

BMJ Open Usual source of primary care and preventive care measures in the COVID-19 pandemic: a nationwide cross-sectional study in Japan

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ABSTRACT

Objectives To assess multiple preventive care measures and to examine their associations with having a usual source of primary care and primary care performance during the COVID-19 pandemic in Japan.

Design Nationwide cross-sectional study.

Setting Japanese general adult population.

Participants 1757 adult residents.

Primary outcome measures Fourteen preventive care measures aggregated the overall screening, immunisation and counselling composites.

Results Depression screening, zoster vaccination and tetanus vaccination had low implementation rates even among participants with a usual source of primary care. After adjustment for possible confounders, having a usual source of primary care was positively associated with all preventive care composites. Primary care performance assessed by the Japanese version of Primary Care Assessment Tool Short Form was also dose dependently associated with an increase in all composites. Results of the sensitivity analyses using a different calculation of preventive care composite were similar to those of the primary analyses.

Conclusions Receipt of primary care, particularly high-quality primary care, contributed to increased preventive care utilisation even during the COVID-19 pandemic. However, the rate of mental health screening in primary care was at a very low level. Therefore, addressing mental health issues should be a major challenge for primary care providers during and after the pandemic.

INTRODUCTION

Primary care has been considered to contribute to better population health, efficiency and equity.^{1 2} This is the reason countries have raised the issue of strengthening primary care systems. For instance, a new consensus report by the national academies of sciences, engineering and medicine emphasised that the USA should prioritise the implementation of high-quality primary care by the government and private sector.³ In Japan, the Ministry of Health, Labour and Welfare has recommended that all individuals should have a usual source of primary care

Strengths and limitations of this study

- The data for this study were sourced from a nationwide study with a sample representative of the Japanese adult population.
- The Primary Care Assessment Tool is a validated and internationally established scale for evaluating the performance of primary care attributes.
- The outcome measures did not address all preventive care qualities.
- Self-reported data on preventive care measures may have introduced social desirability and recall biases.

and identified the improvement of primary care performance as an important issue.⁴ In Japan, physicians trained in an internal medicine-based residency programme have typically delivered primary care. In addition to them, the Japan Primary Care Association has certified family physicians since 2010⁵ and the Japanese Medical Specialty Board started a new certification programme for primary care specialists in 2018.⁶

Preventive care is one of the mechanisms for the beneficial impact of primary care on population health.¹ Several studies before the COVID-19 pandemic have examined the value of primary care in the quality of preventive care at the individual level. For example, previous studies conducted in the USA reported that having a usual source of primary care is associated with better quality of preventive care.^{7 8} Other studies have demonstrated that higher levels of primary care attributes are associated with increased utilisation of preventive care services.^{9 10}

However, the provision of preventive care has been disrupted due to the COVID-19 pandemic. A steep decline in the utilisation of preventive services, such as cancer screening and counselling, was reported in 2020.^{11 12} During the pandemic, healthcare workers and facilities allocated resources to address the

influx of patients with COVID-19. Government restrictions on movement and non-essential activities could be barriers to healthcare accessibility. Studies conducted in the USA and Japan have consistently reported that the number of outpatient visits decreased, while that of telemedicine visits increased during the pandemic.^{13 14} A study in the USA also indicated that primary care physicians are less likely to deliver preventive care, such as blood pressure and cholesterol level assessments, during telemedicine visits compared with office-based ones.¹³

In a pandemic when there are many barriers to providing preventive care by healthcare workers, it becomes unclear whether primary care contributes to the quality of preventive care and what type of preventive care delivery is a challenge for primary care providers. Answering these questions is fundamental to rethinking the role of primary care during and after the COVID-19 pandemic. Therefore, in the present study, we aimed to assess multiple preventive care measures and to examine their associations with having a usual source of primary care and primary care performance during the pandemic. We used a representative sample of the Japanese general adult population.

