

1 **Nationwide survey of municipal policies and COVID-19 vaccination uptake among older adults**

2 **in Japan during 2024–2025**

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17 **Abstract**

18 Many countries continue to recommend COVID-19 vaccination, primarily to older adults. Following
19 the transition of the national immunization program for COVID-19 vaccination in Japan in April 2024,
20 implementation was delegated to municipalities. However, vaccination uptake and its associated
21 factors, particularly municipal-level policies, remain unclear. This ecological study clarifies the factor
22 associated with COVID-19 vaccination uptake among older adults in Japan during 2024–2025 by
23 analyzing 1,740 municipalities. Municipal vaccination uptake among individuals aged ≥ 65 years was
24 estimated from vaccine distribution data for the period. We examined the associations of uptake with
25 municipal policies and sociodemographic factors using negative binomial regression, and incidence
26 rate ratios (IRRs) and 95% confidence intervals (CIs) were calculated. The mean estimated
27 vaccination uptake across Japan was 17.9%. Individual notification via mailed vaccine screening
28 questionnaires had the largest effect, with higher uptake (IRR 1.57; 95% CI, 1.37–1.80). Low
29 out-of-pocket expenses were also associated with higher uptake (IRR 1.31; 95% CI, 1.12–1.52 for
30 $\leq 2,000$ JPY, Reference: $\geq 3,001$ JPY). A higher proportion of those aged ≥ 75 (IRR 1.03; 95% CI,
31 1.01–1.05) and a higher number of physicians (IRR 1.03; 95% CI, 1.00–1.06) were positively
32 associated with uptake as well. Conversely, the area deprivation index was associated with lower
33 uptake (IRR 0.87; 95% CI, 0.76–0.98). Proactive municipal strategies (individual notifications and
34 subsidies to reduce out-of-pocket expenses) were significantly associated with increased vaccination

35 uptake. To ensure equitable access and mitigate disparities, future vaccination campaigns should

36 incorporate outreach measures to address socioeconomic barriers.

37

38 **Keywords**

39 COVID-19, respiratory infection, vaccination strategy, vaccine uptake, municipality, policy,

40 out-of-pocket expense, socioeconomic status, Japan

41

42 **Introduction**

43 During the COVID-19 pandemic, various policies have been implemented across countries to increase
44 vaccination uptake, including free vaccination and the establishment of mass vaccination sites. Since
45 the transition to the Omicron phase, the pathogenicity of SARS-CoV-2 has not changed
46 substantially,^{1,2} and many countries continue to recommend COVID-19 vaccination, mainly for older
47 adults.³

48 In Japan, the Ministry of Health, Labour and Welfare has conducted special temporary vaccinations
49 under the Immunization Act in response to urgent public health needs to prevent the spread of
50 COVID-19. This has led to the implementation of unprecedented policies, such as providing
51 COVID-19 vaccinations free of charge, establishing special vaccination sites, and developing a
52 dedicated vaccine distribution system. As of March 2022, approximately 80% of individuals had
53 received two doses of the vaccine.⁴ The special temporary vaccination program, under which eligible
54 individuals were obligated to make efforts to receive the vaccine, ended on March 31, 2024. Therefore,
55 since April 2024, COVID-19 vaccinations have been administered as routine vaccinations to prevent
56 severe illness, and the disease has been reclassified as a category B disease, similar to influenza, under
57 the Immunization Act.⁵ Regarding routine vaccines for category B diseases, municipalities, rather than
58 the national government, are tasked with implementing public awareness activities, including mailing
59 vouchers for vaccines, managing records, and administering potential subsidies. Vaccine subsidies are

60 limited to individuals aged 65 years and older and those aged 60–64 years with certain underlying
61 medical conditions.⁶

62 Because policies such as COVID-19 vaccine subsidies and vaccination promotion activities vary
63 across municipalities, regional differences in vaccination uptake may reflect variations in municipal
64 policies. However, as few studies have examined the association between vaccination uptake and
65 municipal policies in Japan,⁷ this study aimed to clarify the association between COVID-19
66 vaccination uptake and its associated factors, including sociodemographic factors and municipal
67 policies, among older adults in Japan during 2024–2025.

