

# Effectiveness of an out-of-pocket cost removal intervention on health check attendance in Japan

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## Research Article

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# Abstract

**Background:** Annual health checks are important for identifying individuals at high risk for cardiometabolic diseases. In Japan, there is a nationwide program focused on providing specific health checks to screen for such high-risk individuals aged 40–74 years. However, there are socioeconomic disparities in health check attendance rates, and an intervention to lower financial barriers could be useful for increasing health check utilization. Thus, this study aimed to evaluate the effectiveness of an out-of-pocket (OOP) cost removal intervention on health check attendance in Japan.

**Methods:** Data were obtained on beneficiaries of the National Health Insurance system of Yokohama City, Kanagawa Prefecture, Japan. In 2018, Yokohama started an intervention to remove OOP costs for specific health checks for all National Health Insurance beneficiaries. We analyzed data from 2015–2018 (131,295 people aged 40–74 years; 377,660 observations). Specific health check utilization in each year was set as the outcome variable.

**Results:** A generalized estimating equation showed that people were more likely to receive specific health checks in 2018 (after the OOP cost removal intervention started) than in 2017 (immediately before the intervention; odds ratio [95% confidence interval] = 1.167 [1.149–1.185]), after adjusting for age, gender, tax exemption (a proxy variable for annual income), and residential area. Contrastingly, the likelihood of receiving specific health checks in 2015 and 2016 was almost the same as that in 2017 (1.025 [1.008–1.042] in 2015, and 0.959 [0.945–0.974] in 2016). Subgroup analyses revealed that the effectiveness of the OOP cost removal intervention was greater among the older age group and those who did not receive a tax exemption (i.e., those with relatively higher income).

**Conclusions:** The present study showed that the OOP cost removal intervention could promote specific health check utilization. This indicates that financial incentives could motivate people's behavior regarding health check attendance. However, as the effectiveness differed by age and income level, policymakers should consider the possibility that removing OOP costs widens the disparities in health check access.

## Background

Cardiometabolic diseases (CMDs), including cardiovascular disease, stroke, diabetes, and chronic kidney disease, remain the most common cause of death worldwide [1]. CMDs are primarily caused by metabolic syndrome, which is a cluster of metabolic disorders. The underlying causes of metabolic syndrome include obesity, physical inactivity, and older age [2]; thus, with increasing rates of obesity [3] and insufficient physical activity [4], in combination with the global aging population, there is an urgent need for CMD screening and prevention strategies.

In several developed countries, general health checks are conducted to prevent CMDs [5]. However, for such population-based prevention efforts to succeed, increasing the rates of health check participation is essential. A systematic review reported that many studies identified socioeconomic status as one of the

most critical determinants of health check attendance [6]. In particular, financial condition was found to be significantly associated with health check utilization. For example, some studies from European countries, such as Denmark and Austria, revealed that individuals with lower income were less likely to attend health checks than those with higher income [7,8]. In the UK, house tenure and vehicle access were inversely associated with health check non-attendance [9]. Moreover, in the US, those with lower income often did not have health insurance and could not afford to see a doctor, thereby making them less likely to attend health checks [10]. Therefore, an intervention to lower financial barriers could be effective for increasing health check attendance.

A meta-analysis illustrated that an approach that provides financial incentives was practical for increasing the health check attendance [11]. For instance, a study in Denmark reported that the rate of preventive health check attendance was higher in areas where the checks were free than in areas where a payment was required (40 US dollars to undergo health checks; 66% vs. 37%) [12]. These findings indicate that interventions to remove or reduce costs can promote health check attendance; however, research on this issue can be improved on at least two points. First, there is still sparse evidence on the effectiveness of financial incentives to increase health check attendance. Although the above-mentioned meta-analysis revealed the effectiveness of financial incentives, it included only three papers. Second, previous studies came from Western nations. Therefore, as attitudes toward health, which are known to be a determinant of health check attendance [6], can be influenced by individual cultural backgrounds, intervention effects might differ across regions. Thus, further research conducted in non-Western populations (e.g., Asian populations) is warranted.

In 2008, Japan established a national health policy to prevent lifestyle-related diseases such as CMDs. This comprehensive preventive policy involves a nationwide screening (called specific health checks, or *Tokutei Kenshin* in Japanese). Annual health checks focused on cardiometabolic are conducted for individuals and their family members aged 40–74 years and covered as primary beneficiaries under Japan's health insurance system. Out-of-pocket (OOP) costs for specific health checks depend on the health insurance society in which people are enrolled.

