

TITLE PAGE

Title of the article

Prevalence of Type 2 Diabetes by Age, Sex, and Geographical Area among 2 Million Public Assistance Recipients
in Japan: A Cross-sectional Study Using a Nationally Representative Claims Database

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7

ABSTRACT

Background

Recognizing the importance of the social determinants of health, the Japanese government introduced a health management support program targeted at type 2 diabetes (T2D) for public assistance recipients (PAR) in 2018. However, evidence of the T2D prevalence among PAR is lacking. We aimed to estimate T2D prevalence by age and sex among PAR, compared to the prevalence among health insurance enrollees (HIE). Additionally, regional differences in T2D prevalence among PAR were examined.

Methods

This was a cross-sectional study using 1-month health insurance claims of both PAR and HIE. The Fact-finding Survey data on Medical Assistance and the National Database of Health Insurance Claims data were used. T2D prevalence among PAR and HIE were assessed by age and sex, respectively. Moreover, to examine regional differences in T2D prevalence of inpatients and outpatients among PAR, T2D crude prevalence and age-standardized prevalence were calculated by prefecture. Multilevel logistic regression analysis was also conducted at the city level.

Results

T2D crude prevalence was 7.7% in PAR (inpatients and outpatients). Among outpatients, the prevalence was 7.5% in PAR and 4.1% in HIE, respectively. The mean crude prevalence and age-standardized prevalence of T2D (inpatients and outpatients) among 47 prefectures was 7.8% and 3.9%, respectively. In the city-level analysis, the odds ratio for the prevalence of T2D by region ranged from 0.31 to 1.51.

Conclusion

The prevalence of T2D among PAR was higher than HIE, and there were regional differences in the prevalence of PAR. Measures to prevent the progression of diabetes among PAR by region are needed.

MAIN TEXT

INTRODUCTION

Social and economic environments are listed as determinants of health by the World Health Organization¹, and many countries have adopted various measures²⁻⁴ to combat them. In recent years, it has been pointed out that income disparities are expanding in Japan as well, and health inequalities are widening due to socioeconomic conditions⁵. The proportion of the total population on public assistance has grown from 0.7% in 1995 to 1.6% in 2019. Therefore, in Japan, improvement plans that address social inequalities in health have been developed^{6,7}.

The Public Assistance Act⁸ aims for the state to guarantee a minimum standard of living by providing the necessary public assistance according to the level of poverty. Individuals suffering from poverty apply for public assistance through welfare offices. Their utilization of assets, utilization of abilities, and precedence of support are assessed and if they are approved, they become public assistance recipients (PAR). The public assistance system is composed of support for livelihood, education, housing, medical, long-term care, maternity care, occupational aid, and funeral assistance. PAR can receive any or all of these supports according to their needs as long as their application is accepted by the welfare office. The medical assistance system that provides medical services is 100% financed by the government because the services are important in enabling individuals to maintain and improve their health status, quality of life, and life expectancy. Japan has universal health coverage and almost all citizens have some kind of public medical insurance; meanwhile, recipients of medical assistance receive the same level of medical care as those with health insurance. The medical assistance system contributes to the health of PAR, although approximately 80% of PAR receive medical assistance and medical care costs are increasing. In a preliminary report, PAR had a higher incidence of non-communicable diseases such as type 2 diabetes (T2D) than health insurance enrollees (HIE)⁹. Progression of diabetes causes microvascular complications and presents as major obstacles to independent living such as dialysis treatment due to diabetic nephropathy, blindness from diabetic retinopathy, and leg amputation from diabetic neuropathy. Also, diabetes, and hypertension and dyslipidemia comorbidities are risk factors of heart disease and stroke^{10,11}.

The Ministry of Health, Labour and Welfare, Japan (MHLW) focuses on the prevention of onset and progression of non-communicable diseases among PAR. The MHLW started a health management support program to reduce non-communicable diseases, especially T2D⁹. The MHLW instructed local governments and welfare offices to prepare and enact a localized plan with a plan-do-check-action (PDCA) cycle. However, information related to the overall current status of T2D among PAR is limited to reports from certain geographical areas or is

1 based only on the results of medical checkups. The actual nationwide prevalence in Japan and regional differences
2 are also unclear. Therefore, we aimed to describe the T2D prevalence by age and sex among PAR in Japan. To
3 consider the significance of T2D prevalence, we calculated the prevalence among HIE for comparison. Also, we
4 examined regional differences in T2D prevalence among PAR.

6 **METHODS**

7 **Design**

8 A cross-sectional study using health insurance claims data for both medical assistance and public medical
9 insurance.

11 **Data source 1: PAR**

12 The Fact-finding Survey on Medical Assistance (FSMA) data were used to obtain the number of patients^{12,13}. The
13 National Survey on Public Assistance Recipients (NAPSR) data were used to obtain the number of PAR. The
14 prevalence of recipients was calculated using the number from the FSMA as the numerator and the number from
15 the NAPSR as the denominator.

16 The FSMA is conducted every year by the MHLW. FSMA, a general statistical survey based on the Statistics Act,
17 aims to understand the treatment details of medical assistance recipients under the Public Assistance Act. All claims
18 data of medical assistance recipients are assessed every year in June (for medical treatments in April and May) and
19 the survey includes claims for outpatients, inpatients, diagnosis procedure combination (DPC) inpatients,
20 prescription dispensing, and dental treatments. The present study used data on medical treatments for May related
21 to inpatients, outpatients, and prescription dispensing. As for personal identification, each anonymized data entry
22 was given an ID number created from the number of municipal welfare offices and the “ID2”¹⁴, which was
23 generated based on the person’s name, date of birth, and sex.

24 NAPSR, a general statistical survey based on the Statistics Act, aims to understand the status of households that are
25 current and past recipients of public assistance based on the Public Assistance Act. Annual surveys, the baseline
26 survey, and the individual survey are conducted every year in July in addition to monthly overview surveys. Since
27 the monthly surveys report total numbers, the total number of PAR for May by sex and age was calculated by
28 multiplying the sex and age ratios reported in the annual survey by the total number of recipients in May.

Data source 2: HIE

We used the sampling dataset of the National Database of Health Insurance Claims and Specific Health Checkups of Japan^{15,16} (NDB) to obtain the number of patients. The NDB is a database that collects almost 100% of the digitized health insurance claims data nationwide. In Japan, all persons are required to be covered by public health insurance and it is possible to assess the status of nearly all medical treatments provided to HIE. The MHLW provides a NDB sampling dataset (NDB-SD)¹⁷ that is created by extracting 10% of health insurance claims for inpatients and DPC inpatients and 1% of claims for outpatients over a 1-month period from the NDB. The NDB-SD is random sampling data and it was not possible to connect the inpatient and outpatient claims data of the same individual. Therefore, outpatient and prescription dispensing claims were used.

The baseline survey on health insurance data was used to obtain the number of HIE. The baseline survey on health insurance, compiled by the MHLW's Health Insurance Bureau's Actuarial Research Division is a collection of data such as the application of different systems and surveys of the status of its services in each health insurance system. Since HIE are reported as a total number by age group, the numbers for each sex were calculated by the rate of population numbers by sex and age group shown in the National Livelihood Survey report.

The prevalence of HIE was calculated using the number from the NDB-SD as the numerator and the number from the baseline survey on health insurance as the denominator.

Target period

One month's worth of data of medical treatments for May in 2015, 2016, and 2017 from FSMA data and medical treatments for April 2015 from the NDB-SD were used. Data from the July annual surveys in 2015, 2016, and 2017 and the monthly surveys in May from the NAPSRS were used along with the data from the baseline survey on health insurance and the 2015 annual National Livelihood Survey data.

Variables

Items related to sex, age group, geographical area, disease code, and medication were obtained from the health insurance claims data. For area, data for prefecture (47 areas) and city level (112 geographical areas) were examined. At the city level, 20 government ordinance-designated cities and 45 core cities were examined and all others were aggregated at the prefectural level because publication of results analyzed by smaller categories was restricted by the MHLW.

Definition of disease

Diabetes, hypertension, dyslipidemia and diabetes-related renal complications, ophthalmic complications, and neurological complications were defined based on the 2013 version of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) code. Also, those not receiving medication for diabetes, hypertension, and dyslipidemia were excluded to avoid including individuals whose disease was not clinically confirmed. Drugs were defined using classification code 87 of the Japan Standard Commodity Classification¹⁸ (Appendix 1). Moreover, type 1 diabetes was excluded from the analysis, and T2D was targeted.

Statistical analysis

Among PAR, T2D prevalence and the proportion of comorbidity (hypertension and dyslipidemia) and complications (diabetic nephropathy, retinopathy, and polyneuropathy) were determined by sex and by age group. The data used were inpatient and outpatient claims data in May 2015, 2016 and 2017. Among HIE, prevalence and proportion were determined by sex and age group. The data used were outpatient claims data in April 2015. In the comparison between PAR and HIE, the population composition by age group was different (Figure 1), so the T2D prevalence was age-standardized with a 1985 Japanese model population¹⁹. The data used for comparison were both outpatient claims data in May 2015 and April 2015, respectively. The proportion of comorbidity and complications was calculated with T2D patients as the denominator.