68

69 **Materials and Methods**

70 *Data sources*

71 This exploratory study adopted an ecological design. As COVID-19 vaccinations are mainly
72 conducted for those aged 65 years and older, this study included the vaccination uptake among those
73 individuals. All subsidy periods began on October 1, 2024, while the end date for these periods varied
74 by municipality. The final possible end date was March 31, 2025, for a maximum of 182 days. In
75 addition, as official data on COVID-19 vaccine uptake had not been made publicly available following
76 the start of routine vaccination in Japan at the time of the survey, the COVID-19 vaccination uptake

77 was estimated using Pfizer’s COVID-19 vaccine production, inventory, and return numbers, along
78 with municipal population data. During this period, Pfizer’s COVID-19 vaccine was widely
79 administered in Japan,⁸ accounting for a substantial proportion of the total vaccinations.
80 Sociodemographic factors previously reported to be associated with other vaccination uptake, along
81 with municipal policy, were evaluated as independent variables.⁹ Data on population and
82 sociodemographic factors by municipality were obtained from e-Stat, a portal site for Japanese
83 Government Statistics.¹⁰ Information on municipal policies were obtained from official municipal
84 websites that made this information available. If information on COVID-19 vaccination for a
85 particular municipality were not publicly accessible online, the municipal vaccination officer was
86 contacted by telephone. We defined a municipal policy as “not implemented” when no information of
87 its implementation could be confirmed on the website or by telephone. In cases where the number of
88 vaccination sites and subsidy duration could not be confirmed on the website or by telephone, the data
89 were marked as missing. Municipalities with no persons eligible for the COVID-19 vaccine were
90 excluded from the analysis because of missing population data. Ethical review was not required
91 because the study used only publicly available data. Sales data for the vaccinations that were collected
92 for this study represented regional-level summaries, and did not include any personally identifiable
93 information.
94

95 ***Dependent variables***

96 The estimated number of COVID-19 vaccine recipients was calculated using data on COVID-19
97 vaccine production, inventory, and returns by municipality during the 2024–2025 season in Japan. The
98 population aged 65 years and older as of January 1, 2024, was extracted from the 2024 Basic Resident
99 Registration.¹⁰ COVID-19 vaccination uptake was defined as the estimated number of COVID-19
100 vaccine recipients divided by the population aged 65 years and older, as of January 1, 2024. If the
101 uptake calculated using this method exceeded 100%, any uptake exceeding 100% was converted to
102 100%.

103

104 ***Independent variable: sociodemographic factors***

105 Population density was defined as the number of people per square kilometer (number/km²), and the
106 number of employed individuals aged 65 years and older was extracted from the 2020 census of Japan,
107 which is the most recent data source available. Population density was transformed using its natural
108 logarithm because of the right-skewed distribution. The regional classification was based on the most
109 commonly used geographic divisions in Japan: Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku,
110 Shikoku, and Kyushu. The proportion of workers aged 65 years and older was calculated by dividing
111 the number of employed individuals aged 65 years and older by the total population of the same age.

112 The area deprivation index (ADI) derived from the 2020 census was used as an indicator of
113 municipality-level socioeconomic status. This composite indicator is the weighted sum of census
114 variables related to poverty. A higher ADI score indicates greater deprivation in the municipality. The
115 details of the ADI calculation are provided elsewhere.¹¹ The data on the population aged 65 and older
116 and aged 75 and older as of January 1, 2024 were extracted from the 2024 Basic Resident Registration.
117 The percentage of individuals aged 75 and older was calculated by dividing the population aged 75
118 and older by the population aged 65 and older. The number of physicians was obtained from the
119 Statistics of Physicians, Dentists and Pharmacists for 2022.¹² The number of physicians per 1,000
120 population was calculated using population data from the 2020 census.

121

122 ***Independent variable: municipal policies***

123 The following municipal policies were investigated to assess the implementation of
124 vaccination-related information dissemination (implemented/not implemented): mailing vaccine
125 screening questionnaires, notifications via communication apps (e.g., LINE®), notification on social
126 media (e.g., X®), postings on official municipal websites, creating campaign posters, publication in
127 public relations magazines, reminders about subsidy deadlines, and making campaign flyers. In Japan,
128 everyone who receives a vaccination must fill out a vaccine screening questionnaire to confirm their
129 health status, vaccination records, and signatures of consent. The number of vaccination sites per

130 square kilometer was calculated by dividing the number of vaccination sites by the inhabitable land
131 area, as reported in the statistical observations of municipalities 2024.¹⁰ The number of vaccination
132 sites per square kilometer was classified into two groups based on the median value: less than 0.3 sites
133 per km² and 0.3 or more. Regarding financial subsidies, the methods for determining subsidy amounts
134 varied among municipalities and generally followed one of these three patterns: (1) a fixed
135 out-of-pocket expense for vaccine recipients; (2) a specified subsidy amount provided by the
136 municipalities; or (3) a specified percentage of the total vaccination cost to be paid by the recipient. In
137 this study, out-of-pocket expenses were used as the independent variable. Therefore, in cases (2) and
138 (3), where the exact out-of-pocket amount was not stated, the cost was based on a standard vaccination
139 cost of JPY 15,300 (approximately \$105 USD), which was calculated as the amount to be paid by an
140 individual from the subsidies allocated by each municipality. We categorized out-of-pocket expenses
141 based on their distribution, which was highly concentrated in the JPY 2,000–3,000 range. For
142 descriptive purposes, we established four categories: JPY 0, 1–2,000, 2,001–3,000, and $\geq 3,001$.
143 However, for the multivariable regression model, we combined the JPY 0 and 1–2,000 categories.
144 This decision was made to ensure sufficient statistical power and model stability given the relatively
145 small number of municipalities (n=49) with no out-of-pocket expenses. Therefore, the final
146 independent variable for the multivariate analysis consisted of three levels: JPY 0–2,000, 2,001–3,000,
147 and $\geq 3,001$, with the highest-cost category serving as a reference. We also evaluated the policies

