offers a public assistance program that ensures monthly minimum income protection for the recipients, and that exempts payments for their medical care utilization[8].

Recently, poverty has been reconceptualized to include multidimensional livelihood difficulties that affect fundamental areas of human life and well-being, such as health, education, and standards of living[9]. However, social relationships have been overlooked as an aspect of multidimensional poverty[10], even though social isolation and exclusions from the labor market or

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local communities form an intrinsically important component of poverty[7,10,11]. Recent studies in high-income countries have reported a higher prevalence of adverse health conditions, such as diabetes and other chronic diseases, mortality, and poor lifestyle, among the recipients of public financial assistance than non-recipients[12–14]. These studies suggested that financial support might not be able to compensate for the non-financial aspects of poverty.

To balance the increasing medical care costs of diabetes, the Japanese government has started a special secondary and tertiary prevention of diabetes program for those under the public assistance program. However, there has been some difficulty in identifying and prioritizing targets owing to a dearth of studies that ascertain the non-financial sociodemographic factors associated with diabetes among the recipients of public assistance. Hence, the objective of the present study was to explore the association between individual non-financial sociodemographic factors, such as working status and living arrangement, and diabetes, among people who receive minimum income protection as public assistance, using the individual linkage data of public assistance recipients' database and their medical assistance claim data, administered by the municipalities in Japan.

METHODS

Study participants

The present retrospective cohort study included adults who received public assistance in two suburban municipalities, Osaka and Tokyo, in January 2016. Public assistance is the governmental welfare program availed by households who are living below the poverty line without any assets. In Japan, approximately 2% of the population receives public assistance. Households availing public assistance obtain monthly minimum income protection and are fully exempted from payment on their medical care utilization[8]. We excluded the data of patients who stopped receiving public assistance during the study. This occurs mainly when their income has increased or on the death of recipients (Figure 1).

Data sources

For baseline data, we used the public assistance recipients' database of the welfare offices of the municipalities. This database included information on age, sex, number of family members, household composition, nationality, working status, income including working income, pension and disability pension. These data were collected by the staff members at the municipality welfare offices to determine the receipt of public assistance and the amount of monthly minimum income protection, thus, we did not have any missing data. To obtain the outcome data, we used medical assistance claims data from January 2016 to December 2016, which included the month of the recipients' medical consultation, total cost of medical receipts, total numbers of visits each month, and their diagnosis.

Each municipality individually linked the two databases, using individual identification codes. The welfare offices of the two municipalities agreed to provide anonymized data to the authors through a system company that had provided the management software of the public assistance database for municipalities. This study protocol was approved by the ethics committee of the Graduate School of Medicine of the University of Tokyo (Approval No: 11503).

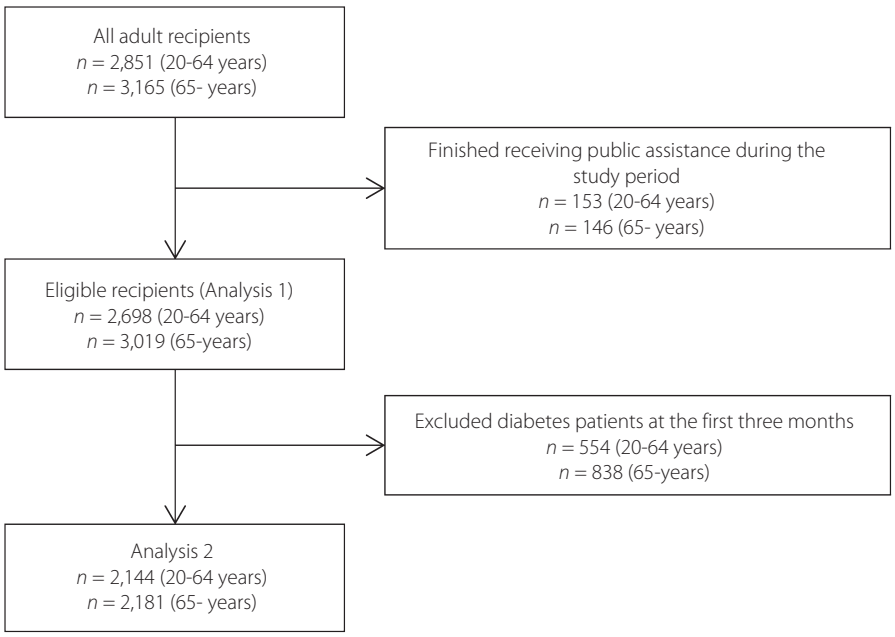

Figure 1 | Flowchart of study participants.