Additionally, regional differences in T2D prevalence at the prefecture (2015, 2016, 2017) and city levels (in 2015) were determined among PAR. For prefecture, T2D prevalence of crude and age-standardized prevalence was examined. The prevalence in each prefecture was classified into five categories: (A) higher than the mean value of 47 prefectures plus the standard deviation; (B) higher than the mean value and lower than A; (C) mean value; (D) lower than the mean value and higher than E; and (E) lower than the mean value minus the standard deviation. For the city-level analysis, multilevel logistic regression analysis with a random intercept was performed using T2D as the outcome variable, sex and age group as the fixed effect parameters, and the welfare office region as the random effect parameter. The target participants of the analysis were those 30 years and older. The number of people who did not consult healthcare facilities was derived from the number of PAR in the NAPS for the corresponding month (by sex, age group, and geographical area). The HIE aged 40 years and older are required health checkups focusing on visceral fat obesity in Japan. However, a previous report found that the impact of

diabetes on coronary artery disease was markedly greater in men aged 31–40 years compared with those aged 41–60 years²⁰. Thus, we targeted PAR aged 30 years and older.

The t-test was used to test for differences and the chi-square test was used to test for independence. The significance levels of the tests were set at 0.05. Statistical analysis was performed using R version 3.4.3.

Ethical considerations

The raw data of the FSMA was obtained after receiving approval from the MHLW in accordance with Article 33 of the Statistics Act²¹. The raw data of the NDB-SD was obtained after receiving approval from the MHLW according to the “Guidelines for the provision of NDB”²². The data for the NAPS, National Livelihood Surveys, and baseline surveys on health insurance were collected using online aggregated data.

RESULTS

The number of PAR in 2015, 2016 and 2017 was 2,161,442 (49.5% men; mean age, 56.0 years), 2,148,282 (49.5%; 56.0 years), and 2,130,482 (49.6%; 56.0), and the T2D crude prevalence in inpatients and outpatients was 7.7%, 7.9%, and 8.3% (Figures 1, 2), respectively. The T2D prevalence tended to be higher with survey data and was highest (11.5%, 11.6%, 11.9%) among people in their 60s. The prevalence in men (8.6%, 8.8%, 9.2%) was statistically significantly higher (<0.001) compared to that in women (6.8%, 7.0%, 7.3%) (Figure 3; Appendix 2).

In 2015, for comorbidities, the proportion with hypertension was 66.8% (65.7% of men and 68.2% of women), dyslipidemia was 47.7% (42.3%, 54.3%, respectively) and both hypertension and dyslipidemia was 35.5% (31.6%, 40.4%, respectively). The proportion of hypertension was higher with age in both men and women until their 70s and there was a slight decrease in their 80s. As for dyslipidemia, the comorbid proportion peaked in their 40s among men and decreased thereafter, and among women, it continued to be higher until their 60s. The comorbid proportion of both hypertension and dyslipidemia was higher with age, peaking in their 60s in men and their 70s in women. The proportion of complications was as follows: renal complications 15.9% (16.9%, 14.8%, respectively), ophthalmic complications 16.4% (17.7%, 14.8%, respectively) and neurological complications 12.5% (14.1%, 10.6%, respectively) (see Appendix 3 for age-specific details).

The mean crude prevalence and age-standardized prevalence of PAR among 47 prefectures in 2015 were 7.8% (standard deviation; 1.5%) and 3.9% (0.8%), respectively. There were no notable characteristics when the

correlation was examined by plotting T2D prevalence (crude and age standardized) on the y-axis, and old-age index (the proportion of the population 65 years and older to the population between 15 and 64 years), public assistance proportion (the proportion of the population receiving public assistance to the population of each prefecture) and prefectural population on each x-axis (Appendix 4). The T2D prevalence in each prefecture was classified into five categories, and the results showed there was no considerable difference in the categories of each prefecture for 3 years in both crude and age-standardized prevalence (Figure 4).

When examined by city level (112 geographical areas), the crude prevalence of patients with T2D was 166,335 (9.1%) out of a total of 1,830,162 people. There was a five-fold difference ($=13.1\%/2.6\%$) in diabetes prevalence in the crude prevalence by city level (Appendix 5). The multilevel logistic regression analysis showed that the standard deviation for the geographical area was 0.27 ($\exp(-0.27)=0.76$, $\exp(0.27)=1.31$) and the odds ratio by city level was within the range of 0.31 and 1.51 (Table 1).

A comparison of PAR and HIE among outpatients in 2015 showed the T2D crude prevalence of outpatients was 7.5% in PAR (8.3% in men and 6.6% in women) and 4.1% among HIE (4.8%, 3.3%, respectively) (see Appendix 6 for age-specific details). In other words, the prevalence was higher in PAR. The age-standardized prevalence was 3.8% in PAR (4.3%, 3.3%, respectively) and 2.3% in HIE (3.0%, 1.7%, respectively) ($p<0.01$). As for the proportion of comorbidities, 67.4% of PAR and 65.2% of HIE had comorbid hypertension. Similarly, the proportion with comorbid dyslipidemia was 48.5% and 47.9%, respectively, and the proportion of those with both dyslipidemia and hypertension was 36.2% and 34.2%, respectively. In other words, the proportion of comorbidity was higher among PAR. The proportion of renal, ophthalmic, and neurological complications was 16.2%, 16.7%, and 12.7%, respectively, among PAR and 15.1%, 13.1%, and 6.8%, respectively, among HIE. The proportion with complications was higher among PAR (see Appendix 7 for age-specific details).

DISCUSSION

We revealed through health insurance claims that the prevalence of those receiving drug treatment for T2D was 7.7% (8.6% in men, 6.8% in women) among inpatients and outpatients. In outpatients, the prevalence was 7.5% (age-standardized prevalence; 3.8%) and 4.1% (2.3%) among PAR and HIE, respectively. Diabetes prevalence among the general Japanese population has been reported by the MHLW's "National Health and Nutrition Survey". The survey includes interviews regarding diabetes and the presence or absence of medication, and it is estimated the number of diabetics and prediabetics in Japan is 10 million patients each and the age-standardized prevalence of

1 diabetes is 12.1% (16.3% for men and 9.3% for women in 2016)²³. A community-based cohort study reported that
2 the prevalence of age-normalized diabetes was 20.8% in men and 11.2% in women²⁴. Furthermore, a study using
3 medical claim data from regional HIE reported a diabetes prevalence of 9.6%²⁵. There is a limitation in
4 understanding diabetes prevalence based on interview surveys reporting estimates and regional surveys; therefore,
5 the comparison prevalence of diabetes among HIE and PAR nationwide is unknown. In this study, we determined
6 the prevalence by using health insurance claims.

7 The T2D prevalence was higher among PAR and the proportion of comorbid hypertension, dyslipidemia,
8 and diabetic renal, ophthalmic, neurological complications was also higher in PAR compared to HIE. By sex, the
9 prevalence in men was higher than in women, as in previous reports. The high proportion of diabetes comorbidities
10 and complications among PAR could be due to the fact that life difficulties harm their health. Complications greatly
11 affect the rise in healthcare expenditure. Suzuki *et al.*²⁵ reported that, compared to having no complication,
12 necessary expenditure rises 1.7 and 1.6 times with renal complications and ophthalmic complications, respectively,
13 and measures to address the prevention of complications are also needed. Funakoshi *et al.*²⁶ reported that low
14 socioeconomic status is related to the high prevalence of T2D complications among young adults. Their study
15 suggested that to decrease diabetes complications, interventions that target both general risk factors and social
16 determinants of health are needed. Various complications develop when diabetes progresses, and therefore,
17 continued support in health management is needed to delay the progression. Among individuals who were first
18 diagnosed with diabetes at a checkup, those who started to visit the hospital once a month had a 10 to 14 times
19 higher chance of improving hemoglobin A1c levels by 1% or more at the following year's checkup compared to
20 those who were untreated²⁷. The recommendation to receive periodic medical checkups and follow-ups among PAR
21 may prevent the progression of the disease.

22 In the examination of T2D prevalence by geographical area, the city-level analysis suggested that there
23 are regional differences. By prefecture, the old-age index, regional population, and the number of PAR were
24 considered as factors; however, as none of these factors alone was the cause of the regional difference, multiple
25 factors may have been associated^{28,29}. Minagawa *et al.*³⁰ pointed at regional welfare spending as a factor related to
26 healthy life expectancy in PAR. Nomura *et al.*³¹ suggested that the performance of regional health variations,
27 including the subnational health system, may also be related to behavioral factors, psychosocial factors, and social
28 factors. Furthermore, Nishioka *et al.*³² reported that unemployment and living alone might be additional risk factors
29 for diabetes among younger PAR.

The progression of diabetes not only decreases the quality of life but is also a great burden on the medical economy. In Japan, local governments cover one-quarter of the finances for public assistance programs and rising healthcare costs per patient are a heavy burden on the financial resources. The amount of health expenditure paid on behalf of PAR as medical assistance accounted for 4.2% of total healthcare expenditure in 2014³³. To limit further increase in healthcare spending, the government promotes health management programs based on data for people availing of public assistance. Our method of research using health insurance claims will provide the fundamental methodological procedures to conduct a “data health plan” which aims to enable efficient and effective health activities based on the PDCA cycle for the MHLW and local governments. Japan seemed to have successful universal health coverage and public assistance system as a safety net. However, Japan is struggling with the escalation of medical costs and health disparities³¹. The potential sources of fundamental health status among PAR urgently need assessment. This empirical evidence in Japan would be helpful to achieve no poverty, good health, and reduced inequalities as sustainable development goals.