METHODS

Design, setting and participants

The data for this study were sourced from the National Usual source of Care Survey (NUCS), which was conducted in May 2021. The NUCS was a nationwide mail survey that collected data on the usual source of primary care, healthcare utilisation, health conditions, health-related quality of life and sociodemographic characteristics of a representative sample of the Japanese adult population. In the NUCS, a nationally representative panel in Japan, which was administered by the Nippon Research Center, was used to select potential participants. This panel comprised approximately 70 000 residents aged 15–79 years who were selected using a multistage sampling method and participated in a previous survey of the Nippon Research Center.¹⁵ From the panel, 2000 potential participants aged 20–75 years were selected using stratified sampling by age, sex and residential area. The minimum sample size to estimate the population proportion receiving preventive care was 1067 for a level of confidence of 95% and a margin of error of $\pm 3\%$ (expected proportion 50%). The survey participants received JPY500 gift certificates.

Measures

Usual source of primary care

To identify an individual's usual source of primary care, the following item was used in the Primary Care Assessment Tool (PCAT)¹⁶ and nationwide surveys: the Medical Expenditure Panel Survey (MEPS)¹⁷ with questions such as 'Is there a doctor that you usually go to if you are sick or need advice about your health?'. A participant was considered to have a usual source of primary care if he or

she was able to identify a physician who practices outside of university hospitals.

For participants who have a usual source of primary care, we conducted a primary care performance assessment based on patient experience using the Japanese version of PCAT Short Form (JPCAT-SF).¹⁸ The JPCAT-SF is based on the PCAT,¹⁶ which was developed by the Johns Hopkins Primary Care Policy Center. This tool is a Japanese version of the PCAT and not a simple Japanese translation of the PCAT. It consists of fewer items than the original version for better usability. A previous study showed that the JPCAT-SF has good reliability and validity.¹⁸ This 13-item tool comprises six multi-item subscales addressing the following primary care attributes: first contact, longitudinality, coordination, comprehensiveness (services available), comprehensiveness (services provided) and community orientation. The JPCAT-SF's scoring system is structured as follows: each response on a 5-point Likert Scale (1=strongly disagree, 2=somewhat disagree, 3=not sure, 4=somewhat agree and 5=strongly agree) is converted into an item score between 0 and 4. The calculated means of item scores in the same subscale are multiplied by 25 to yield subscale scores ranging from 0 to 100 points. The JPCAT-SF score is the mean of the six subscale scores and reflects an overall measure of primary care performance, with higher scores indicating better performance.

Preventive care measures

The outcome measures in this study were defined as selected multiple preventive care measures according to the recommendations of the U.S. Preventive Services Task Force (Grades A and B)¹⁹ and Centers for Disease Control and Prevention.²⁰ From the recommendations, we excluded measures of preventive therapies, those that had not been formally approved in Japan and those that could not be accurately assessed using a self-administered questionnaire (eg, measures that require an assessment of additional risk factors). After applying the exclusion criteria, we included 14 preventive care measures: colorectal cancer screening, breast cancer screening, cervical cancer screening, hypertension screening, abnormal blood glucose screening, osteoporosis screening, depression screening, influenza vaccination, pneumococcal vaccination, zoster vaccination, tetanus vaccination, smoking cessation counselling, alcohol use counselling and weight loss counselling (table 1 and online supplemental file). We constructed an overall preventive care composite and three clinically meaningful composites (screening, immunisation and counselling composites). The primary outcome measure in this study was the overall preventive care composite, and the secondary outcome measures were screening, immunisation and counselling composites.