148 related to the municipal subsidy period. The maximum possible subsidy duration was 182 days
149 (October 1, 2024, to March 31, 2025). Although some municipalities set shorter periods initially, the
150 Ministry of Health, Labour and Welfare encouraged an extension of these periods. To examine
151 whether encouragement from the government had an impact on the vaccination uptake, the extension
152 of the subsidy period was also included as a variable. Reflecting on this context, we created a
153 composite categorical variable, “subsidy duration and extension,” that combined two dimensions: (1)
154 whether the municipality extended its subsidy period and (2) whether the final duration covered the
155 full 182 days. This resulted in a four-category variable: (1) full period (182 days) subsidy without
156 extension, (2) shorter than the full period without extension, (3) full period (182 days) following
157 extension, and (4) shorter than the full period following extension.

158

159 *Statistical analysis*

160 First, we calculated descriptive statistics for all variables. For continuous variables, the mean, standard
161 deviation (SD), range, and interquartile range (IQR) were calculated. For categorical variables, the
162 number (n) and proportion (%) of municipalities in each category were calculated. We also calculated
163 the mean COVID-19 vaccination uptake for each category of municipal policy variables. To visualize
164 the geographic distribution of COVID-19 vaccination uptake across Japan, a choropleth map was
165 created at the municipal level. Furthermore, to illustrate the association between the key policy

166 variable of out-of-pocket expenses and vaccination uptake, a box-and-whisker plot was generated to
167 compare the distribution of uptake across the four cost categories: JPY 0, 1–2,000 2,001–3,000, and
168 $\geq 3,001$. Finally, to identify the factors associated with COVID-19 vaccination uptake, a negative
169 binomial regression analysis was performed. The dependent variable was the estimated number of
170 COVID-19 recipients. The offset term was the population aged 65 years and older as of January 1,
171 2024. The independent variables were the following: mailing vaccine screening questionnaires,
172 notifications via LINE[®], notification on X[®], postings on official municipal websites, creating
173 campaign posters, publication in public relations magazines, reminders about subsidy deadlines,
174 making campaign flyers, out-of-pocket expenses, subsidy duration and extension, number of
175 vaccination sites, population density, proportion of aged 75 and older, proportion of workers aged 65
176 and older, ADI, number of physicians per 1,000 population, and region. To address missing data in the
177 explanatory variables, we applied a maximum likelihood estimation under the assumption that the data
178 were missing at random. This model-based approach allowed consistent estimates by leveraging all
179 available data. Incidence rate ratios (IRR) were calculated for each indicator. The significance level
180 used for statistical testing was 0.05, and the confidence level for the interval estimation was 95% on
181 both sides. SAS 9.4 (SAS Institute Inc., Cary, NC, USA) was used to perform the statistical analyses.

182

183 **Results**

184 ***Characteristics of municipalities***

185 The number of municipalities conducting COVID-19 vaccination was 1,741. Due to the exclusion of
186 one municipality with no eligible people for the COVID-19 vaccine, the final dataset used for the
187 analysis included 1,740 municipalities. The basic characteristics of these municipalities are listed in
188 Table 1. The mean out-of-pocket expense for vaccination was JPY 2,727 (SD 927.7), and the mean
189 proportion of aged 75 and older among those aged 65 and older was 55.4% (SD 3.8).

190

191 ***COVID-19 vaccination uptake***

192 The estimated COVID-19 vaccination uptake across Japan for those aged 65 and older was 17.9%, and
193 the mean COVID-19 vaccination uptake by municipality was 16.6%. Figure 1 illustrates the
194 geographic distribution of the vaccination uptake, which reveals considerable variations across
195 municipalities. The number of municipalities and the vaccination uptake for each category of
196 out-of-pocket expenses are as follows, JPY 0: 49 municipalities and 22.2%, JPY 1–2,000: 377
197 municipalities and 18.4%, JPY 2,001–3,000: 757 municipalities and 16.6%, and \geq JPY 3,001: 557
198 municipalities and 14.7% (Figure 2).