We acknowledge that there are several limitations of this study. First, the results were obtained through a cross-sectional study using 1 month of health insurance claims data. Thus, the prevalence could be underestimated because some patients with diabetes may not visit healthcare facilities every month. According to a report using an electronic database of Japanese community pharmacy chains, the average number of prescription days per prescription for outpatients with chronic diseases was Metformin hydrochloride 38.1 ± 15.0 days and Sitagliptin phosphate hydrate 36.7 ± 15.5 days³⁴. According to a 2019 survey report on hypoglycemic drugs by the MHLW, about 70% were within 30 prescription days³⁵. The proportion of prescriptions written for ≥ 31 days could be very small in Japan. However, the difference between prescription days for PAR and HIE should be considered in future research. Second, the reverse causality may have biased the findings. Patients with T2D among PAR include cases of both patients derived from poverty (T2D onset after PAR) and people who become PAR because of T2D (PAR after T2D onset). The high diabetes prevalence among PAR could be due to the inclusion of people receiving public assistance due to diseases, and life difficulties that may harm their health. Third, FSMA does not include some patients, whose other welfare services are prioritized over the public assistance program. For example, if recipients are receiving other welfare services such as disability assistance, claims on their medical services are not reflected in medical assistance survey data. Also, some PAR (2-3%) are still enrolled in employee health insurance³⁶, and very few of the individuals who have received medical treatment under employee health insurance are included in the NDB-SD. These facts may have biased the findings and there is a possibility that the number of T2D patients in

1 PAR is underestimated.

2

3 **CONCLUSION**

4 The prevalence of T2D and comorbidity proportion among PAR was higher compared to public insurance enrollees.

5 Furthermore, there was a regional difference in the prevalence. Measures by region to prevent the progression of
6 diabetes among PAR are needed.

7

1 **What is already known on this subject?**

2 It is well-known that social and economic environments are determinants of health. Public assistance recipients
3 (PAR) had a higher incidence of non-communicable diseases such as type 2 diabetes (T2D) than health insurance
4 enrollees (HIE) in a preliminary report; however, the evidence is limited. Since the Japanese government has
5 started a health management support program especially targeted at T2D among PAR, local governments and
6 welfare offices should prepare and enact a localized plan.

7 **What this study adds?**

8 T2D receiving medical treatment comprised 7.5% of PAR and 4.1% of HIE, respectively. There was a regional
9 difference in the prevalence of PAR. The prevalence of T2D among PAR was higher than HIE and measures to
10 prevent the progression of diabetes depending on the region are needed.

11

1 **FIGURE LEGENDS**

2 Figure 1. Japanese population, public assistance recipient population, and diabetes population of public assistance
3 recipients by age group.

4 Figure 2. Flow diagram of public assistance recipients in the study population.

5 Figure 3. Type 2 diabetes prevalence among public assistance recipients.

6 Figure 4. Age-standardized and crude prevalence of type 2 diabetic public assistance recipients by prefecture.

7 Table 1. Results of multilevel analysis of the prevalence of patients with type 2 diabetes by city for sex and age
8 group.

9

1 Table 1. Results of multilevel analysis of the prevalence of patients with type 2 diabetes by city for sex and age
2 group.

Fixed effects parameters		Value	
Odds ratio (95%CI ^a)	Female	0.83	(0.82-0.83)
	30s	Reference	
	40s	2.27	(2.19-2.34)
	50s	4.14	(4.02-4.27)
	60s	5.54	(5.39-5.70)
	70s	5.54	(5.38-5.70)
	80s	4.13	(4.01-4.26)
	≥90	2.17	(2.06-2.28)
Random effects parameters			
112 areas	Variance	0.072	112 areas
	SD	0.27	
	exp ^b (±SD ^c)	0.76, 1.31	
	Odds ratio, max	0.31	
	Odds ratio, mean	1.51	
	MOR ^d	1.29	

^aCI=confidence interval. ^bexp=exponential function. ^cSD=standard deviation. ^dMOR=median odds ratio.

1 **APPENDICES**

2 Appendix 1. Statistical classification of diseases and drugs.

3 Appendix 2. The number of public assistance recipients and diabetes prevalence by age and sex. Data are for 2015,
4 2016, and 2017.

5 Appendix 3. Proportion of comorbidity and complications in type 2 diabetic public assistance recipients.

6 Appendix 4. Correlation between the prevalence of type 2 diabetes and the old-age index, the proportion of public
7 assistance, and the prefectural population. Data are for 2015.

8 Appendix 5. Odds ratios and number of public assistance recipients with type 2 diabetes by area. Data are for 2015.

9 Appendix 6. Type 2 diabetes prevalence in public assistance recipients and public health insurance enrollees (crude
10 prevalence). Data are for 2015.

11 Appendix 7. Comorbidity and complication proportion in type 2 diabetic public assistance recipients and health
12 insurance enrollees. Data are for 2015.

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5 **Competing interests:** None declared.

6 **Disclaimer:** The findings and conclusions of this article are solely the responsibility of the authors and do not
7 represent the official views of the Japanese government.

8

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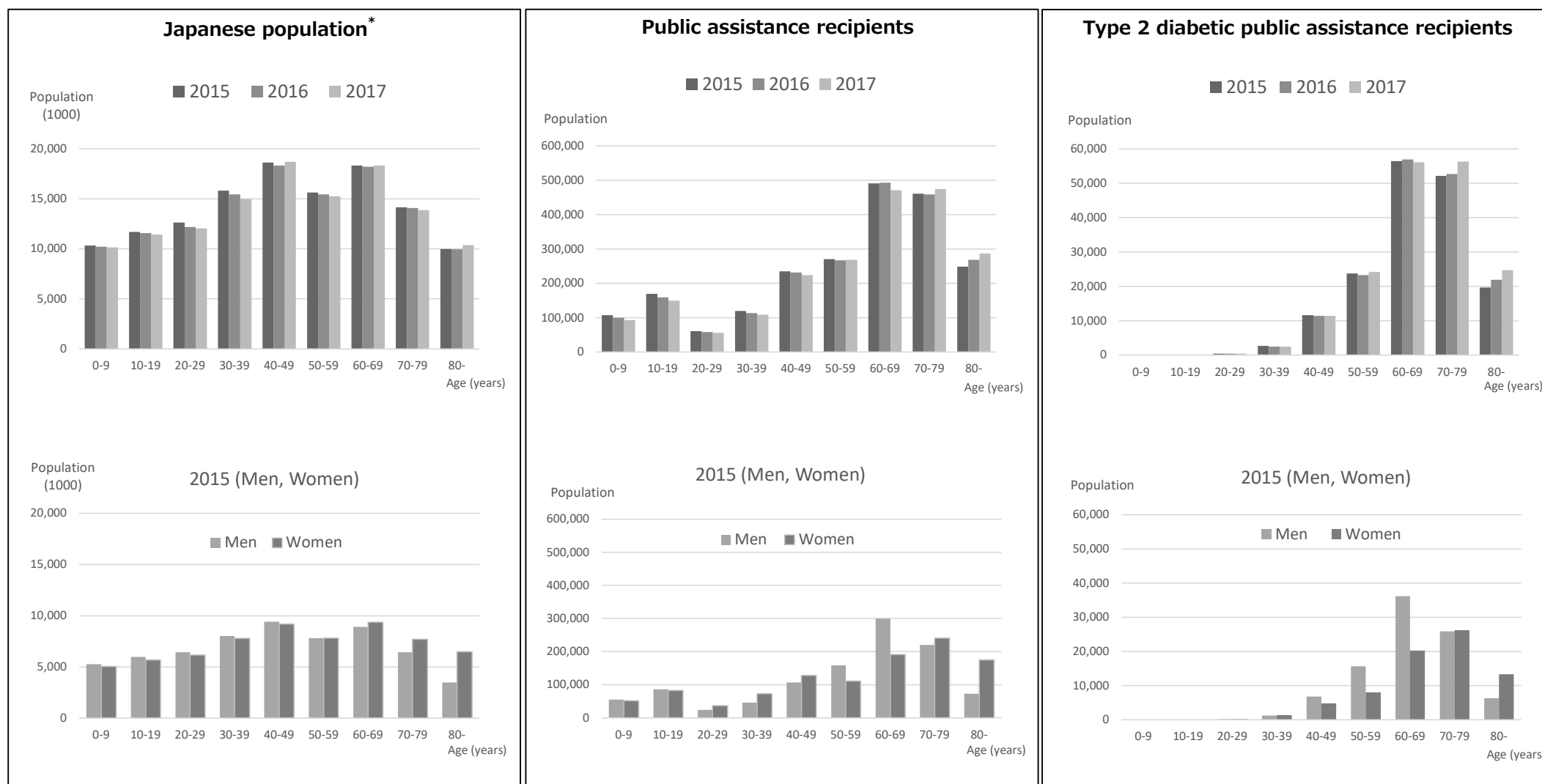
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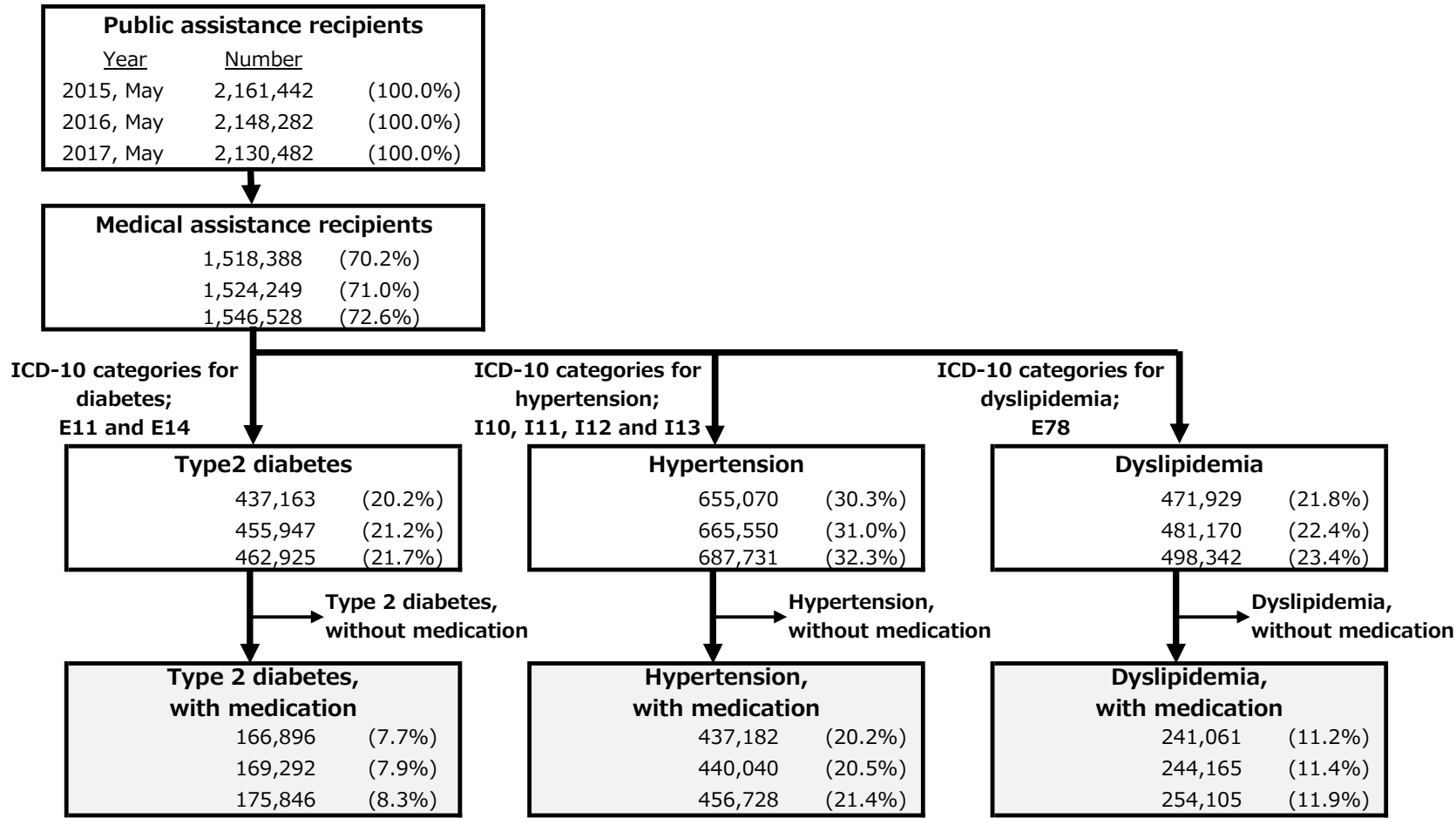
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14