Socioeconomic disparities between those who do and do not utilize health checks have been observed in Japan, similar to those in Western countries. Lower income, less financial stability, and higher unemployment were found to be associated with a lower likelihood of health check participation [13,14]. Therefore, removing OOP costs, which can lower the financial barrier, could be useful for increasing health check attendance rates. Although previous research reported the effectiveness of an OOP cost removal intervention on cancer screening utilization in Japan [15,16], no study to date has examined whether this would also help increase health check attendance. Therefore, this study aimed to evaluate the effectiveness of an OOP cost removal intervention on health check attendance in Japan.

## Methods

### *Sample and Procedures*

In the present study, data were obtained from the National Health Insurance (NHI) system of Yokohama City, Kanagawa Prefecture, Japan. Japan has over 3,000 insurers, which can generally be divided into three types: occupation-based health insurance, residence-based health insurance (NHI), and health insurance for people aged 75 years and over. The NHI is a system for farmers, self-employed individuals, pensioners, and their dependents, and is administered by municipalities. Yokohama is the capital of Kanagawa Prefecture, located 30 km southwest of central Tokyo. As of January 2018, Yokohama was reported to have 18 administrative wards and a population of 3,733,084. At the time of this study, the NHI covered approximately 20% of the city's population.

In 2018, Yokohama began an intervention that eliminated OOP costs for specific health checks for all NHI beneficiaries aged 40–74 years. Before 2018, OOP costs for specific health checks in Yokohama depended on an individual's annual income level. In Japan, people with a total annual income below a certain threshold do not need to pay city inhabitant taxes; thus, receiving a tax exemption indicates one has a relatively lower income. Prior to 2018, specific health checks in Yokohama cost 1,200 yen (approximately 11 US dollars) and 400 yen (approximately 4 US dollars), respectively, among those without and with tax-exempt status.

To examine the influence of the OOP cost removal intervention, we included data from four years (2015–2018). Moreover, to understand the effect of socioeconomic variation in residential areas on the intervention's outcome, we selected 3 out of 18 administrative wards based on residents' average income level in 2018: Aoba (the highest, 1st), Kanazawa (middle, 9th), and Seya (the lowest, 18th). Consequently, we analyzed all NHI beneficiaries aged 40–74 years who lived in those three wards in April (the beginning of the fiscal year in Japan) of each year, excluding those hospitalized or admitted to care facilities. A total of 131,295 people with 377,660 observations (100,023, 96,985, 92,426, and 88,226, in 2015, 2016, 2016, and 2018, respectively) were included.

The study protocol was reviewed and approved by the Research Ethics Committee of the University of Tokyo. The data were anonymized before analysis by officers of Yokohama, who did not participate in data analysis. All personally identifiable information was completely removed from the dataset.

### *Measures*

We set specific health check utilization as the outcome variable in the present study. This was defined as whether a person received a specific health check in each observational year (i.e., 2015–2018). The observational year was used as the exposure variable, with 2017 (i.e., the year before the OOP cost removal intervention started) set as the reference. Age (40–49, 50–59, 60–69, or 70–74 years), gender (male or female), tax exemption (receiving or not receiving), and residential area (Aoba, Kanazawa, or Seya) were used as covariates in the analysis. Tax-exempt status was used as a proxy of annual income, as receiving a tax exemption would indicate having a relatively lower annual income. When participants had no taxable annual income at least once during the observational period, we categorized them as receiving a tax exemption.

## Statistical Analysis

A generalized estimating equation that accounted for the extra component of variation within participants was used to adjust for correlations among repeated measures. In Model 1, only the observational year was added. In Model 2, we additionally controlled for participant characteristics (i.e., age, gender, tax exemption, and residential area). In Model 3, interaction terms between each covariate and observational year (i.e., age × year, gender × year, tax exemption × year, and residential area × year) were examined to determine whether the effectiveness of the OOP cost removal intervention on specific health checks utilization differed by participant characteristics. When any significant interaction was detected, we performed a stratified analysis by participant characteristics to identify the differences in effectiveness by factor. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, IL, USA).