199 Table 2 shows the implementation proportion of municipal policies and COVID-19 vaccination
200 uptake by category. Many municipalities posted on official municipal websites and published in public

201 relations magazines (78.7% and 83.7%, respectively). Meanwhile, vaccine screening questionnaires
202 were mailed in 21.6% of municipalities.

203

204 ***Factors associated with vaccination uptake in the negative binomial regression analysis***

205 The results of the negative binomial regression analysis are shown in Figure 3. Among the evaluated
206 municipal policies, mailing vaccine screening questionnaires showed the largest effect estimate for its
207 association with higher uptake (IRR 1.57; 95% CI, 1.37–1.80). Lower out-of-pocket expenses also
208 remained significantly associated with higher uptake compared to the reference group (\geq JPY 3,001):
209 the IRR was 1.31 (95% CI, 1.12–1.52) for expenses of JPY 0–2,000 and 1.15 (95% CI, 1.01–1.30) for
210 expenses of JPY 2,001–3,000. Regarding sociodemographic factors, the proportion of those aged 75
211 and older (IRR 1.03; 95% CI, 1.01–1.05) and number of physicians per 1,000 population (IRR 1.03;
212 95% CI, 1.00–1.06) were positively associated with uptake. Conversely, ADI (IRR 0.87; 95% CI,
213 0.76–0.98) and the proportion of workers aged 65 and older (IRR 0.98; 95% CI, 0.97–0.99) were
214 negatively associated with uptake. Most other informational campaigns, such as using notification via
215 LINE[®] or notification on X[®], were not significantly associated with uptake in the adjusted model.

216

217 **Discussion**

218 In this ecological study conducted during the inaugural 2024–2025 season of Japan’s immunization
219 program for COVID-19 routine vaccination, municipal-level policies, particularly direct
220 communication and financial support, were significantly associated with COVID-19 vaccination
221 uptake among older adults. To the best of our knowledge, this is the first study to clarify such
222 associations for Japan’s new vaccination program. Specifically, mailing vaccine screening
223 questionnaires was associated with the largest increase in uptake among the municipal policies, and a
224 dose–response relationship was observed for lower out-of-pocket expenses. These findings
225 underscore the important role of municipal strategies in maintaining vaccination uptake even after
226 national mandates and recommendations have weakened, and they provide evidence for designing
227 future public health interventions.

228 The estimated national vaccination uptake was 17.9% across Japan, although vaccination uptake
229 varied greatly depending on municipality. The COVID-19 vaccination uptake for special temporary
230 vaccination was 54.4% among older adults in the 2023–2024 season, placing Japan in a challenging
231 position when viewed in an international context.¹³ The lower uptake in the 2024–2025 season was
232 likely attributable to a confluence of factors following the transition of the program. The special
233 temporary vaccination programs for the COVID-19 vaccine include various policies, such as proactive
234 recommendations by the government,^{6,14} free vaccinations for all older adults, and large-scale special
235 vaccination sites. However, these were not included in the routine vaccination program in the

236 2024–2025 season. The vaccination uptake in the 2024–2025 season (17.9%) was lower than that
237 reported in the United Kingdom¹⁵ (59.3%) and the United States¹⁶ (44.1%) for individuals aged 65
238 years and older. It is particularly noteworthy that Japan’s uptake declined significantly from the
239 previous season’s (2023–2024) proportion of 54.4%,¹³ despite the vaccination uptake for individuals
240 aged 65 years and older in the 2023–2024 season being higher than that in the United States (37.7%).¹⁷
241 While the US has maintained vaccination access through pharmacies and drugstores,¹⁸ Japan needs to
242 implement effective strategies to increase the vaccination uptake.

243 This study demonstrated that lower out-of-pocket expenses are associated with a higher COVID-19
244 vaccination uptake. This association is consistent with previous studies on pneumococcal vaccines in
245 Japan.^{7,19} In the 2024–2025 season, a special national fund limited the maximum out-of-pocket
246 expenses to approximately JPY 7,000.²⁰ With the addition of municipal subsidies, the mean cost of the
247 COVID-19 vaccine was JPY 2,727. Our results suggest that an increase in out-of-pocket expenses can
248 lead to a further decline in vaccination uptake, highlighting the importance of financial accessibility.