Figure 1. Japanese population, public assistance recipient population, and diabetes population of public assistance recipients by age group.



*Data derived from Statistics Bureau of Japan. Available <https://www.stat.go.jp/english/> (accessed 16 Nov 2020)

Figure 2. Flow diagram of public assistance recipients in the study population.



※Denominator of the ratio is the number of public assistance recipients

Comorbidity: patient number and proportion	2015,May	2016,May	2017,May
Type 2 diabetic patients with hypertension	111,564 (66.8%)	113,468 (67.0%)	118,036 (67.1%)
Type 2 diabetic patients with dyslipidemia	79,541 (47.7%)	81,464 (48.1%)	85,117 (48.4%)
Type 2 diabetic patients with hypertension and dyslipidemia	59,296 (35.5%)	60,732 (35.9%)	63,492 (36.1%)

Proportion (%): number of patients with comorbidities/number of patients with diabetes.

Figure 3. Type 2 diabetes prevalence among public assistance recipients.

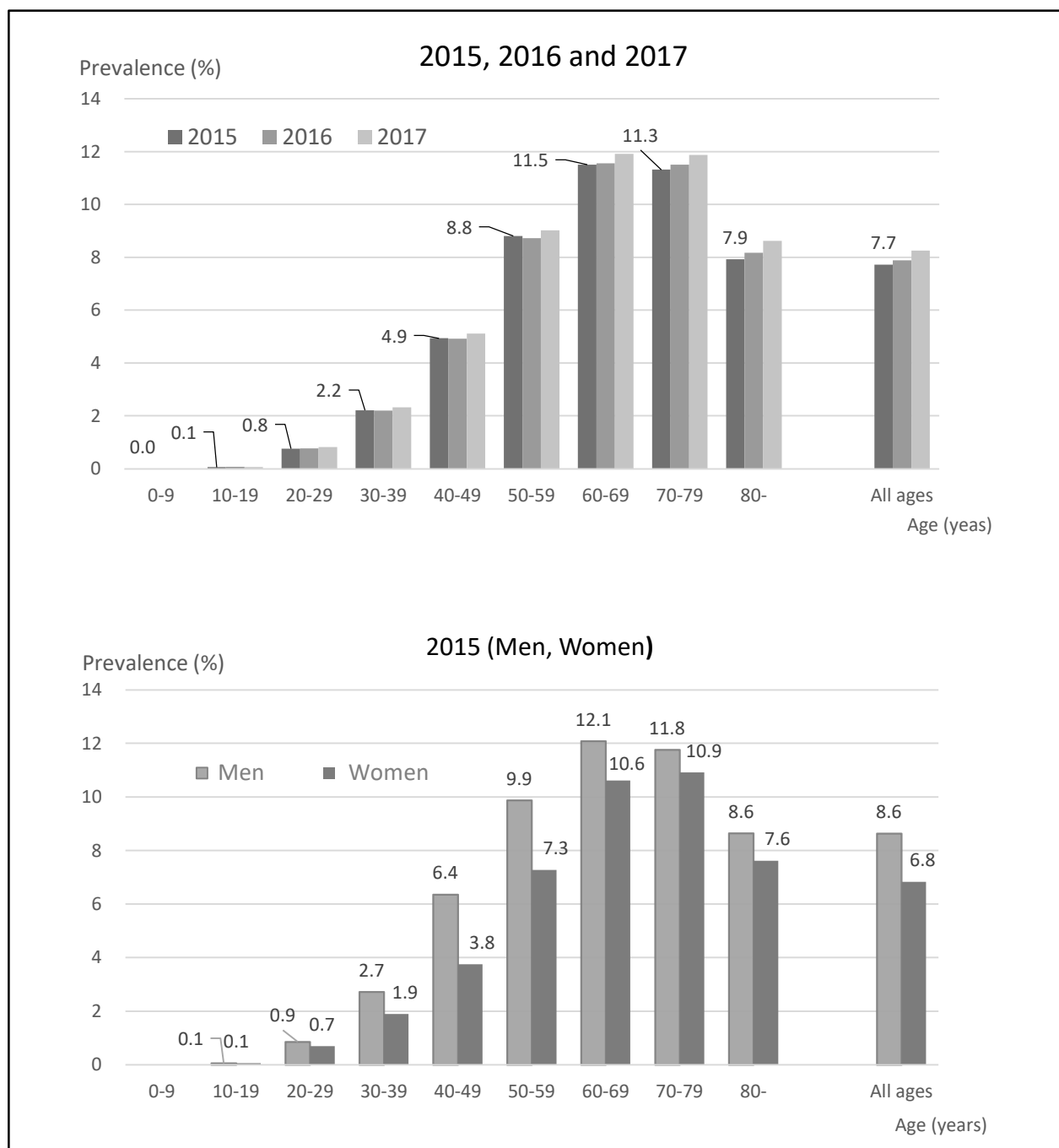
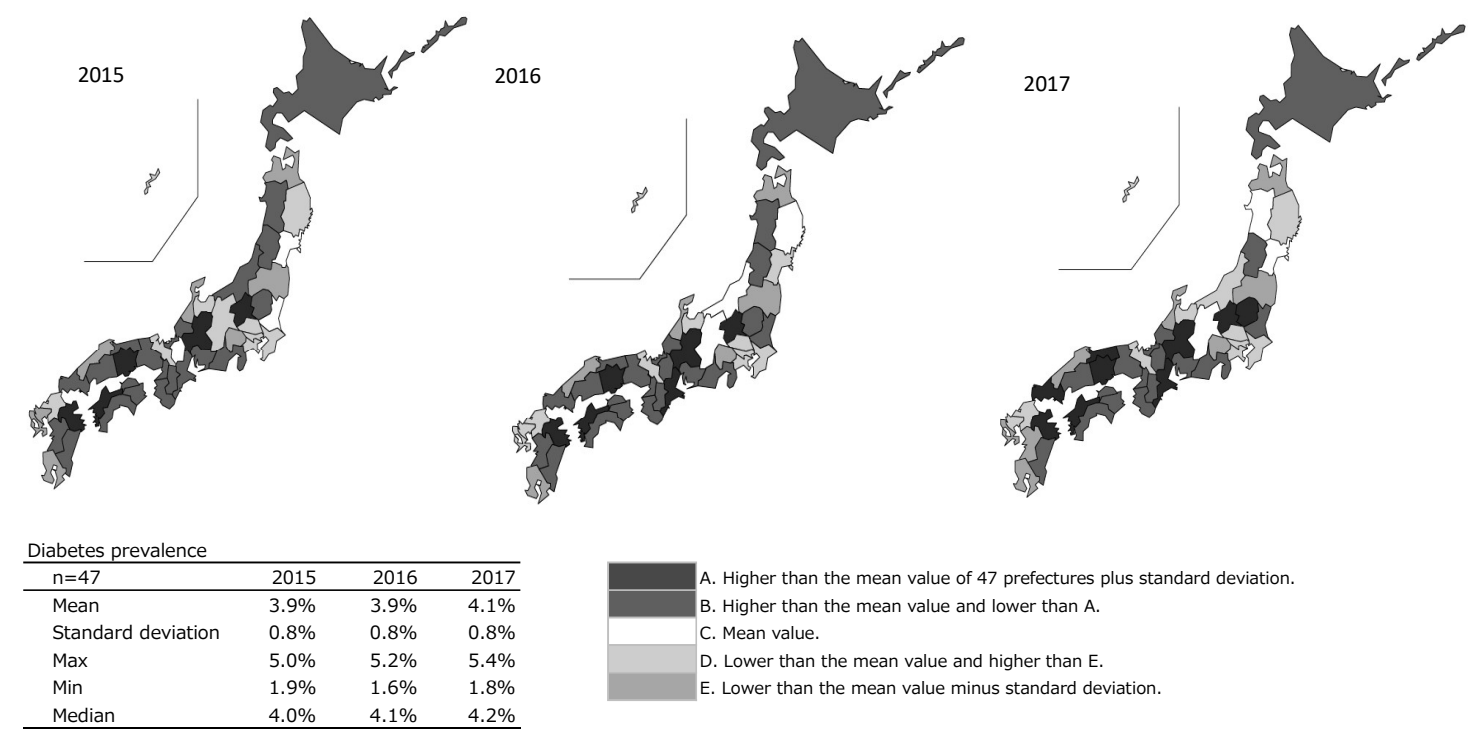
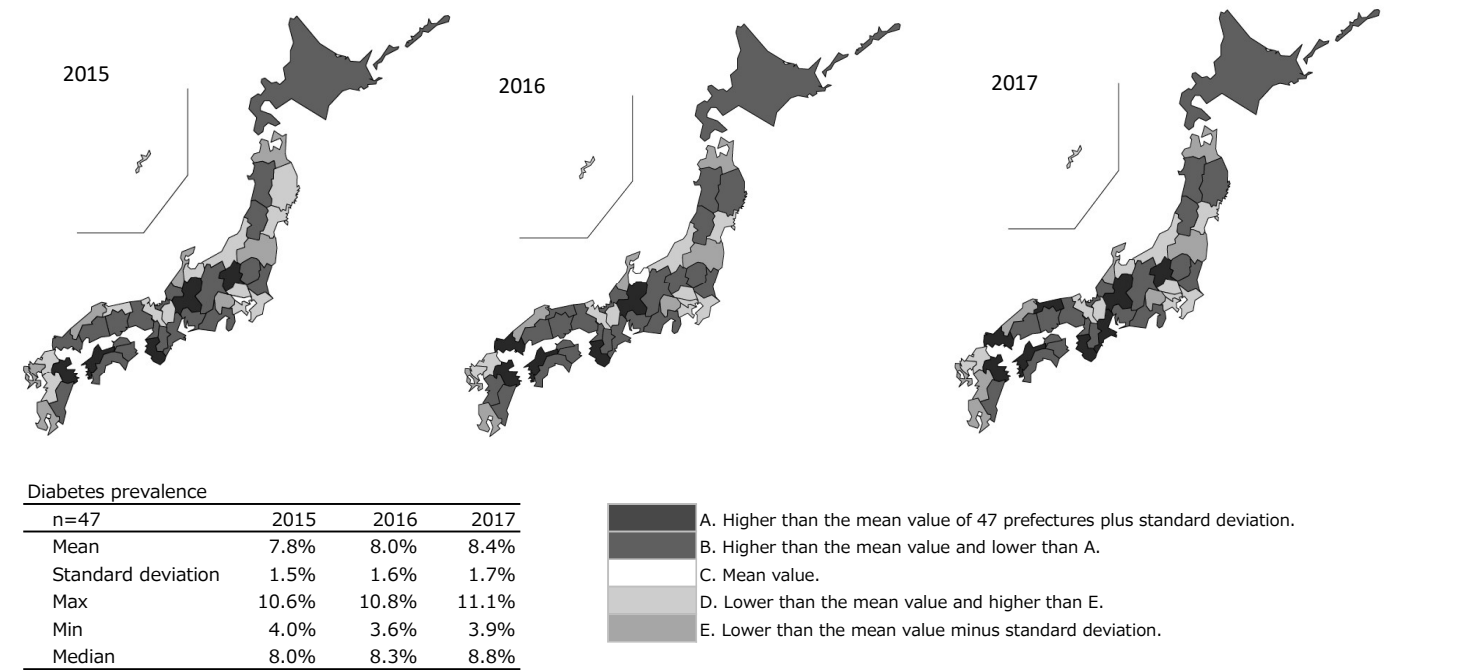