## Results

Table 1 shows participant characteristics. When participants had multiple observations during the four years, we used the baseline information on their ages. The average age was 61.2 years, and the largest age group ranged from 60–69 years (40.4%). Of the participants, 44.8% were male and 44.5% received a tax exemption during the observational period.

Figure 1 illustrates the proportion of people who received specific health checks from 2015–2018 among the residents of the three wards examined in the present study. Before the OOP cost removal intervention (i.e., in 2015, 2016, and 2017), approximately 21% of participants attended specific health checks; however, this increased to 24.0% in 2018.

Table 2 presents the association between the OOP cost removal intervention and specific health check utilization in the present study. In Model 1, people were more likely to receive specific health checks in 2018 (after the OOP cost removal intervention began) than in 2017 (immediately before the intervention started; OR [95% CI] = 1.180 [1.163–1.198]), while the likelihood of receiving specific health checks in 2015 and 2016 was almost the same as in 2017 (1.009 [0.993–1.025] in 2015, and 0.950 [0.936–0.964] in 2016). In Model 2, even after adjusting for age, gender, tax exemption, and residential area, the associations remained unchanged. The likelihood of receiving specific health checks increased by approximately 17% in 2018, compared to 2017 (1.167 [1.149–1.185]), and there was a statistically significant, but relatively small, difference in likelihood from 2015–2017 (1.025 [1.008–1.042] in 2015 and 0.959 [0.945–0.974] in 2016). Regarding covariates, younger age, gender (male), receiving a tax exemption, and Seya residency were associated with a lower likelihood of specific health check attendance.

The interactions between the covariates and observational years were added in Model 3. We found significant interactions between age subgroups and the year 2018 (0.923 [0.865–0.986], 0.943 [0.891–0.998], and 0.953 [0.917–0.990] for 40–49, 50–59, 60–69 years, respectively). We also found a significant interaction between receiving a tax exemption and the year 2018 (0.936 [0.905–0.968]).

To better understand these interactions, we performed stratified analyses by age and tax exemption, as shown in Tables 3 and 4. The likelihood of utilizing specific health checks was higher among the older age group in 2018 than in 2017 (1.113 [1.048–1.182], 1.141 [1.085–1.201], 1.146 [1.118–1.174], and 1.206 [1.175–1.237] for 40–49, 50–59, 60–69, and 70–74 years, respectively). In addition, compared to in 2017, the likelihood of utilizing specific health checks in 2018 was approximately 21% higher among those without a tax exemption (1.207 [1.179–1.236]), while it was approximately 14% higher among those with a tax exemption (1.138 [1.116–1.161]).

## Discussion

Based on NHI data for beneficiaries aged from 40–74 years, this study examined the effectiveness of an OOP cost removal intervention on attendance rates for specific health checks to screen individuals at high risk for CMDs. To the best of our knowledge, this was the first study to evaluate the effectiveness of a financial incentive (i.e., the OOP cost removal) for increasing health check attendance in an Asian population. CMDs are a major cause of death worldwide, including in Asia. Therefore, it would be useful to determine whether financial incentives could increase the likelihood individuals would utilize health checks.

We found that the OOP cost removal intervention examined in this study could increase specific health check utilization. Previous systematic reviews on economic interventions to increase screenings for cardiovascular disease risk factors reported that removing financial barriers (e.g., offering free screening) increased attendance, while rewards or monetary incentives (e.g., providing shopping vouchers, gifts, or bus tickets) did not [11,17]. The results of the current study were consistent with these systematic reviews. We estimated that the likelihood of receiving a specific health check increased by approximately 17% following the OOP cost removal intervention (Model 2); however, this estimate seemed to be relatively smaller than what was found in previous studies [12,18]. This may have been partly due to the amount of the subsidy covering OOP costs for health checks. In this study, before the intervention, OOP costs were approximately 11 US dollars and 4 US dollars for people who did not and did receive a tax exemption, respectively. In contrast, for example, in a study by Christensen [12], a cost of 40 US dollars was fully covered in the intervention area for health examinations related to coronary heart disease, leading to a greater attendance rate increase than was found in the present study. Furthermore, our subgroup analysis revealed that the effectiveness of the OOP cost removal intervention was greater among those without than those with a tax exemption (21% vs. 14%). As the subsidy amount to cover OOP costs was greater among those without a tax exemption than those with one, those without might feel the subsidy was more financially beneficial, thus increasing the likelihood they would attend specific health checks.