Measurement and variables

Outcome variables

From the medical assistance claims data, we identified the cumulative incidence of diabetes diagnosis, defined as those who visited medical care institutions for diabetes care once or more during the observation period. Diabetes was determined according to International Classification of Disease, Tenth Edition code[15] E10-14.

Explanatory variables

We extracted information of household composition (living alone or not) and the employment status (working or not) from the database.

Covariates

Based on data availability, we used the age (continuous), sex (women/men) and nationality (Japanese or others), as of January 2016, as demographic factors. We coded the municipality as a dummy variable to adjust for unmeasured cultural and environmental characteristics of the two municipalities (A/B). We also considered psychological, intellectual and physical disabilities as potential confounding factors, noting the information on the qualifications for welfare benefits for disabled persons. The municipality officials certify them with the diagnosis of designated physicians and agency. The recipients of disability assistance can have the benefit of additional income and social care. We also considered the levels of long-term care needs based on the information in the public long-term care insurance system. In the system, there are seven nationally standardized levels of long-term care need (support required levels 1 and 2 and care need levels 1–5)[8]. People aged ≥65 years who are potentially in need of long-term care, and people aged ≥40 years with the designated diseases can apply for the insurance benefit. Based on the definition of the level, insurers (in most cases municipality governments) assess and certify the use of insurance benefits. The amount of benefit is determined based on the certified level. In the present study, we dichotomized the levels into support required level and care need level.

Statistical analysis

First, we described the characteristics of participants and recipients of public assistance in the cohort who were assigned to have diabetes. Second, we carried out univariable Poisson regression analysis, and calculated the crude cumulative incidence ratio (IR) and 95% confidence interval (CI) of each explanatory variable. Third, we carried out a multiple Poisson regression analysis to calculate the multivariable-adjusted IR of each explanatory variable (analysis 1). To eliminate the potential reverse causation between non-financial poverty and diabetes diagnosis, we carried out additional analysis, not counting new cases of diabetes diagnoses in the first 3 months (analysis 2). We chose to exclude the first 3 months because medical consultations of diabetes patients usually occur at intervals of a maximum of 3 months[16]. The robust standard error estimator was adopted for all statistical analysis to calculate 95% CIs. All analyses were stratified by age group (<65 years and ≥65 years), because the policy approach of the Japanese government is differentiated based on age, for people receiving public assistance. We carried out three sensitivity analyses to identify individuals at risk for the incidence of diabetes diagnoses, by excluding the cases of individuals who visited medical institutions for diabetes care in the first 2 months (analysis S1) and the first 4 months (Analysis S2). Furthermore, we carried out analysis 2 stratified by both sex and age group to identify the difference between sexes and between age groups. Statistical analyses were carried out using Stata SE version 16.2 (StataCorp, College Station, TX, USA).

RESULTS

We obtained the data of 2,851 younger (aged <65 years) people and 3,165 older (≥65 years) people receiving public assistance. Among them, 2,698 younger people and 3,019 older people were eligible (Figure 1). Among the younger recipients, 1,385 (51.3%) were men, 1,623 (60.2%) were living alone and 838 (31.1%) were employed (Table 1). Among the older recipients, 1,405 (46.5%) were men, 2,139 (70.9%) were living alone and 250 (8.3%) were employed (Table 1). After diabetes patients were excluded in the first 3 months, we identified 2,144 younger and 2,181 older recipients at risk. During the study period, 269 younger diabetes patients (12.5%) and 329 older diabetes patients (15.1%) were identified (Table 2).