To calculate each outcome measure, we first identified eligible participants for the measure and then determined whether or not they received particular preventive care. To calculate composites, we divided all instances

Table 1 Definition of preventive care measures

Measure	Numerator	Denominator
Screening		
Colorectal cancer screening	Faecal occult blood test within past year or colonoscopy within past 10 years	Age 45–75 years, no prior diagnosis of colorectal cancer, no total colectomy
Breast cancer screening	Mammogram within past 2 years	Women, age 50–74 years, no prior diagnosis of breast cancer, no bilateral mastectomy
Cervical cancer screening	Cervical cytology within past 3 years	Women, age 21–65 years, no prior diagnosis of cervical cancer, no hysterectomy
Hypertension screening	Office blood pressure measurement within past year	All
Abnormal blood glucose screening	Blood glucose measurement within past 3 years	Age 40–70 years, BMI≥25
Osteoporosis screening	Bone density measurement within any interval	Women, age≥65 years
Depression screening	Depression screening by medical staff within past year	All
Immunisation		
Influenza vaccination	Influenza vaccine within past year	All
Pneumococcal vaccination	Pneumococcal vaccine within any interval	Age≥65 years
Zoster vaccination	Zoster vaccine within any interval	Age≥50 years
Tetanus vaccination	Tetanus vaccine within past 10 years	All
Counselling		
Smoking cessation counselling	Smoking cessation counselling within past year	Current smokers
Alcohol use counselling	Alcohol use counselling within past year	Risky alcohol use*
Weight loss counselling	Weight loss counselling within past year	BMI≥25

*Daily alcohol consumption>20 g (alcohol-related goal in Health Japan 21).
BMI, body mass index.

in which the recommended service was delivered by the number of times participants were eligible for the service in the category, as others have done.^{8 21} Composites could range from 0% to 100%.

Statistical analysis

We computed the descriptive statistics for individual preventive care measures and composites with or without a usual source of primary care. To examine whether having a usual source of primary care was associated with preventive care composites, we used multivariable linear regression analyses. The following potential confounders were included in the analyses: age, sex, marital status, years of education, employment status, annual household income, smoking status, body mass index, health literacy assessed by the Communicative and Critical Health Literacy,²² number of chronic conditions and health-related quality of life assessed by the five-level version of the EuroQoL five-dimensional questionnaire.²³ We used a validated list of 20 chronic conditions that were created based on previous multimorbidity literature and their relevance to the primary care population:²⁴ hypertension,

depression/anxiety, chronic musculoskeletal conditions causing pain or limitation, arthritis/rheumatoid arthritis, osteoporosis, chronic respiratory disease (asthma, chronic obstructive pulmonary disease or chronic bronchitis), cardiovascular disease, heart failure, stroke/transient ischaemic attack, stomach problem, colon problem, chronic hepatitis, diabetes, thyroid disorder, any cancer in the previous 5 years, kidney disease/failure, chronic urinary problem, dementia/Alzheimer's disease, hyperlipidemia and obesity. All confounders were evaluated using a self-administered questionnaire. In addition, to examine the dose–response association between primary care performance and preventive care composites, we performed analyses of the outcomes in relation to the JPCAT-SF score quartile, adjusting for the same potential confounders.

We also conducted sensitivity analyses using a different calculation of the overall preventive care composite. In the sensitivity analyses, we included only measures with an interval of 1 year or less: colorectal cancer screening, hypertension screening, depression screening, influenza

vaccination, smoking cessation counselling, alcohol use counselling and weight loss counselling, because participants may have received services before the pandemic for the preventive care measures with longer recommended intervals.

For each analysis, we used a two-sided significance level of $p=0.05$, without adjustment for multiple comparisons.²⁵ For missing independent variables in the regression model, we performed complete case analyses. Statistical analyses were conducted using R, V.4.1.0 (R Foundation for Statistical Computing, Vienna, Austria; www.R-project.org).

Patient and public involvement

No patient involved.

RESULTS

Participants' characteristics

Of the 2000 adult residents, 1757 responded to the NUCS (response rate: 87.9%). Table 2 shows the characteristics of the study population, with or without a usual source of primary care. Among the participants, 1011 (57.5%) had a usual source of primary care. Compared with participants without a usual source of primary care, those with a usual source of primary care were older (mean age, 53.1 vs 45.9 years), more often female (53.9% vs 47.3%), more frequently unemployed (29.7% vs 20.2%) and had more chronic conditions (with ≥ 2 chronic conditions, 34.5% vs 11.9%).