Our subgroup analysis, as stratified by age, showed that the effectiveness of the OOP cost removal intervention was stronger in the older subgroup (21% in 70–74 years; 11% in 40–49 years). Compared with younger people, older people tend to perceive health checks as being more relevant to their lives and are more ready to face the related outcomes, which are factors known to facilitate health check utilization

[19,20]. Although a systematic review of qualitative research indicated that older adults generally tend to have limited trust in explicit financial incentives [21], a financial incentive could encourage behaviors among older individuals ready to attend health checks, as compared with younger individuals who may be less ready.

Earlier studies revealed that higher income and older age were associated with greater health check attendance [7,8,22,23]. Our results indicated that the OOP cost removal intervention promoted health check attendance among older people and those without a tax exemption (i.e., those with a relatively higher income). These findings indicated it is possible that the intervention might widen socioeconomic disparities in health check access. Although this study generally showed that the OOP cost removal intervention could promote health check participation, when developing or evaluating such strategies using financial incentives, policymakers should consider the possibility that the impact of different sociodemographic factors on the effectiveness of these interventions could widen the disparities in health check access.

The present study has some limitations. First, we did not adjust for several potential confounders in the analysis. We obtained the data from the NHI system; however, variables such as sociodemographic conditions and health status were not available in the present study. Furthermore, individual perceptions, such as relevance of health checks, attitudes toward disease prevention, and expectations about health check outcomes, could affect health check utilization [6,19,20,24]. These factors should be considered in future analyses. Second, we only evaluated the immediate effects of the OOP cost removal intervention. Thus, a longer follow-up period would be necessary to monitor the sustainability of the intervention's effectiveness. Third, because this study was performed in a local municipality, care should be taken in generalizing the findings.

## Conclusions

The present study showed that an OOP cost removal intervention could promote specific health check attendance among NHI beneficiaries between the ages of 40–74 years in Japan. This indicates that this type of financial incentive could motivate people to utilize health checks. In addition, this effect was greater among the older age group and people who did not receive a tax exemption (i.e., those with relatively higher income), suggesting that the effectiveness of the financial incentive might differ according to sociodemographic characteristics. Policymakers should therefore consider that removing OOP costs could potentially widen the disparities in health check access.

## Abbreviations

CI, confidence interval; CMD, cardiometabolic disease; NHI, National Health Insurance; OOP, out-of-pocket; OR, odds ratio

## Declarations

### ***Ethical approval and consent to participate***

The study protocol was reviewed and approved by the Research Ethics Committee of the University of Tokyo. The data were anonymized before analysis by officers of Yokohama City, who did not participate in analyses. All personally identifiable information was completely removed from the dataset.

### ***Consent for publication***

Not applicable.

### ***Availability of data and materials***

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

### ***Competing interests***

The authors declare they have no competing interests.

### ***Funding***

None.

### ***Authors' contributions***

All authors designed the study. YT and SS generated the dataset. HM analyzed the data and prepared the manuscript. All authors interpreted the data, revised the manuscript, and approved the final version.

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## Tables

<b>Table 1.</b> Participant Characteristics (N = 131,295)		
	Mean ± SD	%
Age (years)	61.2 ± 10.4	
40–49 years		19.7
50–59 years		15.6
60–69 years		40.4
70–74 years		24.3
Gender		
Male		44.8
Female		55.2
Tax exemption		
Receiving		44.5
Not receiving		55.5
Residential area		
Aoba		43.2
Kanazawa		34.9
Seya		21.9
SD: standard deviation.		

**Table 2.** Increases in specific health check attendance after the out-of-pocket cost removal intervention

	Model 1		Model 2		Model 3	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Year						
2015	1.009	(0.993–1.025)	1.025	(1.008–1.042)	1.021	(1.003–1.039)
2016	0.950	(0.936–0.964)	0.959	(0.945–0.974)	0.960	(0.945–0.976)
2017	1.000		1.000		1.000	
2018	1.180	(1.163–1.198)	1.167	(1.149–1.185)	1.158	(1.139–1.177)
Age						
40–49 years			0.328	(0.314–0.342)	0.328	(0.315–0.342)
50–59 years			0.448	(0.430–0.466)	0.448	(0.431–0.466)
60–69 years			0.820	(0.800–0.841)	0.821	(0.800–0.842)
70–74 years			1.000		1.000	
Gender						
Male			0.742	(0.721–0.763)	0.742	(0.721–0.763)
Female			1.000		1.000	
Tax exemption						
Receiving			0.874	(0.850–0.899)	0.874	(0.850–0.899)
Not receiving			1.000		1.000	
Residential area						
Aoba			1.000		1.000	
Kanazawa			0.986	(0.958–1.014)	0.986	(0.958–1.014)
Seya			0.853	(0.825–0.882)	0.853	(0.824–0.882)