Among younger recipients, univariable Poisson regression analysis showed that living alone and unemployment were associated with a higher incidence of diabetes diagnosis (Table S1). The results of analysis 1 showed that adjusted IR of unemployment was 1.26 (95% CI 1.10–1.45), when compared with being employed. Compared with living with someone, adjusted IR of living alone was 1.12 (95% CI 0.99–1.28; Table 3). The results of analysis 2, which excluded diabetes patients in the first 3 months, showed that both unemployment and living alone were seen to have a slight association with incidence of diabetes diagnosis (IR 1.20, 95% CI 0.93–1.54 and IR 1.15, 95% CI 0.89–1.48, respectively). Compared with employment, the adjusted IR of unemployment was 1.07 (95% CI 0.86–1.34) in analysis S1 and 1.13 (95% CI 0.84–1.51) in analysis S2 (Table S2). Living alone was seen to have a slight association with the incidence of diabetes diagnosis in both analyses (Table S2). Furthermore, sex-stratified analysis showed that, among younger men, both unemployment and living alone had a higher incidence of diabetes diagnosis (IR 1.28, 95% CI 0.85–1.91 and IR 1.48, 95% CI 0.96–2.29, respectively), whereas no strong association was seen among women (Table S3). Among older recipients, the results of analysis 1 showed that unemployment was slightly associated with a higher incidence of diabetes diagnosis (IR 1.18, 95% CI 0.98–1.41) when compared with being employed; however, no association was found in analysis 2 (Table 3).

Table 1 | Characteristics of public assistance recipients and diabetes patients in the cohort

Character	Category	20–64 years old		≥65 years old	
		Total participants (*n* = 2,698) *n* (%)	Diabetes patients (*n* = 823) *n*, % for total	Total participants (*n* = 3,019) *n* (%)	Diabetes patients (*n* = 1,167) *n*, % for total
Age	Mean (SD)	48.7 (11.1)	52.0 (9.5)	74.9 (6.9)	74.4 (6.4)
Sex	Male	1,385 (51.3)	451, 32.6%	1,405 (46.5)	571, 40.6%
	Female	1,313 (48.7)	372, 28.3%	1,614 (53.5)	596, 36.9%
Living alone	Yes	1,623 (60.2)	560, 34.5%	2,139 (70.9)	815, 38.1%
	No	1,075 (39.8)	263, 24.5%	880 (29.1)	352, 40.0%
Working status	Yes	838 (31.1)	201, 24.0%	250 (8.3)	85, 34.0%
	No	1,860 (68.9)	622, 33.4%	2,769 (91.7)	1,082, 39.1%
Nationality	Japanese	2,590 (96.0)	801, 30.9%	2,968 (98.3)	1,151, 38.8%
	Other	108 (4.0)	22, 20.4%	51 (1.7)	16, 31.4%
Long-term care status	None	2,639 (97.8)	801, 30.4%	2,257 (74.8)	857, 38.0%
	Support required	10 (0.4)	4, 40.0%	192 (6.4)	95, 49.5%
	Care needs	49 (1.8)	18, 36.7%	570 (18.9)	215, 37.7%
Disabilities certificate	None	2,000 (74.1)	582, 29.1%	2,645 (87.6)	1,023, 38.7%
	Psychological disability	421 (15.6)	145, 34.4%	115 (3.8)	39, 33.9%
	Intellectual disability	77 (2.9)	16, 20.8%	6 (0.2)	2, 33.3%
	Physical disability	200 (7.4)	80, 40.0%	253 (8.4)	103, 40.7%
Municipality	A	2,032 (75.3)	597, 29.4%	2,181 (72.2)	826, 37.9%
	B	666 (24.7)	226, 33.9%	838 (27.8)	341, 40.7%

SD, standard deviation.