Preventive care measures with or without a usual source of primary care

Table 3 shows the preventive care measures in the two groups, namely, with or without a usual source of primary care. In both groups, the highest implementation rate was observed in hypertension screening (87.8% for with and 70.6% for without) and the lowest implementation rate was observed in zoster vaccination (1.9% for with and 2.5% for without). Tetanus vaccination and depression screening also had low implementation rates for both groups (tetanus vaccination, 5.2% for with and 3.6% for without; depression screening, 11.2% for with and 7.8%, for without). Having a usual source of primary care was positively associated with increased receipt of each preventive care measure, except for zoster vaccination. Table 3 also shows the adjusted associations between having a usual source of care and preventive care composites. Participants with a usual source of primary care had a higher overall composite compared with those without (mean, 43.9% vs 33.9%; adjusted mean difference, 7.2% (95% CI, 5.2% to 9.1%)). Having a usual source of primary care was significantly associated with an increase in all composites. The largest difference was observed in counselling composite (adjusted mean difference, 8.0% (95% CI, 1.6% to 14.3%)).

Primary care performance and preventive care measures

Table 4 shows the associations between primary care performance, assessed by the JPCAT-SF, and preventive

care composites. Primary care performance was dose dependently associated with an increase in all composites, including the overall composite (adjusted mean difference, 9.9% (95% CI, 7.0% to 12.9%) for the JPCAT-SF highest quartile, compared with no usual source of primary care). The largest association was observed in the counselling composite (adjusted mean difference, 17.0% (95% CI, 7.8% to 26.2%) for the JPCAT-SF highest quartile, compared with no usual source of primary care).

Table 5 shows the results of the sensitivity analyses using different calculations of the overall preventive care composite (including only measures with an interval of 1 year or less). The findings are similar to those in the primary analyses, indicating that having a usual source of primary care and primary care performance are positively associated with the overall composite.

DISCUSSION

Our nationwide study of the Japanese adult population revealed that having a usual source of care was positively associated with multiple preventive care measures, including screening, immunisation and counselling during the COVID-19 pandemic. Our study also found that primary care performance was dose dependently associated with increased receipt of preventive care. These findings indicate that receipt of primary care, particularly high-quality primary care, contributes to increased preventive care even during a pandemic when there are many barriers to providing preventive care by healthcare workers.

To the best of our knowledge, this is the first study to report the contribution of primary care to multiple preventive care measures during a pandemic. Our findings are consistent with prior studies before the pandemic, showing that having a usual source of primary care and primary care performance is positively associated with receipt of preventive care.^{7–10 26 27} This association has been unknown since the pandemic; therefore, this study expanded the evidence of the value of primary care in preventive care during a pandemic or healthcare crisis. Primary care attributes, such as first contact, longitudinality, coordination and comprehensiveness, which are essential to high-performance primary care, may be effective in improving population health through better quality of preventive care, even during and after the pandemic. Policymakers and healthcare system leaders in Japan should consider implementing a patient registration system to ensure that more residents have a usual source of primary care and strongly promote the training of certified primary care specialists for high-quality primary care.

However, we found the implementation rates of depression screening and zoster and tetanus immunisations that are not related to respiratory infections to be at very low levels, even among participants with a usual source of primary care. Especially, depression screening is a crucial preventive care measure because the number

Table 2 Participants' characteristics with or without usual source of primary care