Figure 4. Age-standardized and crude prevalence of type 2 diabetic public assistance recipients by prefecture.

Age-standardized prevalence



Crude prevalence



Appendix 1. Statistical classification of diseases and drugs.

ICD-10 category for diabetes, hypertension and hyperlipidemia.

Disease names	ICD-10 category	
Diabetes	E11	Type 2 diabetes mellitus
	E14	Unspecified diabetes mellitus
Hypertension	I10	Essential (primary) hypertension
	I11	Hypertensive heart disease
	I12	Hypertensive renal disease
	I13	Hypertensive heart and renal disease
Dyslipidemia	E78	Disorders of lipoprotein metabolism and other lipidaemias

ICD-10 category for diabetes mellitus

With renal complications	E112, E142, N083 (glomerular disorders)
With ophthalmic complications	E113, E143, H360 (diabetic retinopathy)
With neurological complications	E114, E144, G632 (diabetic polyneuropathy)

Classification code of drugs for diabetes, hypertension, and hyperlipidemia.

Diseases	Classification code of drugs ^b	
Diabetes	396 Antidiabetic agents	3961 Sulfonylureas
		3962 Biguanides
		3969 Antidiabetic agents, others
	249 Miscellaneous hormones	2492 Pancreatic hormones (insulin)
Hypertension	212 Antiarrhythmic agents	2123 Beta-blockers
	213 Diuretics	2132 Thiazides
		2135 Chlorobenzene sulfonamides
	214 Antihypertensives	2144 Angiotensin-converting enzyme inhibitors
		2149 Antihypertensives, others
	217 Vasodilators	2171 Coronary dilators
Dyslipidemia	218 Hyperlipidemia agents	2183 Clofibrates
		2189 Hyperlipidemia agents, others

^a ICD-10; International Statistical Classification of Diseases and Related Health Problems (10th Revision).

^b Classification code of drugs; Japan Standard Commodity Classification, section 87 Drugs and related commodities.

https://www.soumu.go.jp/english/dgpp_ss/seido/8.htm (accessed 16 Nov 2020)

Appendix 2. The number of public assistance recipients and diabetes prevalence by age and sex. Data are for 2015, 2016, and 2017.