Table 2 | Characteristics of public assistance recipients and diabetes patients among participants after diabetes patients were excluded at the first 3 months

Character	Category	20–64 years		≥65 years	
		Population at risk (*n* = 2,144) *n* (%)	Diabetes patients (*n* = 269) *n*, % for total	Population at risk (*n* = 2,181) *n* (%)	Diabetes patients (*n* = 329) *n*, % for total
Age	Mean (SD)	47.7 (11.3)	50.3 (9.9)	75.2 (7.0)	74.5 (6.4)
Sex	Male	1,060 (49.4)	126, 11.9%	995 (45.6)	161, 16.2%
	Female	1,084 (50.6)	143, 13.2%	1,186 (54.4)	168, 14.2%
Living alone	Yes	1,238 (57.7)	175, 14.1%	1,554 (71.3)	230, 14.8%
	No	906 (42.3)	94, 10.4%	627 (28.7)	99, 15.8%
Working status	Yes	713 (33.3)	76, 10.7%	194 (8.9)	29, 14.9%
	No	1,431 (66.7)	193, 13.5%	1,987 (91.1)	300, 15.1%
Nationality	Japanese	2,049 (95.6)	260, 12.7%	2,142 (98.2)	325, 15.2%
	Other	95 (4.4)	9, 9.5%	39 (1.8)	4, 10.3%
Long-term care status	None	2,099 (97.9)	261, 12.4%	1,637 (75.1)	237, 14.5%
	Support required	7 (0.3)	1, 14.3%	127 (5.8)	30, 23.6%
	Care needs	38 (1.8)	7, 18.4%	417 (19.1)	62, 14.9%
Disabilities certificate	None	1,611 (75.1)	193, 12.0%	1,912 (87.7)	290, 15.2%
	Psychological disability	330 (15.4)	54, 16.4%	90 (4.1)	14, 15.6%
	Intellectual disability	66 (3.1)	5, 7.6%	4 (0.2)	0, 0%
	Physical disability	137 (6.4)	17, 12.4%	175 (8.0)	25, 14.3%
Municipality	A	1,629 (76.0)	194, 11.9%	1,583 (72.6)	228, 14.4%
	B	515 (24.0)	75, 14.6%	598 (27.4)	101, 16.9%

SD, standard deviation.

Table 3 | Adjusted incidence ratios and 95% confidence intervals for incidence of diabetes diagnosis among public assistance recipients

	20–64 years		≥65 years	
	Analysis 1 (n = 2,698) IR (95% CI)	Analysis 2 (n = 2,144) IR (95% CI)	Analysis 1 (n = 3,019) IR (95% CI)	Analysis 2 (n = 2,181) IR (95% CI)
Explanatory variables				
Working status				
Yes	Ref	Ref	Ref	Ref
No	1.26 (1.10–1.45)	1.20 (0.93–1.54)	1.18 (0.98–1.41)	0.93 (0.75–1.15)
Living alone				
No	Ref	Ref	Ref	Ref
Yes	1.12 (0.99–1.28)	1.15 (0.89–1.48)	0.95 (0.86–1.04)	1.03 (0.72–1.47)
Covariates				
Age				
By 1 year	1.03 (1.02–1.04)	1.02 (1.01–1.03)	0.99 (0.98–0.99)	0.98 (0.97–1.00)
Sex				
Female	Ref	Ref	Ref	Ref
Male	0.99 (0.89–1.12)	0.80 (0.64–1.01)	1.08 (0.99–1.18)	1.13 (0.92–1.39)
Nationality				
Japanese	Ref	Ref	Ref	Ref
Other	0.72 (0.50–1.04)	0.77 (0.41–1.43)	0.82 (0.55–1.22)	0.71 (0.28–1.78)
Long-term care status				
None	Ref	Ref	Ref	Ref
Support required	0.99 (0.47–2.10)	1.05 (0.18–5.98)	1.37 (1.18–1.60)	1.76 (1.26–2.46)
Care needs	0.81 (0.55–1.20)	1.24 (0.62–2.51)	1.06 (0.94–1.21)	1.15 (0.88–1.52)
Disabilities certificate				
None	Ref	Ref	Ref	Ref
Psychological disability	1.16 (1.00–1.35)	1.37 (1.03–1.80)	0.79 (0.61–1.03)	1.03 (0.63–1.68)
Intellectual disability	0.87 (0.57–1.34)	0.63 (0.27–1.48)	0.80 (0.26–2.52)	–
Physical disability	1.19 (0.98–1.44)	1.04 (0.65–1.65)	1.00 (0.85–1.17)	0.94 (0.65–1.37)
Municipality				
A	Ref	Ref	Ref	Ref
B	1.10 (0.98–1.25)	1.17 (0.91–1.51)	1.09 (0.98–1.20)	1.22 (0.98–1.52)

Analysis 1 included all eligible participants, and analysis 2 included the population at risk after excluding diabetes patients at the first 3 months. CI, confidence interval; IR, adjusted incidence ratio; Ref, reference.