Characteristic	Total (N=1757)	Has usual source of primary care (n=1011)	No usual source of primary care (n=746)
Age, mean (SD), years	50.1 (15.1)	53.1 (15.1)	45.9 (14.1)
Gender, n (%)			
Female	898 (51.1)	545 (53.9)	353 (47.3)
Marital status, n (%)			
Married	1333 (75.9)	784 (77.5)	549 (73.6)
Widowed	65 (3.7)	45 (4.5)	20 (2.7)
Annulled, divorced, separated	89 (5.1)	55 (5.4)	34 (4.6)
Never married	269 (15.3)	127 (12.6)	142 (19.0)
Data missing	1 (0.1)	0 (0.0)	1 (0.1)
Education, n (%)			
Less than high school	57 (3.2)	37 (3.7)	20 (2.7)
High school	584 (33.2)	348 (34.4)	236 (31.6)
Junior college	484 (27.5)	279 (27.6)	205 (27.5)
More than or equal to college	590 (33.6)	323 (31.9)	267 (35.8)
Data missing	42 (2.4)	24 (2.4)	18 (2.4)
Employment status, n (%)			
Full-time employee	691 (39.3)	347 (34.3)	344 (46.1)
Part-time employee	387 (22.0)	231 (22.8)	156 (20.9)
Self-employee	227 (12.9)	132 (13.1)	95 (12.7)
Unemployed	451 (25.7)	300 (29.7)	151 (20.2)
Data missing	1 (0.1)	1 (0.1)	0 (0.0)
Annual household income, n (%), million JPY			
<3.00 (≒US\$27 000)	288 (16.4)	170 (16.8)	118 (15.8)
3.00–4.99	532 (30.3)	332 (32.8)	200 (26.8)
5.00–6.99	435 (24.8)	256 (25.3)	179 (24.0)
7.00–9.99	312 (17.8)	167 (16.5)	145 (19.4)
10.00	170 (9.7)	76 (7.5)	94 (12.6)
Data missing	20 (1.1)	10 (1.0)	10 (1.3)
Currently smoke, n (%)	265 (15.1)	148 (14.6)	117 (15.7)
Data missing	5 (0.3)	5 (0.5)	0 (0.0)
BMI, mean (SD)	22.9 (3.7)	23.2 (3.6)	22.6 (3.7)
Data missing, n (%)	10 (0.6)	8 (0.8)	2 (0.3)
CCHL, mean (SD)	3.5 (0.7)	3.5 (0.7)	3.5 (0.7)
Data missing, n (%)	8 (0.5)	3 (0.3)	5 (0.7)
Number of chronic conditions, n (%)			
0	794 (45.2)	324 (32.0)	470 (63.0)
1	454 (25.8)	297 (29.4)	157 (21.0)
≥2	438 (24.9)	349 (34.5)	89 (11.9)
Data missing	71 (4.0)	41 (4.1)	30 (4.0)
EQ-5D-5L, mean (SD)	0.89 (0.08)	0.88 (0.09)	0.90 (0.07)
Data missing, n (%)	7 (0.4)	2 (0.2)	5 (0.7)

BMI, body mass index; CCHL, Communicative and Critical Health Literacy; EQ-5D-5L, five-level version of the EuroQol five-dimensional questionnaire.