249 Beyond financial support, our findings underscored the impact of individual notifications.
250 Specifically, mailing vaccine screening questionnaires had the strongest association with COVID-19
251 uptake and the highest IRR (1.57). An IRR of 1.57 indicates that the vaccination uptake was estimated
252 to be 1.57 times higher in municipalities that mailed the questionnaire than in those that did not.
253 Meanwhile, this study found no statistically significant association between vaccination uptake and

254 mass marketing policies such as providing information on a public platform that is not individualized
255 (e.g., notifications via X®, posting on official municipal websites, and publication in public relations
256 magazines). This finding resonates with previous studies on pneumococcal vaccines in Japan, where a
257 direct approach was associated with an increased uptake, while broad awareness campaigns such as
258 providing information on websites, and distributing pamphlets had little effect on the vaccination
259 uptake.²¹ This suggests that direct individual approaches such as mailing vaccine screening
260 questionnaires may be a more impactful strategy for municipalities than broad awareness campaigns,
261 particularly among older adults. However, given the ecological study design and the difficulty of
262 perfectly measuring the implementation and reach of public relations activities, our study may have
263 been unable to detect a modest but meaningful effect of mass marketing. These campaigns might play
264 a foundational role in building public trust and supporting direct approaches, a possibility that requires
265 the elucidation of different study designs. A practical application of this individual notification
266 strategy is its integration with other routine vaccinations, such as the annual influenza vaccination
267 program. Simultaneous administration of COVID-19 and influenza vaccines contributes to increased
268 vaccination uptake.²² This approach helps reduce the burden of individually mailing COVID-19
269 vaccination screening questionnaires.

270 Regarding sociodemographic factors, COVID-19 vaccination uptake was negatively associated
271 with ADI and positively associated with municipality-level social economic status. Socioeconomic

272 status is a critical determinant of health behaviors, including vaccination.²³⁻²⁵ Previous studies on
273 regional disparities in vaccination coverage have also reported area-level socioeconomic status as
274 factor contributing to regional disparities.^{9,24,26} This indicates that vaccination uptake tends to be lower
275 in municipalities with high deprivation levels, and it is important to implement vaccination policies
276 that reduce the regional disparities. By contrast, the positive association with a higher proportion of
277 the population aged 75 and older may reflect several factors, as follows. Individuals aged 75 years and
278 over might perceive greater personal risk from COVID-19, or they may be more regularly engaged
279 with the healthcare system. A previous study reported that vaccination behavior could also be driven
280 by the desire to avoid becoming a burden on families.²⁷ In addition, recommendations from family
281 physicians have been reported to lead to behavioral changes in vaccine uptake among older adults.²⁸
282 These factors may make individuals aged 75 years and older more likely to receive COVID-19
283 vaccination. In this study, the proportion of workers aged 65 and older was negatively associated with
284 vaccination uptake. This may be due to healthy worker bias. This means that people who work tend to
285 be healthier than those who do not and may be less concerned about the risks of COVID-19 and, thus,
286 less likely to receive vaccinations.

287 To improve vaccination uptake, it is necessary to consider a multicomponent approach.^{29,30} This
288 study identified potentially effective interventions for improving COVID-19 vaccination uptake.
289 Ensuring low out-of-pocket expenses is a fundamental requirement, and our study suggests that

290 proactive individual notifications are a particularly effective strategy for encouraging vaccination.

291 This approach is not only a means of conveying information, but is also a tool for ensuring equity in

292 access to vaccination opportunities, especially for older adults or for those who are passive about their

293 health. Unfortunately, national funds for COVID-19 vaccinations are scheduled to be abolished by the

294 2025–2026 season.³¹ To effectively increase vaccination uptake, municipalities may consider

295 continuing financial support, mailing individual notifications, and targeting interventions to specific

296 groups with potentially low vaccination uptake, such as those with low socioeconomic status.

297 This study has several limitations. First, based on COVID-19 vaccine production, inventory, and

298 return in Japan, the outcome variable—the number of vaccinated individuals—was estimated from

299 vaccine distribution data and not from actual administration records. Furthermore, this study may have

300 been affected by bias if the choice of vaccine manufacturer varied systematically across municipalities.

301 Second, some variables relied on the most recent but not concurrent data, such as sociodemographic

302 information from the 2020 census, and policy data collected from websites may not have captured all

303 the implemented initiatives. Third, individual-level factors such as personal health beliefs and

304 vaccination intentions were not considered. Finally, this was an ecological study susceptible to

305 ecological fallacy. Despite these limitations, this study provides the first nationwide evidence of the

306 municipal-level drivers of COVID-19 vaccination uptake in the new routine immunization phase,

307 offering valuable insights for policymakers.

308

309 **Conclusions**

310 The COVID-19 vaccination uptake varied greatly among municipalities. This study identified several
311 sociodemographic factors and municipal policies associated with COVID-19 vaccination uptake
312 among older adults in Japan's routine immunization programs. Mailing vaccine screening
313 questionnaires and providing financial support may be effective strategies to improve the COVID-19
314 vaccination uptake. Policies targeting populations with potentially low vaccination uptake, such as
315 those with a low socioeconomic status, may also be necessary. With an anticipated reduction in
316 government support, the effective implementation of vaccination programs by municipalities will be
317 important to increase COVID-19 vaccination uptake.