Interactions		
40–49 years × year of 2015	0.943	(0.881–1.010)
50–59 years × year of 2015	0.997	(0.937–1.060)
60–69 years × year of 2015	0.996	(0.954–1.040)
40–49 years × year of 2016	1.014	(0.951–1.081)
50–59 years × year of 2016	0.982	(0.928–1.039)
60–69 years × year of 2016	0.988	(0.951–1.027)
40–49 years × year of 2018	0.923	(0.865–0.986)
50–59 years × year of 2018	0.943	(0.891–0.998)
60–69 years × year of 2018	0.953	(0.917–0.990)
Male × year of 2015	1.000	(0.964–1.038)
Male × year of 2016	0.987	(0.954–1.021)
Male × year of 2018	1.000	(0.967–1.035)
Receiving tax exemption × year of 2015	1.044	(1.006–1.082)
Receiving tax exemption × year of 2016	1.018	(0.984–1.053)
Receiving tax exemption × year of 2018	0.936	(0.905–0.968)
Kanazawa × year of 2015	1.015	(0.979–1.053)
Seya × year of 2015	1.032	(0.988–1.078)
Kanazawa × year of 2016	1.024	(0.990–1.060)
Seya × year of 2016	1.030	(0.989–1.073)

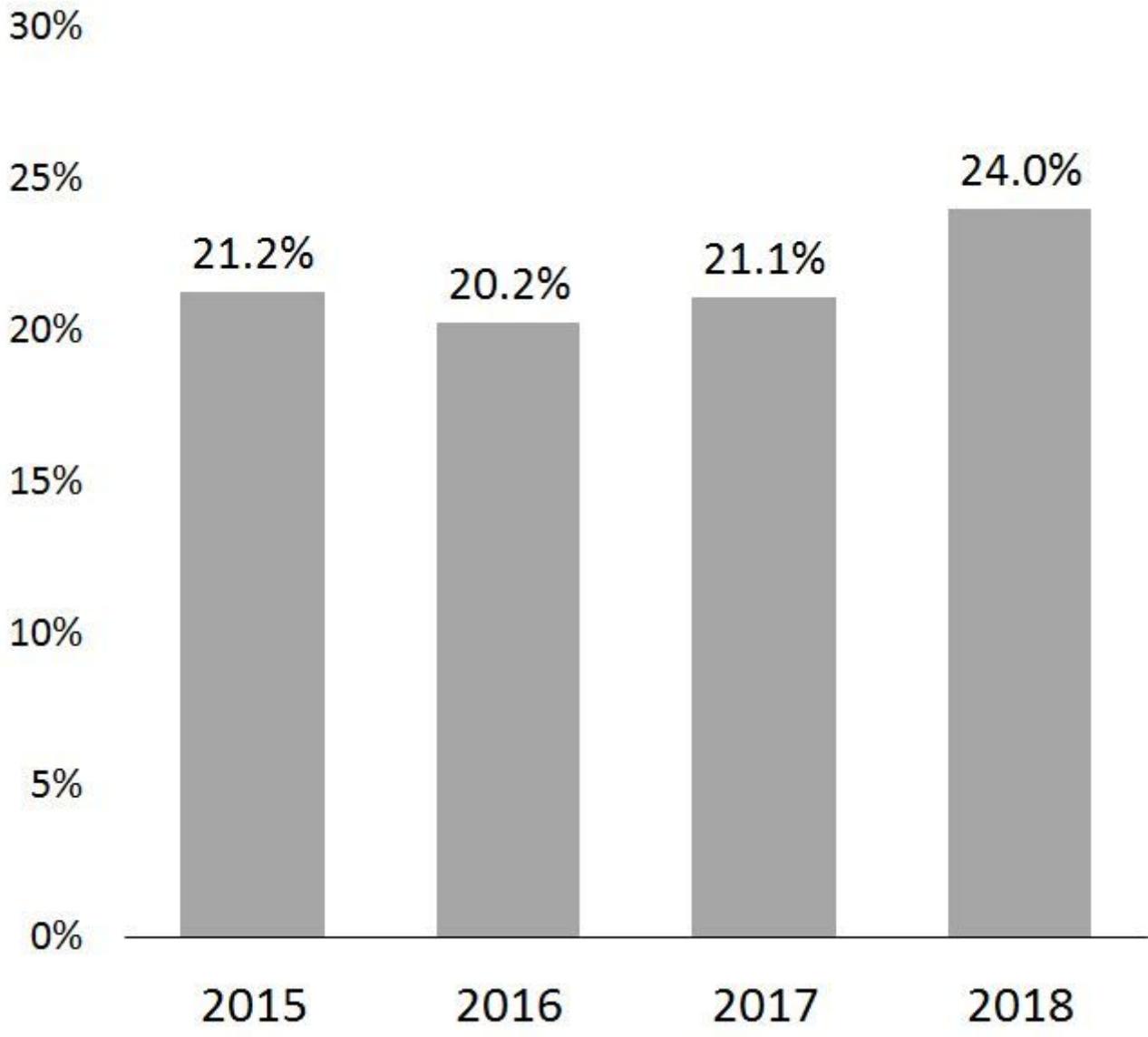
Kanazawa × year of 2018	0.968	(0.935– 1.001)
Seya × year of 2018	0.987	(0.947– 1.028)
CI: confidence interval. OR: odds ratio.		