Table 3 Preventive care measures with or without usual source of primary care

Measure	Has usual source of primary care (n=1011)		No usual source of primary care (n=746)		Adjusted mean difference (95% CI)*	P value
	n	Mean, % (95% CI)	n	Mean, % (95% CI)		
Overall composite	1011	43.9 (42.7 to 45.1)	746	33.9 (32.4 to 35.3)	7.2 (5.2 to 9.1)	<0.001
Screening composite	1011	56.3 (54.8 to 57.8)	746	45.0 (43.0 to 47.0)	7.0 (4.4 to 9.6)	<0.001
Colorectal cancer screening	657	67.1 (63.5 to 70.7)	375	51.5 (46.4 to 56.5)		
Breast cancer screening	296	51.0 (45.3 to 56.7)	130	50.8 (42.1 to 59.5)		
Cervical cancer screening	357	62.5 (57.4 to 67.5)	298	58.1 (52.4 to 63.7)		
Hypertension screening	1011	87.8 (85.8 to 89.9)	746	70.6 (67.4 to 73.9)		
Abnormal blood glucose screening	190	84.2 (79.0 to 89.4)	99	69.7 (60.5 to 78.9)		
Osteoporosis screening	165	77.6 (71.1 to 84.0)	44	63.6 (48.8 to 78.4)		
Depression screening	1011	11.2 (9.2 to 13.1)	746	7.8 (5.8 to 9.7)		
Immunisation composite	1011	28.6 (27.1 to 30.1)	746	20.8 (19.1 to 22.6)	7.9 (5.4 to 10.3)	<0.001
Influenza vaccination	1011	59.8 (56.8 to 62.9)	746	41.6 (38.0 to 45.1)		
Pneumococcal vaccination	305	55.4 (49.8 to 61.0)	93	44.1 (33.8 to 54.4)		
Zoster vaccination	616	1.9 (0.9 to 3.0)	282	2.5 (0.7 to 4.3)		
Tetanus vaccination	1011	5.2 (3.9 to 6.6)	746	3.6 (2.3 to 5.0)		
Counselling composite	494	44.5 (40.4 to 48.6)	338	26.9 (22.4 to 31.5)	8.0 (1.6 to 14.3)	0.014
Smoking cessation counselling	148	46.6 (38.5 to 54.8)	117	25.6 (17.6 to 33.7)		
Alcohol use counselling	226	24.8 (19.1 to 30.5)	176	19.9 (13.9 to 25.8)		
Weight loss counselling	276	62.0 (56.2 to 67.7)	154	38.3 (30.5 to 46.1)		

*Adjusted for age, sex, marital status, years of education, employment status, annual household income, smoking status, BMI, health literacy, number of chronic conditions and EQ-5D-5L; positive difference: participants with primary care received more preventive service. BMI, body mass index; EQ-5D-5L, five-level version of the EuroQol five-dimensional questionnaire.

of residents suffering from mental health problems has increased due to the pandemic.²⁸ During the pandemic, a psychological assessment in primary care should be promoted and include queries about pandemic-related stressors, secondary adversities (eg, economic loss) and psychosocial effects (eg, substance use and domestic violence).²⁹ Addressing mental health issues should be a major challenge for primary care providers during and after the pandemic. The low rate of depression screening in primary care settings has been a problem before the pandemic, thus one of the underlying causes of this problem may be the lack of systems to integrate mental health screening into routine care, such as clinical decision support systems in electronic health records.³⁰

Strengths and limitations

A key strength of our study is the use of data from a nationwide study, with a sample representative of the Japanese adult population, which allows for generalisation of its results to the wider population. Another strength is the high study response rate compared with other national surveys, such as the MEPS, which has often been used to investigate the association between receipt of primary care and the quality of care. The PCAT is a validated and internationally established tool for evaluating the performance of primary care attributes. In

multivariable analyses, we adjusted for important potential confounders, including health literacy, chronic conditions and health-related quality of life.

However, the present study has several limitations. First, our outcome measures did not address all preventive care qualities. For example, we excluded measures of preventive therapies and those that could not be assessed accurately using a questionnaire. Second, although a self-reported survey is a useful method for evaluating preventive care measures in a national study, social desirability and recall biases could have affected our results by overestimating the measures and the associations of interest. Third, for preventive care measures with longer recommended intervals, such as tetanus vaccination, participants' usual source of primary care might have changed in the interval between receipt of preventive care and study participation. Fourth, given that the data were cross-sectional, a causal relationship between receipt of primary care and preventive care measures cannot be established definitively.