DISCUSSION

Among younger people availing public assistance in Japan, the incidence of diabetes diagnosis was greater among those who were unemployed and living alone, especially among men. There was also a slight association between unemployment and diabetes among older recipients. This was the first study to have identified the incidence of diabetes diagnosis, and showed its association with non-financial aspects of poverty and health conditions among adult public assistance recipients in Japan. An important strength of this study was that, using existing standardized databases without missing data, we could examine the association between individual sociodemographic statuses and the incidence of diabetes diagnosis among socially vulnerable populations who were usually difficult to reach in standard social surveys.

The association between unemployment and higher incidence of diabetes was consistent with other recent studies. For example, Varanka-Ruuska *et al.*[17] reviewed 12 studies and reported that unemployment status was associated with diabetes in the general population. Toge[18] reported that the association between unemployment and health was mediated by patients' financial strain. Furthermore, the association between living alone and diabetes, in the general population, has been reported in Japan[19,20]. Living with someone was strongly associated with the prevention of the development of diabetes, which was explained by availabilities of social resources and social engagement[20]. The present study added to the evidence that unemployment and living alone remained associated with a higher incidence of diabetes diagnosis among younger public assistance recipients in Japan, even if their minimum income and healthcare access were ensured by governmental welfare.

Possible explanations for the present findings include the postulations that unemployed recipients might experience psychosocial stress from income reduction and joblessness, and furthermore, might suffer from social isolation. The Japanese public assistance program has strengthened the non-financial

self-reliance support program since 2015, and started providing extra support for those losing jobs, including consultation opportunities, additional housing rent support and job skill training. However, given the findings of the present study, these programs should be further strengthened. Furthermore, although this is just a speculation, the stronger association between unemployment and the incidence of diabetes diagnosis among the younger generation might be explained by a stronger pressure to participate in the labor market, whereas older people have additional healthcare opportunities, including free long-term care, and formal and informal social supports from the community-based integrated care system, which is currently only promoted for older persons (aged >65 years)[21,22]. Preventing diabetes, known as ambulatory care sensitive conditions, through additional individual support, might help avoid unplanned hospitalization[23–26]. For example, the government has launched a health management program for people availing public assistance, which will be mandated for municipality governments in 2021[27]. Given the findings of the present study, those activities might be geared to provide special care for younger male recipients who live alone and those who are unemployed.

There were several limitations to the present study. First, as aforementioned, there is a possibility for reverse causation. Some people might develop severe diabetes and other illness, and thus lose their ability to work; this might have resulted in financial difficulties, thus the need for public assistance[28]. In 2015, among the reasons for receiving public assistance, health issues accounted for 25% of the population[27]. Nevertheless, analyses removing the incidence of our outcomes in the first 3 months showed almost the same results, supporting that the reverse causation does not alter our conclusion. When excluding the diabetes patients only for 2 months from baseline, unemployment did not predict the incidence of diabetes diagnosis. This result might have occurred by misclassification of diabetes morbidity between employment statuses. Employed people usually have longer outpatient intervals. Thus, the morbidity of diabetes among employed recipients might be underestimated in the first 2 months of the cohort. Excluding the cases in the first ≥3 months could sufficiently identify the population at risk among recipients, regardless of their employment status. Second, because we used medical assistance claim data, we might have overestimated or underestimated hospital/clinic visits and disease incidence. The incidence of diabetes diagnosis only happens when recipients visit the facilities. For example, people who were working might not have enough time to consult a physician. If public assistance recipients were also assisted by other welfare programs, their consultations were not shown in the medical assistance claim data. Furthermore, these claim data can also code diabetes, even though it is not clinically confirmed. In Japan, to claim insurance payments, physicians need to write down the name of a disease diagnosis including "suspected" diseases on the medical record. The medical record differentiates the disease names of suspected and confirmed diagnoses. However, this process is not perfect, and could potentially result in overestimation of the incidence of diabetes diagnosis. The diagnosis can also be influenced by their clinical subspecialty and patients' consultation behaviors[29,30]. In contrast, in the present study, the 1-year cumulative incidence of diabetes diagnosis was approximately 12–15% among the study participants, which was higher than the general population in Japan[31]. This might be attributable to the characteristics of the study population, who were older and with more socioeconomic challenges[3–6]. Third, there are important non-financial factors that were not evaluated in the present study, including educational attainments and social relationships. In addition, other unmeasured factors, such as the severity of diseases and the degree of medical treatment, potentially bias our findings. Fourth, the generalizability is limited, because this study used the data from just two municipalities.