2015						2016						2017												
Public assistance recipients																								
Variable	Overall		Men		Women		Overall		Men		Women		Overall		Men		Women							
Number	2,161,442		1,070,856 (49.5)		1,090,586 (50.5)		2,148,282		1,064,467 (49.5)		1,083,815 (50.5)		2,130,482		1,056,123 (49.6)		1,074,359 (50.4)							
Age, mean	56.0		55.2		56.8		56.0		55.2		56.8		56.0		55.2		56.8							
Age category (years)																								
0-9	106,919		55,052		51,867		100,152		51,703		48,449		92,733		47,721		45,012							
10-19	169,270		86,363		82,908		159,071		81,157		77,914		149,217		76,131		73,086							
20-29	60,810		24,127		36,683		57,947		23,112		34,835		56,155		22,593		33,562							
30-39	119,438		46,197		73,241		113,249		44,109		69,140		108,470		42,886		65,585							
40-49	234,769		106,625		128,144		231,234		105,393		125,841		223,983		102,556		121,427							
50-59	270,044		158,923		111,121		267,131		156,163		110,968		268,070		155,373		112,697							
60-69	490,700		299,662		191,038		492,843		301,166		191,677		471,199		289,285		181,914							
70-79	460,949		220,339		240,609		458,387		220,299		238,088		473,906		231,107		242,798							
80-	248,543		73,569		174,974		268,267		81,364		186,903		286,749		88,471		198,278							
Diabetes																								
Variable	Overall		Men		Women		P-value		Overall		Men		Women		P-value		Overall		Men		Women		P-value	
Number	166,896		92,452 (55.4)		74,444 (44.6)				169,292		93,646 (55.3)		75,646 (44.7)				175,846		97,183 (55.3)		78,663 (44.7)			
Age, mean (SD)	66.7 (11.6)		65.0 (10.6)		68.7 (12.4)		<0.05 ^a		66.7 (11.6)		65.0 (10.6)		68.7 (12.4)		<0.05 ^a		66.7 (11.6)		65.0 (10.6)		68.7 (12.4)		<0.05 ^a	
Prevalence, (%) *	7.7		8.6		6.8		<0.05 ^b		7.9		8.8		7.0		<0.05 ^b		8.3		9.2		7.3		<0.05 ^b	
95%CI	7.69-7.76		8.58-8.69		6.78-6.87				7.84-7.92		8.74-8.85		6.93-7.03				8.22-8.29		9.15-9.26		7.27-7.37			
Age category (years), (%)*																								
0-9	0 (0.0)		0 (0.0)		0 (0.0)				0 (0.0)		0 (0.0)		0 (0.0)				1 (0.0)		1 (0.0)		0 (0.0)			
10-19	100 (0.1)		51 (0.1)		49 (0.1)				108 (0.1)		53 (0.1)		55 (0.1)				99 (0.1)		48 (0.1)		51 (0.1)			
20-29	461 (0.8)		207 (0.9)		254 (0.7)				445 (0.8)		196 (0.8)		249 (0.7)				458 (0.8)		199 (0.9)		259 (0.8)			
30-39	2,644 (2.2)		1,256 (2.7)		1,388 (1.9)				2,496 (2.2)		1,201 (2.7)		1,295 (1.9)				2,514 (2.3)		1,249 (2.9)		1,265 (1.9)			
40-49	11,588 (4.9)		6,777 (6.4)		4,811 (3.8)				11,374 (4.9)		6,594 (6.3)		4,780 (3.8)				11,462 (5.1)		6,568 (6.4)		4,894 (4.0)			
50-59	23,778 (8.8)		15,693 (9.9)		8,085 (7.3)				23,299 (8.7)		15,344 (9.8)		7,955 (7.2)				24,170 (9.0)		15,814 (10.2)		8,356 (7.4)			
60-69	56,461 (11.5)		36,199 (12.1)		20,262 (10.6)				56,938 (11.6)		36,578 (12.1)		20,360 (10.6)				56,135 (11.9)		36,288 (12.5)		19,847 (10.9)			
70-79	52,172 (11.3)		25,910 (11.8)		26,262 (10.9)				52,713 (11.5)		26,339 (12.0)		26,374 (11.1)				56,272 (11.9)		28,501 (12.3)		27,771 (11.4)			
80-	19,692 (7.9)		6,359 (8.6)		13,333 (7.6)				21,919 (8.2)		7,341 (9.0)		14,578 (7.8)				24,735 (8.6)		8,515 (9.6)		16,220 (8.2)			

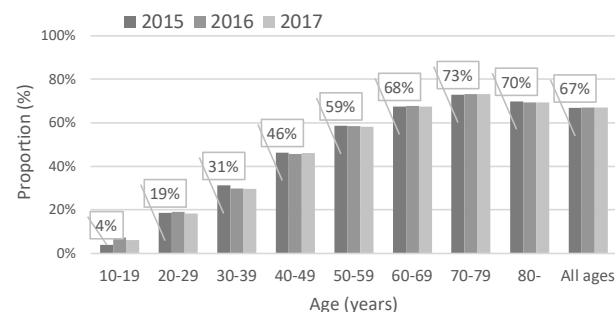
SD; standard deviation. CI; confidence interval.

*Number of diabetes patients/number of public assistance recipients.

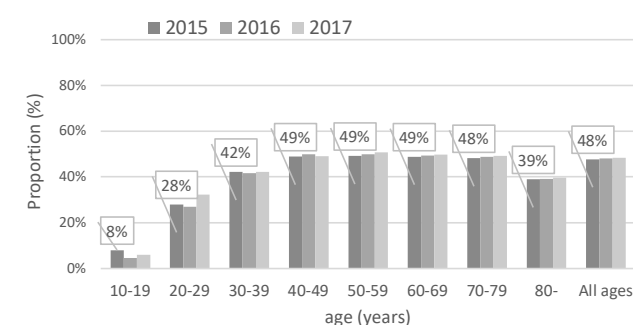
^aThe t-test was used to determine whether the average age of men and women was different.

Appendix 3. Proportion of comorbidity and complications in type 2 diabetic public assistance recipients.

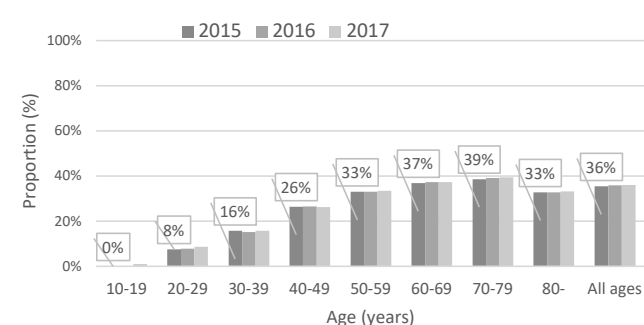
Diabetes comorbidity: Hypertention



Diabetes comorbidity: Dyslipidemia



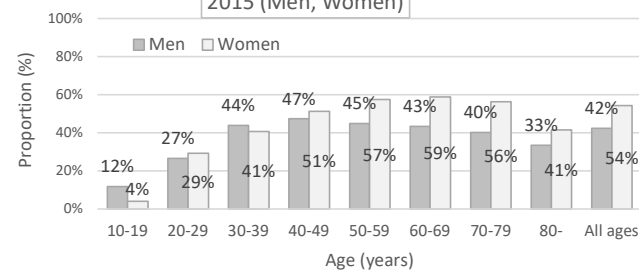
Diabetes comorbidity: Hypertension and Dyslipidemia



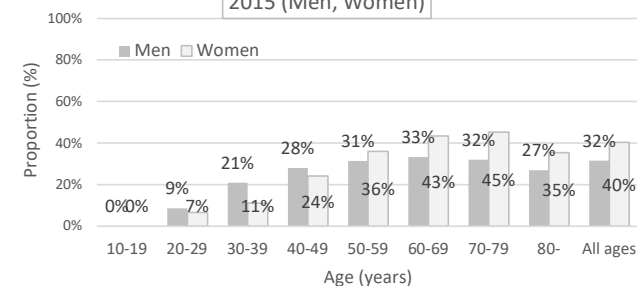
2015 (Men, Women)



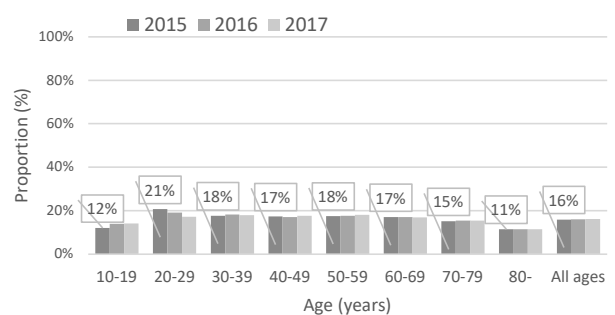
2015 (Men, Women)



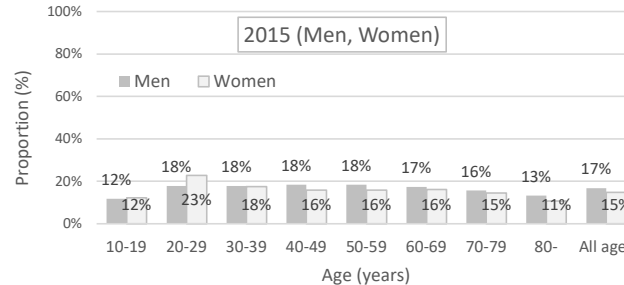
2015 (Men, Women)



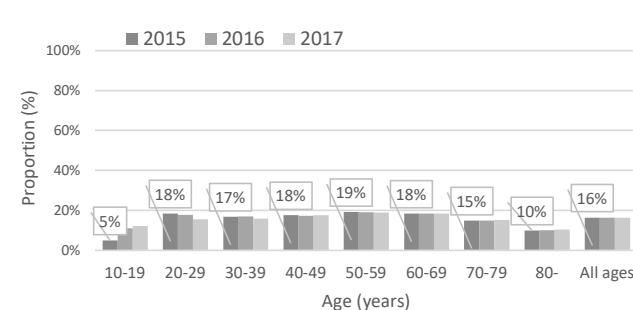
Diabetes renal complications



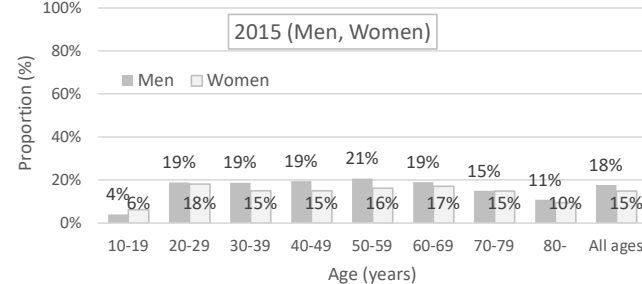
2015 (Men, Women)