CONCLUSION

Our nationwide study of the Japanese adult population revealed that receipt of primary care, particularly

Table 4 Associations between primary care performance and preventive care measures

Measure	Mean, % (95% CI)	Adjusted mean difference (95% CI)*	P value
Overall composite (n=1757)			
No usual source of primary care	33.9 (32.4 to 35.3)	Reference	
JPCAT-SF Score Q1	41.1 (38.5 to 43.7)	3.5 (0.5 to 6.4)	0.021
JPCAT-SF Score Q2	43.4 (41.0 to 45.7)	7.5 (4.8 to 10.3)	<0.001
JPCAT-SF Score Q3	44.0 (41.8 to 46.3)	7.6 (4.8 to 10.5)	<0.001
JPCAT-SF Score Q4	46.7 (44.5 to 48.9)	9.9 (7.0 to 12.9)	<0.001
Screening composite (n=1757)			
No usual source of primary care	45.0 (43.0 to 47.0)	Reference	
JPCAT-SF Score Q1	52.2 (49.0 to 55.5)	2.9 (−1.0 to 6.8)	0.149
JPCAT-SF Score Q2	54.7 (51.6 to 57.8)	7.2 (3.6 to 10.9)	<0.001
JPCAT-SF Score Q3	56.8 (53.8 to 59.7)	7.3 (3.5 to 11.0)	<0.001
JPCAT-SF Score Q4	60.8 (58.1 to 63.5)	10.2 (6.3 to 14.0)	<0.001
Immunisation composite (n=1757)			
No usual source of primary care	20.8 (19.1 to 22.6)	Reference	
JPCAT-SF Score Q1	28.3 (24.9 to 31.7)	5.9 (2.2 to 9.6)	0.002
JPCAT-SF Score Q2	29.7 (26.6 to 32.7)	8.3 (4.8 to 11.8)	<0.001
JPCAT-SF Score Q3	28.2 (25.3 to 31.0)	8.3 (4.8 to 11.9)	<0.001
JPCAT-SF Score Q4	28.4 (25.5 to 31.3)	9.0 (5.3 to 12.7)	<0.001
Counselling composite (n=832)			
No usual source of primary care	26.9 (22.4 to 31.5)	Reference	
JPCAT-SF Score Q1	31.4 (23.1 to 39.8)	−1.0 (−10.4 to 8.5)	0.842
JPCAT-SF Score Q2	37.5 (29.2 to 45.7)	6.3 (−2.9 to 15.4)	0.178
JPCAT-SF Score Q3	48.2 (40.4 to 56.0)	10.2 (1.2 to 19.2)	0.026
JPCAT-SF Score Q4	57.3 (49.3 to 65.3)	17.0 (7.8 to 26.2)	<0.001

JPCAT-SF score quartiles: Q1, 0.0–32.5; Q2, 33.3–43.8; Q3, 45.8–56.3; Q4, 58.3–100.0.

*Adjusted for age, sex, marital status, years of education, employment status, annual household income, smoking status, BMI, health literacy, number of chronic conditions and EQ-5D-5L; positive difference: participants with higher JPCAT-SF score received more preventive service. BMI, body mass index; EQ-5D-5L, five-level version of the EuroQol five-dimensional questionnaire; JPCAT-SF, Japanese version of Primary Care Assessment Tool Short Form.

Table 5 Sensitivity analyses for overall preventive care composite (including only measures with interval of one year or less)*

	Mean, % (95% CI)	Adjusted mean difference (95% CI)†	P value
No usual source of primary care	39.4 (37.6 to 41.3)	Reference	
Has usual source of primary care	53.7 (52.3 to 55.2)	10.2 (7.7 to 12.6)	<0.001
No usual source of primary care	39.4 (37.6 to 41.3)	Reference	
JPCAT-SF Score Q1	49.9 (46.6 to 53.1)	5.6 (1.9 to 9.3)	0.003
JPCAT-SF Score Q2	51.6 (48.7 to 54.5)	9.9 (6.5 to 13.4)	<0.001
JPCAT-SF Score Q3	54.2 (51.4 to 57.0)	10.8 (7.2 to 14.3)	<0.001
JPCAT-SF Score Q4	58.7 (55.9 to 61.6)	14.2 (10.5 to 17.8)	<0.001

JPCAT-SF score quartiles: Q1, 0.0–32.5; Q2, 33.3–43.8; Q3, 45.8–56.3; Q4, 58.3–100.0.