<b>Table 3.</b> Subgroup analysis by age for increases in specific health check attendance after the out-of-pocket cost removal intervention								
	40–49 years		50–59 years		60–69 years		70–74 years	
	OR	(95% CI)						
<b>Year</b>								
2015	0.974	(0.916–1.035)	1.028	(0.975–1.085)	1.029	(1.002–1.056)	1.031	(1.000–1.063)
2016	0.977	(0.922–1.036)	0.945	(0.899–0.993)	0.953	(0.931–0.976)	0.965	(0.939–0.991)
2017	1.000		1.000		1.000		1.000	
2018	1.113	(1.048–1.182)	1.141	(1.085–1.201)	1.146	(1.118–1.174)	1.206	(1.175–1.237)
<b>Gender</b>								
Male	0.679	(0.629–0.733)	0.627	(0.583–0.673)	0.742	(0.711–0.773)	0.771	(0.735–0.810)
Female	1.000		1.000		1.000		1.000	
<b>Tax exemption</b>								
Receiving	0.966	(0.896–1.043)	1.008	(0.939–1.083)	0.923	(0.885–0.962)	0.775	(0.739–0.814)
Not receiving	1.000		1.000		1.000		1.000	
<b>Residential area</b>								
Aoba	1.000		1.000		1.000		1.000	
Kanazawa	0.924	(0.848–1.008)	0.927	(0.856–1.004)	1.025	(0.983–1.069)	0.973	(0.931–1.016)
Seya	0.769	(0.698–0.847)	0.768	(0.700–0.843)	0.851	(0.809–0.896)	0.913	(0.867–0.962)
CI: confidence interval. OR: odds ratio.								

**Table 4.** Subgroup analysis by tax exemption status for increases in specific health check attendance after the out-of-pocket cost removal intervention