318

319 **Author contribution statement**

320 Masaki Machida: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original
321 draft, Writing – review & editing.

322 Akira Nomachi: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original
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324 Kosuke Tanabe: Conceptualization, Investigation, Data curation, Writing – review & editing, Project
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328 Tomoki Nakaya: Methodology, Resources, Writing – review & editing.

329 Takashi Matono: Conceptualization, Methodology, Data curation, Writing – original draft, Writing –

330 review & editing.

331 All authors have read and approved the final manuscript.

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336

337 **Disclosure statement**

338 MM received consulting and lecture fees from Pfizer Japan Inc. and MSD K.K. AN, KT, and SI are

339 employees of Pfizer and KT and SI hold Pfizer stocks. TM has received speaker honoraria from Pfizer

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341

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344

345 **Data availability**

346 The authors confirm that all data used in the analysis are disclosed within the article.

347 Sociodemographic data are from public domain sources (<https://www.e-stat.go.jp/en>).

348

349 **Author biographies**

350 Masaki Machida is an Associate Professor at Tokyo Medical University, specializing in epidemiology

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352 Akira Nomachi specializes in vaccines for infectious disease.

353

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448

449 **Figure Legends**

450 Figure 1. COVID-19 vaccination uptake by municipality in Japan

451 Figure 2. COVID-19 vaccination uptake by category of out-of-pocket expenses

452 Figure 3. Factors associated with COVID-19 vaccination uptake

453 Category 1. Shorter than full period without extension, Category 2. Full period following extension,

454 Category 3. Shorter than full period following extension, Reference 1. \geq JPY 3,001, Reference 2.

455 Full period without extension, Reference 3. $<0.3/\text{km}^2$

456 IRR: Incidence Rate Ratio

Table 1. Basic statistics of each indicator by municipality (n=1,740)

Indicators (units)	Mean (SD)	Range (min, max)	IQR (Q1–Q3)
Population density ^a	5.3 (1.9)	0.3, 10.1	4.0–6.6
Proportion of aged 75 and older (%) ^b	55.4 (3.8)	39.5, 70.8	53.1–57.8
Proportion of workers aged 65 and older (%)	27.3 (6.2)	0.7, 80.4	23.3–30.3
Area deprivation index ^c	6.1 (0.7)	3.6, 9.6	5.7–6.6
Number of physicians per 1,000 population	1.7 (1.9)	0.1, 21.7	0.8–2.1
Out-of-pocket expenses (JPY) ^d	2727 (927.7)	0, 7200	2100–3300
Duration of subsidy (days) ^e	160.9 (28)	51, 182	123–182
Number of vaccination sites per square kilometer ^f	1.0 (2.0)	0, 26.9	0.1–0.9

IQR: interquartile range; SD: standard deviation

^a Population density, defined as the number of people per square kilometer of land area (number/km²), was subjected to a logarithmic transformation using the natural logarithm, owing to its right-skewed distribution.

^b The number of people aged 75 and older divided by the number of people aged 65 and older, described in percentage terms.

^c The area deprivation index derived from the 2020 census results was used as an indicator of socioeconomic status at the municipal level. This composite indicator comprises the weighted sum of poverty-related census variables.

^d In cases where the amount to be paid by the patient was not specified, the estimated amount was calculated based on the standard cost of JPY 15,300 for vaccinations that were not covered by routine vaccination.

^e Each municipality sets its own subsidy period, and the number of subsidy days is indicated. Although all subsidy periods began on October 1, 2024, the end date for these periods varied by municipality. The final possible end date was March 31, 2025. The maximum number of days eligible for subsidies is 182 days.

^f Dividing the number of medical institutions administering COVID-19 vaccines by the inhabitable land area

Table 2. Proportion of municipal policies implemented and COVID-19 vaccination uptake by category

Indicators (units)	n (%)	Vaccination uptake (%)
Mailing vaccine screening questionnaires ^a		
Implemented	376 (21.6)	21.4
Not implemented	1364 (78.4)	15.2
Notifications via LINE [®]		
Implemented	24 (1.4)	16.5
Not implemented	1716 (98.6)	16.6
Notification on X [®]		
Implemented	134 (7.7)	19.2
Not implemented	1606 (92.3)	16.3
Posting on official municipal websites		
Implemented	1369 (78.7)	16.4
Not implemented	371 (21.3)	17.0
Creating campaign posters		
Implemented	13 (0.7)	15.7
Not implemented	1727 (99.3)	16.6
Publication in public relations magazines		
Implemented	1456 (83.7)	16.1
Not implemented	284 (16.3)	19.0
Reminders about subsidy deadlines		
Implemented	374 (21.5)	15.6
Not implemented	1366 (78.5)	16.8