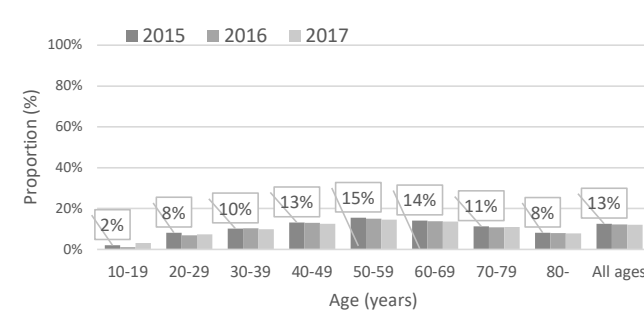
Diabetes ophthalmic complications



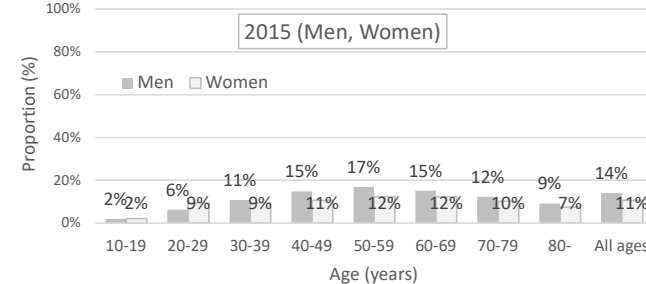
2015 (Men, Women)



Diabetes neurological complications

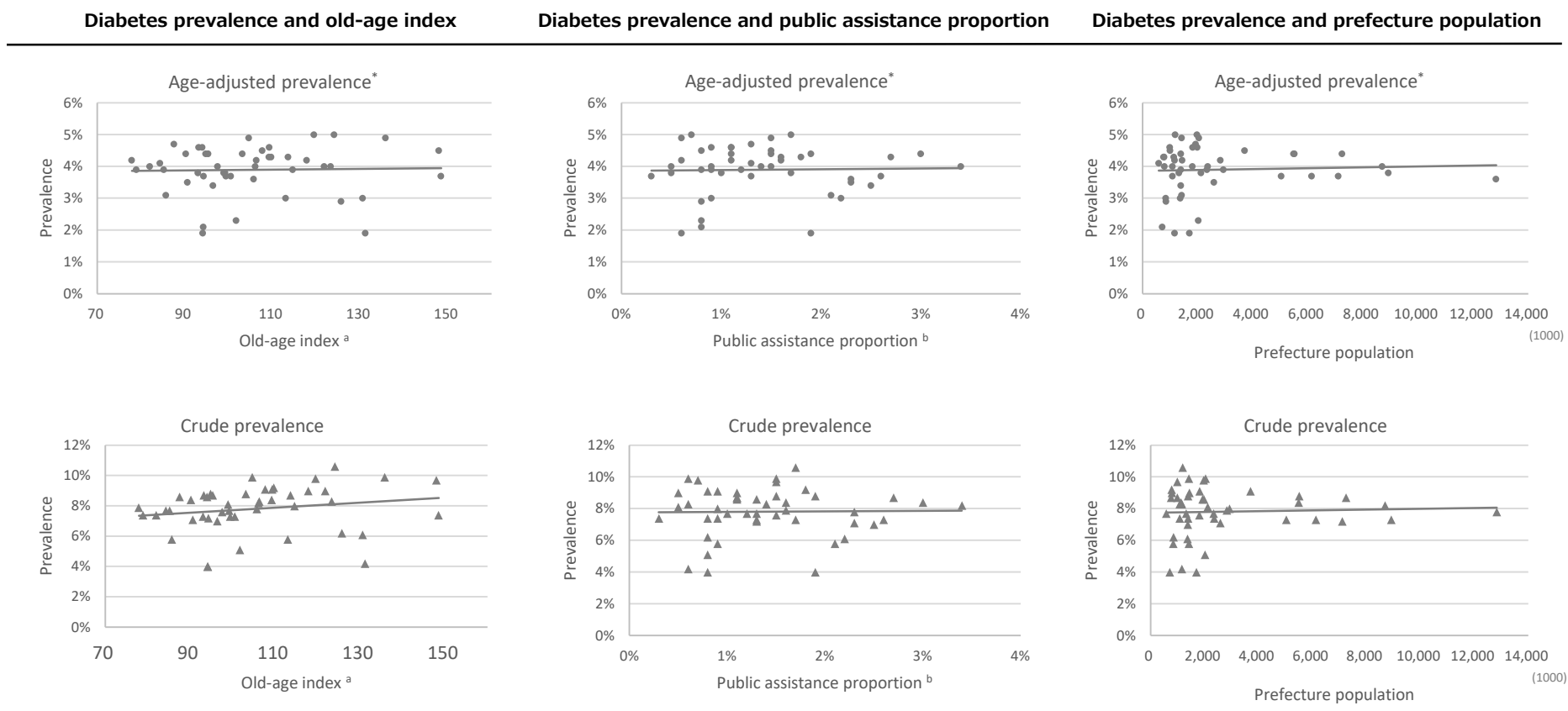


2015 (Men, Women)



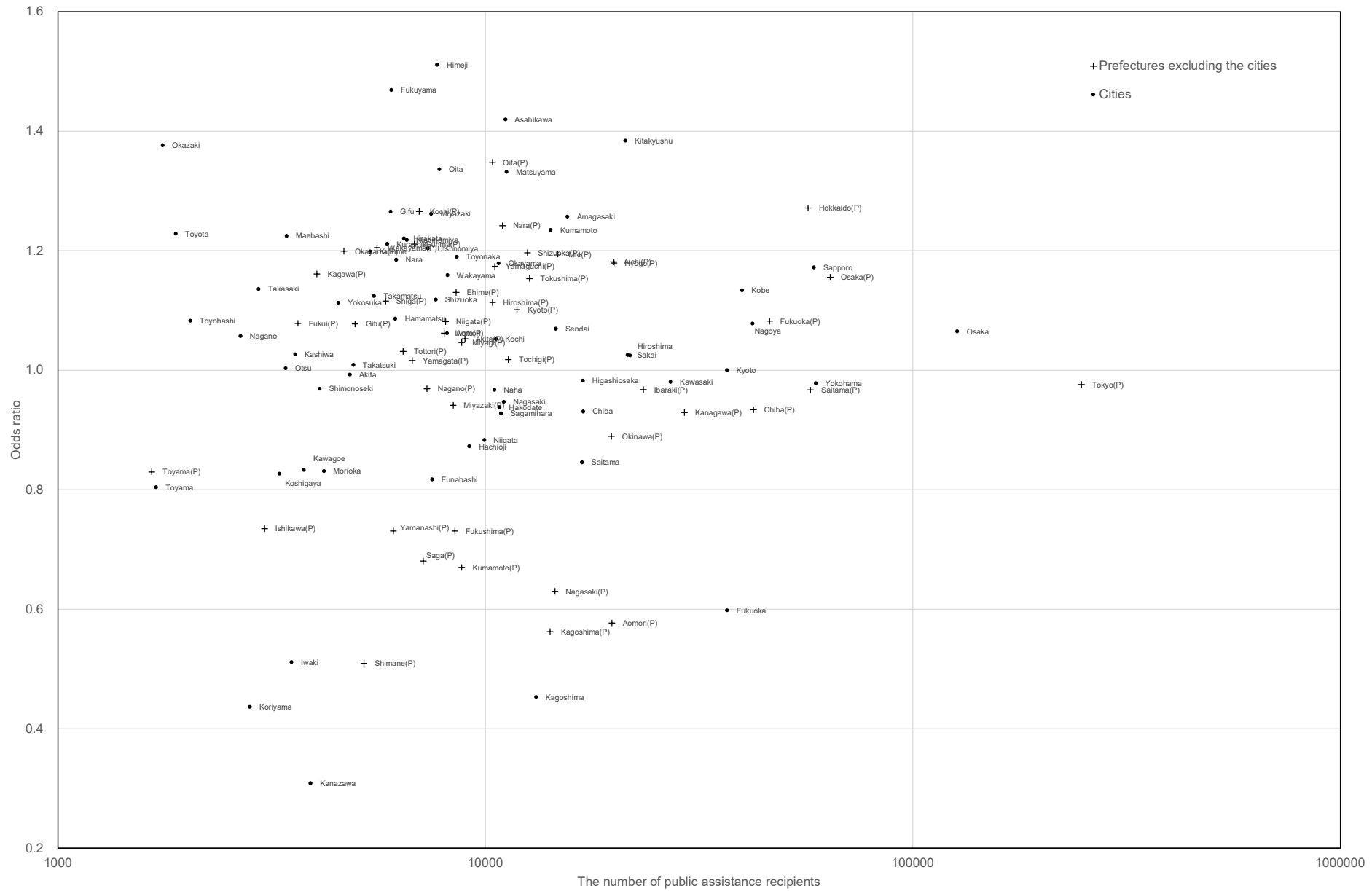
Proportion (%): number of patients with each disease/number of patients with type 2 diabetes.

Appendix 4. Correlation between the prevalence of type 2 diabetes and the old-age index, the proportion of public assistance, and the prefectural population. Data are for 2015.