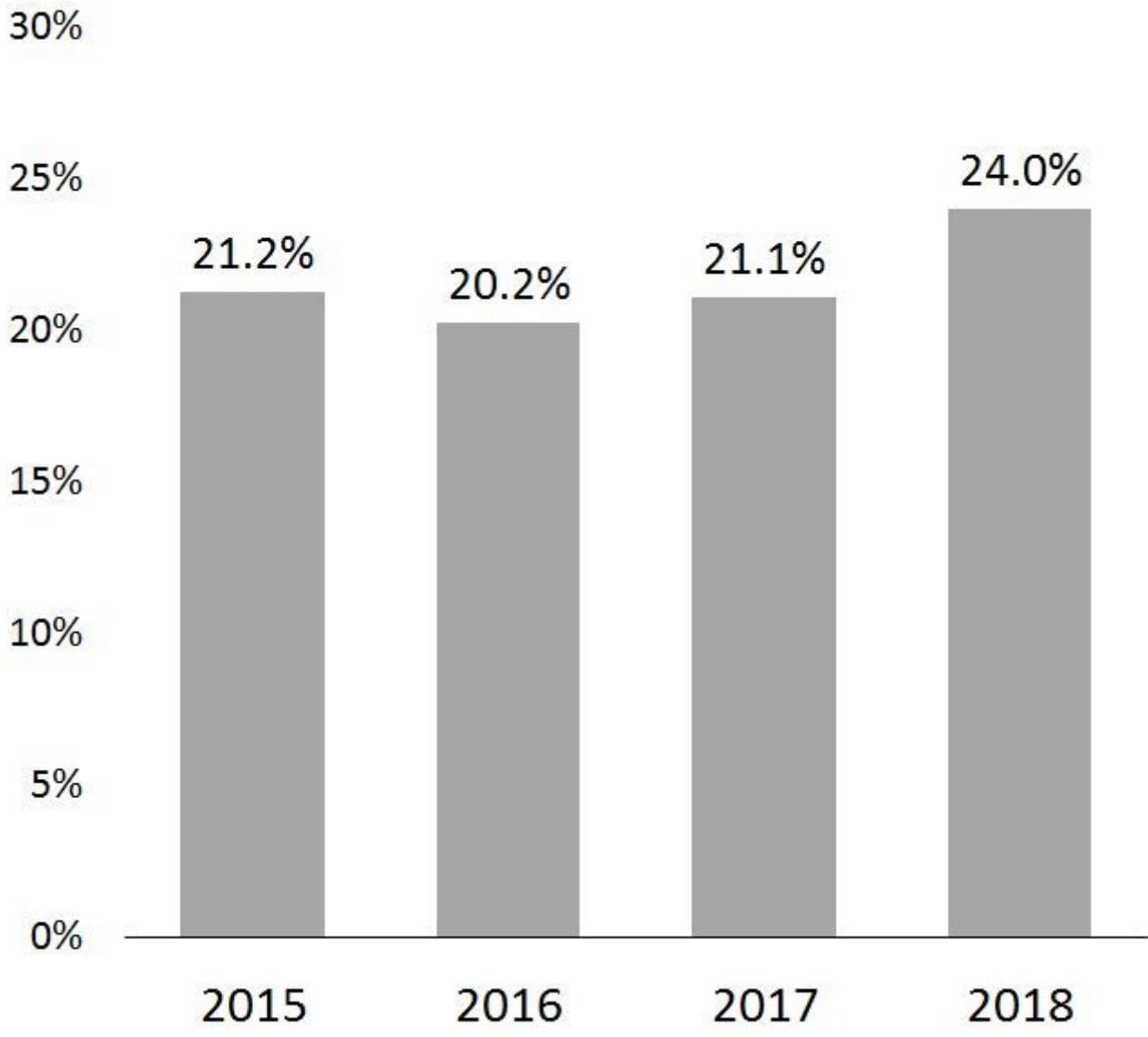
	Receiving tax exemption		Not receiving tax exemption	
	OR	(95% CI)	OR	(95% CI)
Year				
2015	1.039	(1.017–1.061)	1.001	(0.976–1.027)
2016	0.961	(0.942–0.980)	0.954	(0.932–0.977)
2017	1.000		1.000	
2018	1.138	(1.116–1.161)	1.207	(1.179–1.236)
Age				
40–49 years	0.383	(0.362–0.405)	0.295	(0.276–0.314)
50–59 years	0.533	(0.505–0.562)	0.392	(0.369–0.416)
60–69 years	0.904	(0.874–0.935)	0.753	(0.725–0.783)
70–74 years	1.000		1.000	
Gender				
Male	0.603	(0.577–0.629)	0.875	(0.839–0.913)
Female	1.000		1.000	
Residential area				
Aoba	1.000		1.000	
Kanazawa	0.971	(0.934–1.008)	1.001	(0.959–1.045)
Seya	0.852	(0.815–0.890)	0.856	(0.812–0.902)
CI: confidence interval. OR: odds ratio.				

## Figures



**Figure 1**

Specific health check attendance rates from 2015–2018



**Figure 1**

Specific health check attendance rates from 2015–2018