*Included colorectal cancer screening, hypertension screening, depression screening, influenza vaccination, smoking cessation counselling, alcohol use counselling and weight loss counselling.

†Adjusted for age, sex, marital status, years of education, employment status, annual household income, smoking status, BMI, health literacy, number of chronic conditions and EQ-5D-5L; positive difference: participants with higher JPCAT-SF score received more preventive service. BMI, body mass index; EQ-5D-5L, five-level version of the EuroQol five-dimensional questionnaire; JPCAT-SF, Japanese version of Primary Care Assessment Tool Short Form.

high-quality primary care, contributed to an increase in preventive care utilisation even during the COVID-19 pandemic when there are many barriers to providing preventive care by healthcare workers. However, the rate of mental health screening in primary care was at a very low level. Therefore, addressing mental health issues should be a major challenge for primary care providers during and after the pandemic.

Contributors All authors contributed to the conception or design of the work and to the discussion of the data, reviewed and edited the manuscript, performed critical review of the manuscript, interpreted the analyses and gave the final approval of the manuscript before submission. TA performed the statistical analyses and drafted the manuscript. TA is the guarantor of the work and accepts full responsibility for the presented content.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants. The Institutional Review Board of the Jikei University School of Medicine provided ethical approval for this study (approval no. 32-416(10505)). Participants gave informed consent to participate in the study before taking part.

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Supplement. Survey items of preventive care measures

1. In the past year, have you had a flu vaccine?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
2. Have you ever had a pneumococcal vaccine before?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
3. Have you ever had a zoster vaccine before?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
4. In the past 10 years, have you had a tetanus vaccine?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
5. In the past year, have you had your blood pressure checked by a doctor, nurse, or other health care professional?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
6. In the past year, has your doctor, nurse, or other health care professional asked you about your mood, such as whether you are anxious or depressed?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
7. Have you ever had a bone density test before?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
8. Do you currently smoke habitually?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No ⇒ Skip to Question 10						
							
9. In the past year, were you advised by a doctor, nurse, or other health care professional to quit smoking?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
10. On average, how much alcohol do you drink each day? Please answer in terms of sake.							
1 <input type="checkbox"/> 180ml or more	2 <input type="checkbox"/> Less than 180ml ⇒ Skip to Question 12						
							
11. In the past year, has a doctor, nurse, or other health care professional advised you to cut back on drinking alcohol?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
12. What is your current height and weight?							
Height <table border="1" data-bbox="331 1657 466 1724"><tr><td></td><td></td><td></td></tr></table> cm				Weight <table border="1" data-bbox="670 1657 804 1724"><tr><td></td><td></td><td></td></tr></table> kg			
13. In the past year, has a doctor, nurse, or other health care professional given you advice about diet or exercise to lose weight?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						
14. In the past 3 years, have you had a blood glucose test?							
1 <input type="checkbox"/> Yes	2 <input type="checkbox"/> No						

15. Have you had colon cancer or your entire colon removed?1 ☐ No2 ☐ Yes ⇒ Skip to Question 18**16. Within the past year, have you had a blood stool test?**1 ☐ Yes2 ☐ No**17. Within the past 10 years, have you had a colonoscopy?**1 ☐ Yes2 ☐ No**18. Please answer the question for women only.****Have you had both breasts removed or have you ever had breast cancer?**1 ☐ No2 ☐ Yes ⇒ Skip to Question 20**19. Within the past 2 years, have you had a mammogram?**1 ☐ Yes2 ☐ No**20. Please answer the question for women only.****Have you had a hysterectomy or have you ever had cervical cancer?**1 ☐ No2 ☐ Yes**21. Within the past 3 years, have you had a cervical cancer screening (Pap test)?**1 ☐ Yes2 ☐ No