To conclude, public assistance programs should go beyond financial protection, and comprehensively include additional social care to prevent social isolation and exclusion due to non-financial reasons. Although further in-depth studies are necessary, the present study suggests that younger male recipients who are unemployed and living alone should be prioritized in the program providing social care.

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DISCLOSURE

Naoki Kondo carried out collaborative research with KITACOM, which provided the data used in the present study. Naoki Kondo received a research fund and scholarship donation from KITACOM. KITACOM had no discretion and involvement in our study protocol, analysis, interpretation of the results or submission of this manuscript. Daisuke Nishioka, Junko Saito, and Keiko Ueno declare no conflict of interest.

REFERENCES

1. Marmot M, Friel S, Bell R, *et al*. Closing the gap in a generation: health equity through action on the social determinants of health. *Lancet* 2008; 372: 1661–1669.
2. Marmot M. Social determinants of health inequalities. *Lancet* 2005; 365: 1099–1104.
3. Lee H, Andrew M, Gebremariam A, *et al*. Longitudinal associations between poverty and obesity from birth through adolescence. *Am J Public Health* 2014; 104: E70–E76.

4. Hsu CC, Lee CH, Wahlqvist ML, *et al*. Poverty increases type 2 diabetes incidence and inequality of care despite universal health coverage. *Diabetes Care* 2012; 35: 2286–2292.
5. Agardh E, Allebeck P, Hallqvist J, *et al*. Type 2 diabetes incidence and socio-economic position: a systematic review and meta-analysis. *Int J Epidemiol* 2011; 40: 804–818.
6. Nagamine Y, Kondo N, Yokobayashi K, *et al*. Socioeconomic disparity in the prevalence of objectively evaluated diabetes among older Japanese adults: JAGES cross-sectional data in 2010. *J Epidemiol* 2019; 29: 295–301.
7. World Health Organization. A conceptual framework for action on the social determinants of health, 2010. Available from: https://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf Accessed April 30, 2020.
8. Sakamoto H, Rahman M, Nomura S, *et al*. Japan health system review[online]. World Health Organization. Regional Office for South- East Asia, 2018. Available from: https://apps.who.int/iris/handle/10665/259941 Accessed June 08, 2020.
9. United Nations Development Programme. The 2019 global multidimensional poverty index (MPI), 2019. Available from: http://hdr.undp.org/en/2018-MPI Accessed June 08, 2020.
10. Samuel K, Alkire S, Zavaleta D, *et al*. Social isolation and its relationship to multidimensional poverty. *Oxford Dev Stud* 2018; 46: 83–97.
11. Spicker P. Definitions of poverty: twelve clusters of meaning. In: Spicker P, Alvarez Leguizamon S, Gordon D (eds). Poverty: An International Glossary. London: Zed Books, 2007; 229–243.
12. Shahidi FV, Ramraj C, Sod-Erdene O, *et al*. The impact of social assistance programs on population health: a systematic review of research in high-income countries. *BMC Public Health* 2019; 19: 2.
13. Muennig P, Rosen Z, Wilde ET. Welfare programs that target workforce participation may negatively affect mortality. *Health Aff* 2013; 32: 1072–1077.
14. Wilde ET, Rosen Z, Couch K, *et al*. Impact of welfare reform on mortality: an evaluation of the Connecticut jobs first program, a randomized controlled trial. *Am J Public Health* 2014; 104: 534–538.
15. World Health Organization. International statistical classification of diseases and related health problems, 10th revision (ICD-10), 2019. Available from: https://www.who.int/classifications/icd/icdonlineversions/en/ Accessed June 08 2020.