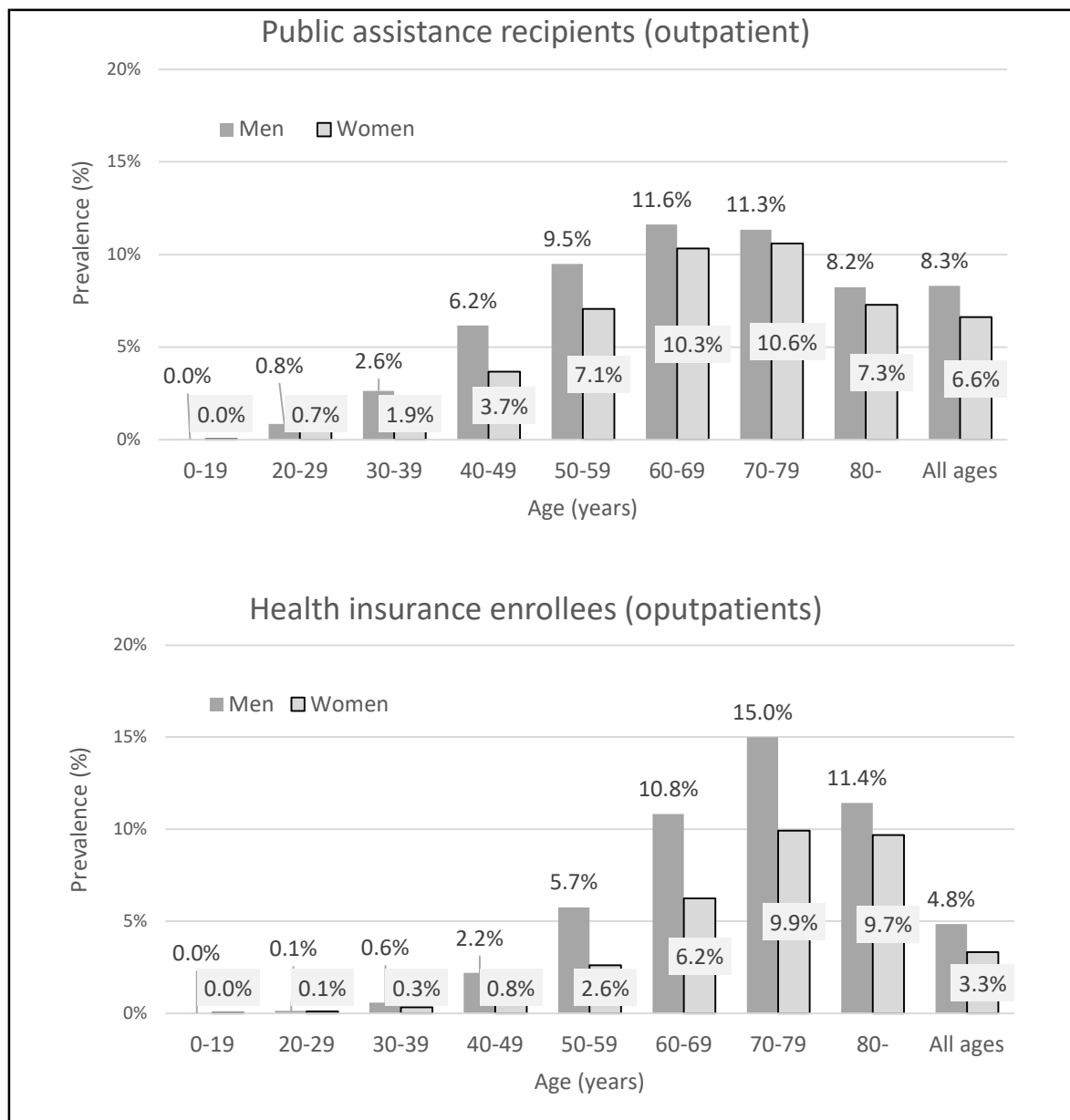


^aThe proportion of the population aged 65 years and older to the population aged from 15 to 64 years.

Appendix 5. Odds ratios and number of public assistance recipients with type 2 diabetes by area. Data are for 2015.

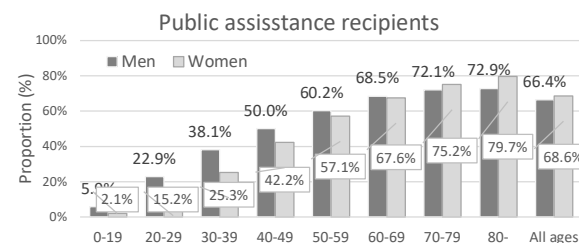


Appendix 6. Type 2 diabetes prevalence in public assistance recipients and public health insurance enrollees (crude prevalence). Data are for 2015.

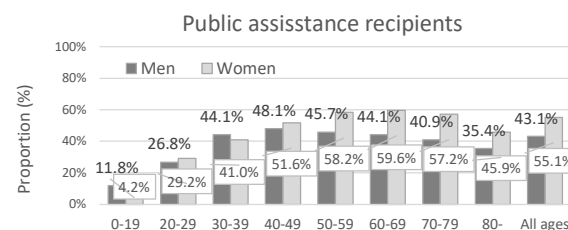


Appendix 7. Comorbidity and complication proportion in type 2 diabetic public assistance recipients and health insurance enrollees. Data are for 2015.

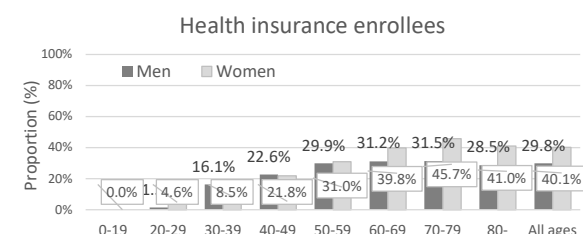
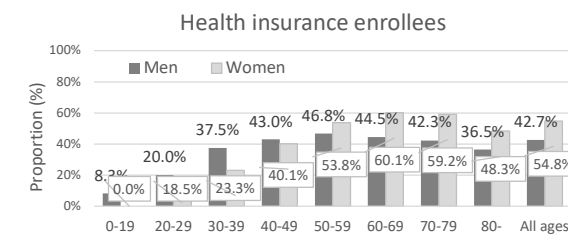
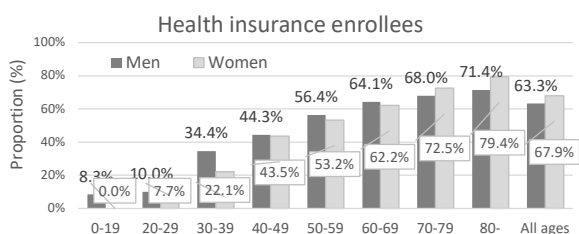
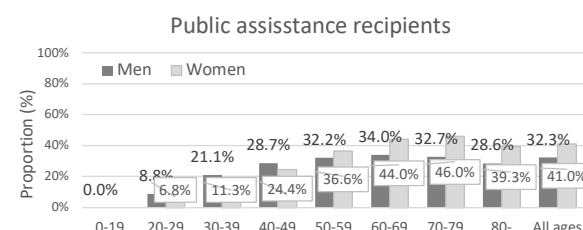
Diabetes comorbidity: Hypertention



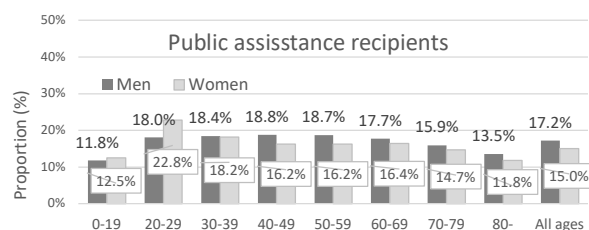
Diabetes comorbidity: Dyslipidemia



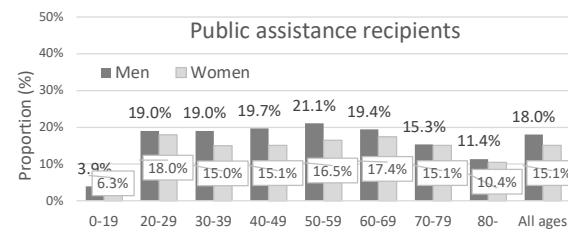
Diabetes comorbidity; hypertension and dyslipidemia



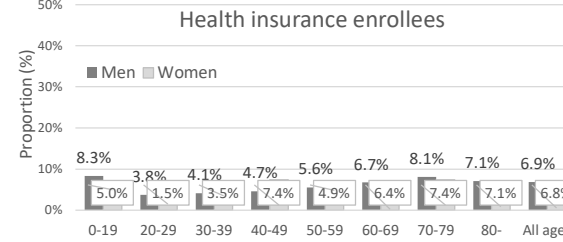
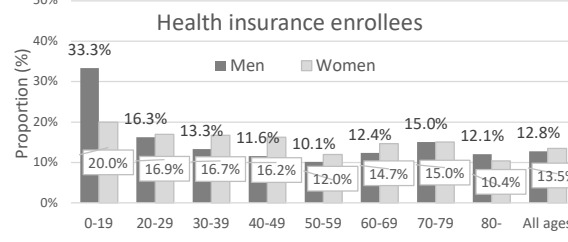
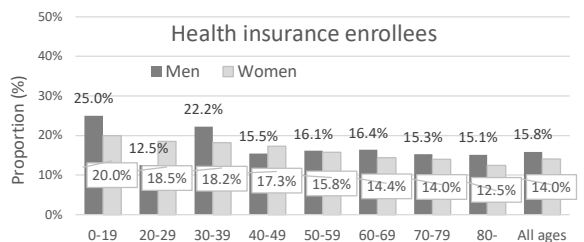
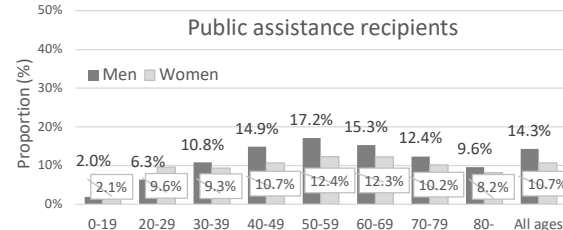
Diabetes renal complications



Diabetes ophthalmic complications



Diabetes neurological complications



Proportion (%): number of patients with each disease/number of patients with type 2 diabetes.