Making campaign flyers		
Implemented	159 (9.1)	15.3
Not implemented	1581 (90.9)	16.7
Out-of-pocket expenses		
JPY 0	49 (2.8)	22.2
JPY 1–2,000	377 (21.7)	18.4
JPY 2,001–3,000	757 (43.5)	16.6
≥JPY 3,001	557 (32.0)	14.7
Subsidy duration and extension ^b		
Missing	17 (1.0)	22.9
Full period without an extension	938 (53.9)	16.6
Shorter than full period without an extension	647 (37.2)	16.2
Full period following an extension	84 (4.8)	14.8
Shorter than full period following an extension	54 (3.1)	20.1
Number of vaccination sites per square kilometer ^c		
Missing	446 (25.6)	15.9
<0.3	596 (34.3)	17.1
≥0.3	698 (40.1)	16.5

^aIn Japan, everyone who receives a vaccination must fill out a vaccine screening questionnaire.

^bThe full period of routine vaccination was 182 days. Subsidy duration and extension were categorized into four groups: full period without extension, municipalities that did not extend the period and kept it shorter than the full period, municipalities that extended the period to the full period, and municipalities that extended the period but kept it shorter than the full period.

^cThe number of medical institutions was classified into two groups based on the median value.

Figure 1.

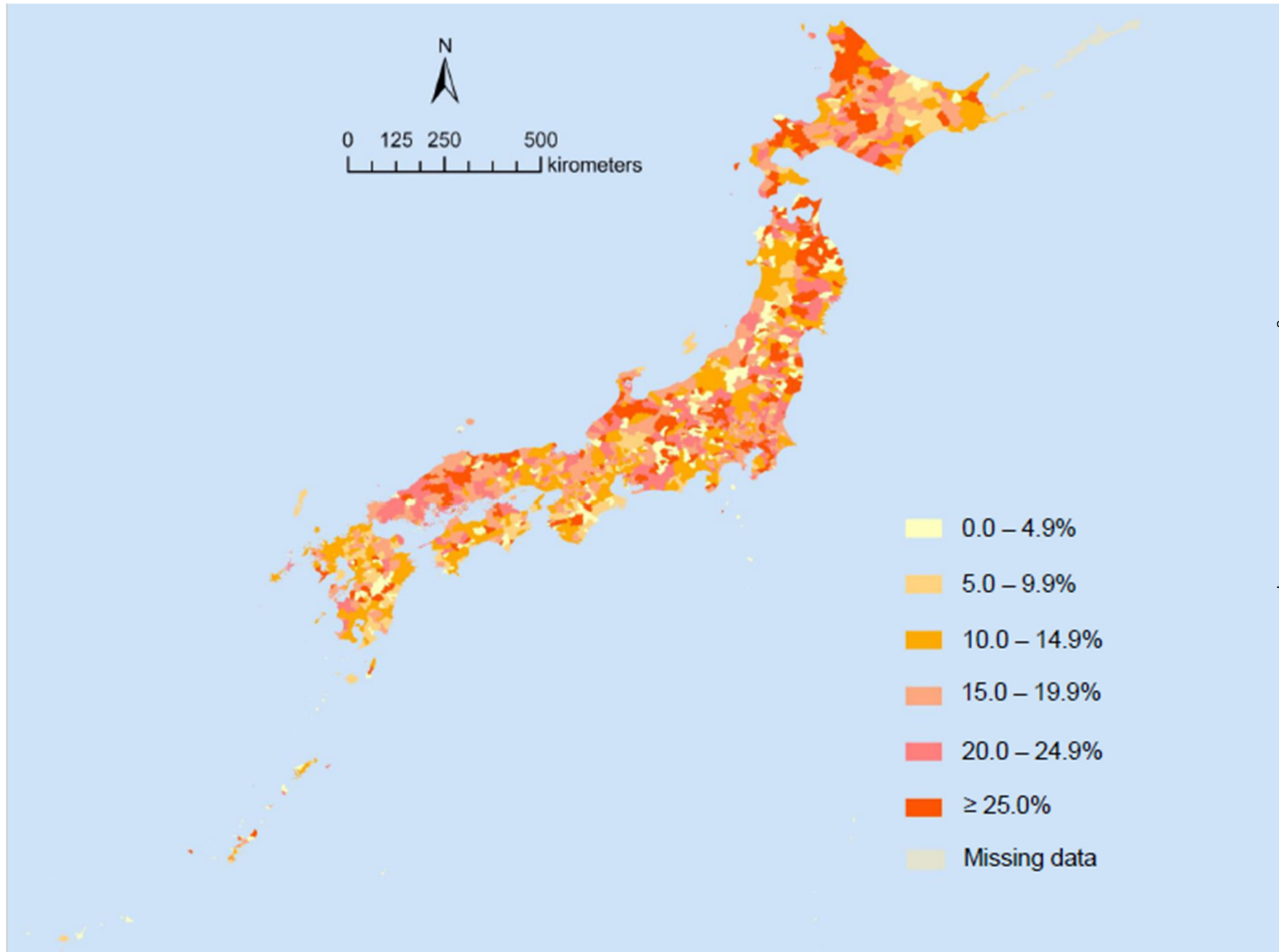


Figure 2.

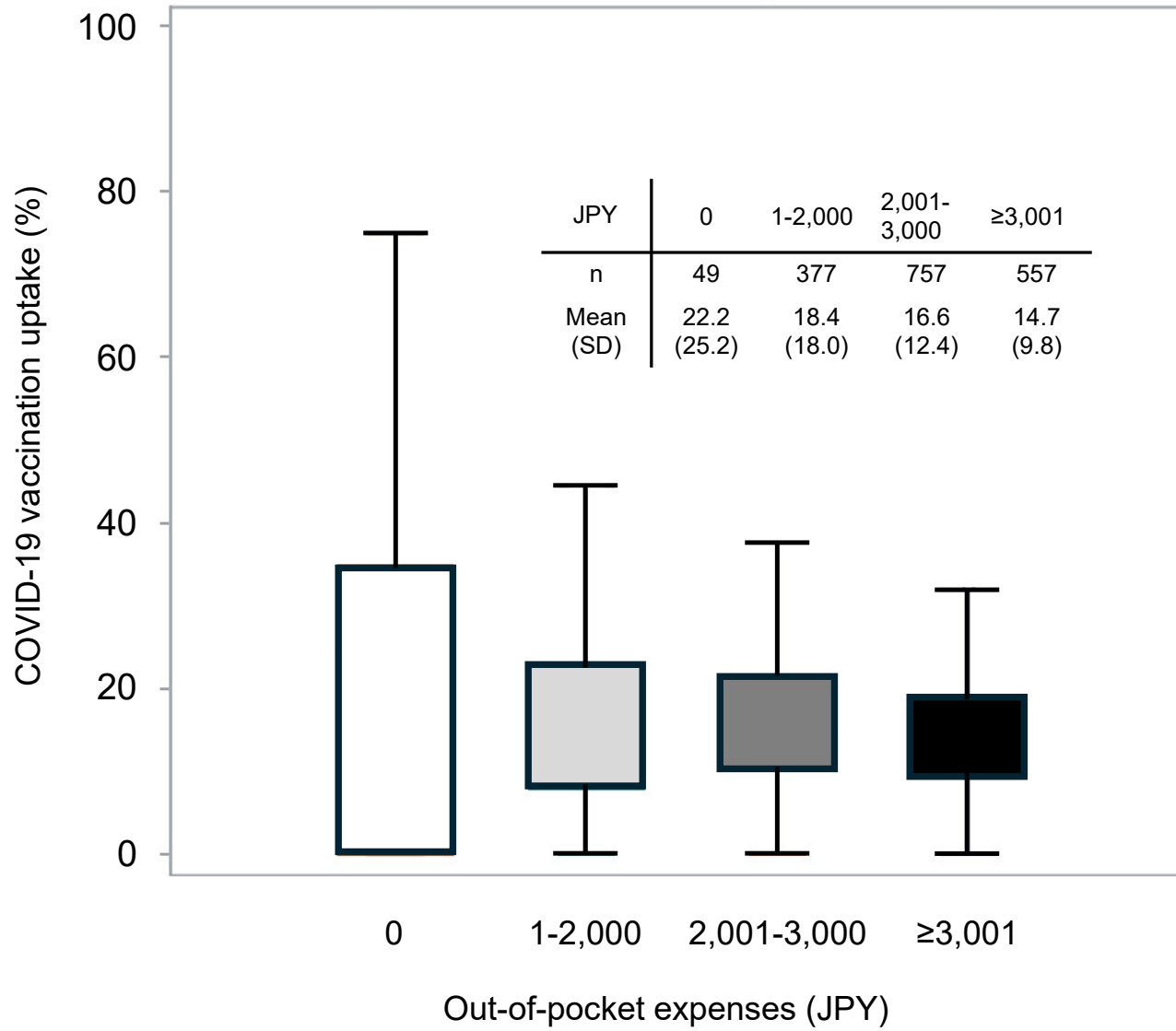


Figure 3.