16. Kubo S, Noda T, Kawado M, *et al*. Changes in the average interval since last visit and the number of repeat outpatients in the Patient Survey of Japan. [Nihon koshu eisei zasshi]. *Jpn J Publ Health* 2017; 64: 619–629 (Japanese).
17. Varanka-Ruuska T, Rautio N, Lehtiniemi H, *et al*. The association of unemployment with glucose metabolism: a systematic review and meta-analysis. *Int J Public Health* 2018; 63: 435–446.
18. Toge AG. Health effects of unemployment in Europe (2008–2011): a longitudinal analysis of income and financial strain as mediating factors. *Int J Equity Health* 2016; 15: 75.
19. Heianza Y, Arase Y, Kodama S, *et al*. Association of living alone with the presence of undiagnosed diabetes in Japanese men: the role of modifiable risk factors for diabetes: Toranomon Hospital Health Management Center Study 13 (TOPICS 13). *Diabet Med* 2013; 30: 1355–1359.
20. Shibayama T, Noguchi H, Takahashi H, *et al*. Relationship between social engagement and diabetes incidence in a middle-aged population: results from a longitudinal nationwide survey in Japan. *J Diabetes Investig* 2018; 9: 1060–1066.
21. Ministry of Health, Labour, and Welfare. Report on Job Support for Public Assistance Recipients, 2019 (Japanese).
22. Ministry of Health, Labour, and Welfare. Establishing 'the Community-based Integrated Care System'. Available from: https://www.mhlw.go.jp/english/policy/care-welfare/care-welfare-elderly/dl/establish_e.pdf Accessed August 05, 2020.
23. Ministry of Health, Labour, and Welfare. Materials of the meeting of the Director of the Department of Social Welfare and War Victims' Relief Bureau, Ministry of Health, Labour and Welfare, 2019 (Japanese).
24. Purdy S, Griffin T, Salisbury C, *et al*. Ambulatory care sensitive conditions: terminology and disease coding need to be more specific to aid policy makers and clinicians. *Public Health* 2009; 123: 169–173.
25. Hodgson K, Deeny SR, Steventon A. Ambulatory care-sensitive conditions: their potential uses and limitations. *BMJ Qual Saf* 2019; 28: 429–433.
26. Ingram M, Doubleday K, Bell ML, *et al*. Community health worker impact on chronic disease outcomes within primary care examined using electronic health records. *Am J Public Health* 2017; 107: 1668–1674.
27. Horny M, Glover W, Gupte G, *et al*. Patient navigation to improve diabetes outpatient care at a safety-net hospital: a retrospective cohort study. *BMC Health Serv Res* 2017; 17: 759.
28. Stauder J. Unemployment, unemployment duration, and health: selection or causation? *Eur J Health Econ* 2019; 20: 59–73.
29. Delgado-Rodriguez M, Llorca J. Bias. *J Epidemiol Community Health* 2004; 58: 635–641.
30. Nishioka D, Saito J, Ueno K, *et al*. Frequent outpatient attendance among people on the governmental welfare programme in Japan: assessing both patient and supplier characteristics. *BMJ Open* 2020; 10: e038663.
31. Goto A, Goto M, Noda M, *et al*. Incidence of type 2 diabetes in Japan: a systematic review and meta-analysis. *PLoS One* 2013; 8: e74699.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 | Crude incidence ratios and 95% confidence intervals for the incidence of diabetes diagnosis among public assistance recipients.

Table S2 | Adjusted incidence ratios and 95% confidence intervals for the incidence of diabetes diagnosis after excluding diabetes patients at the first 2 and 4 months.

Table S3 | Adjusted incidence ratios and 95% confidence intervals for the incidence of diabetes diagnosis among public assistance recipients in Japan, stratified by age and sex.