

Individual and regional determinants of long-term care expenditure in Japan: evidence from national long-term care claims

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Background: Japan, with the oldest population in the world, faces a financial challenge caused by rising long-term care (LTC) expenditure. For policymakers to address this, it is important that we have a better understanding of how individual and regional characteristics affect LTC expenditure. **Methods:** We linked national LTC insurance (LTCI) claim data, covering the entire population who used LTCI services in Japan, with municipality data on an individual level. Individuals 65 years and older ($n=3\,876\,068$) who had used LTCI benefits at least once in the fiscal year (FY) 2016 were included. We examined the associations of individual and municipality characteristics regarding supply and demand of healthcare with the LTC expenditures on facility care, home and community care, and total care (the sum of both types of care), after adjusting for regional differences in LTC extra charges. **Results:** The following variables were associated with higher total expenditure; at the individual level: female, a higher care-need level, a lower income (0% co-payments) or a facility service user; at the municipality level: municipalities locating in metropolitan areas, with a higher proportion of single elderly households, more doctors per 1000 citizens, more nursing homes per 100 000 LTC benefit users or more outpatient medical spending per citizen ≥ 75 years old. **Conclusions:** As we are able to identify several individual and municipality characteristics associated with higher LTC expenditure in Japan, the study offers insights into dealing with the rapidly growing LTC expenditure.

Introduction

As a consequence of population ageing, the rapid increase in health-related expenditures, including medical and long-term care (LTC), has become a critical issue for most governments in developed countries.¹ LTC expenditure covered by government and compulsory insurance schemes has increased more rapidly than medical expenditure over the last decade.²

The societal financial burden caused by LTC expenditure is particularly remarkable in Japan, a country with the oldest population in the world, with 27.7% of 65 years of age or older as of 2018.³ In response to society's concern about caring for its older population, Japan introduced an LTC insurance (LTCI) system in 2000 to reduce the family care burden and to support the care of older adults. This universal LTC coverage system is one of the most comprehensive social care systems for older adults in the world, aimed to assure support for citizens needing LTC. Financing for the LTCI comes from insurance premiums (50%) and general taxes (50%). For the primary insurance premiums, municipalities calculate premiums based on their local needs and budget allocations. Among the 50% covered by general taxes, 25% is covered by federal taxes, 12.5% is covered by prefectural governments and 12.5% is covered by municipal governments.⁴ The number of LTCI users has

increased rapidly, and, consequently, corresponding LTC expenditure has also increased every year. Thus, this is threatening the financial sustainability of the LTCI system.⁵

Most previous research on LTC expenditures has focussed on projecting future LTC expenditures in various national settings^{6,7} or by international organizations, such as OECD.⁸ Few studies have investigated determinants of LTC expenditure at the individual level. Recently, one study from the Netherlands covering individual data from the entire population reported that people with the characteristics of older age, female, higher income, disability and living alone spent significantly more on LTC expenditures.⁹ Several pieces of evidence in Japan have shown that the characteristics of older age, dementia, decline of functional status and receiving facility services were associated with high expenditures.^{5,10} However, no previous studies have considered regional-level characteristics.

In contrast with LTC expenditure, research on the drivers of medical expenditure is well documented.^{11–13} Regional-level (i.e. county-level) data have been widely used for addressing more detailed information regarding supply and demand factors as explanatory variables.^{11,13} GDP per inhabitant, education, proportion of private hospital beds, hospital bed density per 1000 inhabitants and general practitioners per 1000 inhabitants showed significant associations with medical expenditures.¹²

This study's objective is, therefore, to clarify both individual and regional characteristics associated with LTC expenditure using national-level claims data.

Methods

Japan's LTCI system and services

Under the LTCI system, those 65 years or older are eligible, along with citizens aged 40–64 with health-related disabilities. Eligibility for LTCI is determined by municipalities according to nationally standardized assessments based on the extent of a physical or mental disability. There are two types of service designations differing in benefits. Individuals in support levels 1 or 2 are eligible to use 'preventive benefits' that are based on a 'care plan for prevention'. While individuals at care-need level 1 (less disabled) to level 5 (most disabled) are eligible to use 'LTCI benefits' including institutional care, home care and community-based services.¹⁴

Data sources and participants

We analyzed anonymous national LTCI claims data from April 2016 to March 2017 (i.e. FY 2016). Notably, the dataset covers all LTCI users in all 47 prefectures in Japan and provides detailed information on the types of LTC services used, amount of care granted and the associated payments, living areas and the demographics of the LTCI subscribers. Subsequently, we linked LTCI claims data with municipality data on an individual level. The municipality-level data are collected annually from the Statistic Bureau, Ministry of Internal Affairs and Communications in Japan and include regional information about population structure, economic status and population health care status. Our inclusion criteria require that individuals are 65 years or older, have had a care need of levels 1–5 and have used LTC services at least once in FY 2016.

Our study has been approved by the ethics committee of the University of Tsukuba (approval number: 1324).

Dependent variables

The annual LTC expenditures for individuals who satisfied the inclusion criteria were calculated by summing monthly reimbursements from LTCI claims and out-of-pocket payments. In Japan, the government unifies unit amounts according to type of LTC service at the national level (i.e. 1 unit equates to 10 Japanese yen). The differences across regions are related to extra charges for LTC expenses. Eight regional levels have been determined by the government according to the labour costs of local government employees; the extra rates in specific regions are as follows: level 1 (20%), level 2 (16%), level 3 (15%), level 4 (12%), level 5 (10%), level 6 (6%), level 7 (3%) and level 8 (0%).¹⁵ To gain a better understanding of LTC expenditure in terms of the amount of LTC service utilization, we calculated price-adjusted (i.e. adjusted for regional extra charges) annual LTCI expenditure for each person. Thus, higher LTC expenditures represent higher amounts of LTC service utilization. The expenditures are presented in Japanese thousand yen (equivalent to 9.2 US dollars or 8.3 Euros as of 2016).¹⁶

Independent variable

We selected the variables reported as predictors of LTC expenditure in previous research. Individual characteristics were included, such as age (age and age squared were included because non-linear relationships between age and health-related expenditure have typically been reported in previous studies and books^{17,18}), sex, LTC-need levels 1–5 and service types (facility service vs. home and community services).^{5,10} Three categories of co-payments were included¹⁹: 0% (livelihood protection recipients), 10% (general) and 20% (when household income is above a certain level). Under the LTCI system, general insured persons are required to pay 10% co-payments, and

those with higher income levels (i.e. the total income of the person is 1.6 million yen or more and 3.46 million yen or more for a household of two or more persons) are required to pay 20% co-payments. For livelihood protection recipients, people who are unable to maintain a minimum standard of living due to poverty, the 10% co-payment is paid by government under the support of the Public Assistance Act.²⁰

The following municipality variables were used to characterize healthcare demand and supply. The variables capturing demand for population healthcare included (i) proportion of elderly single households among all households and (ii) annual mortality rate. The variables capturing healthcare supply were (i) number of LTC welfare facilities per 100 000 LTCI users (care-need levels 1–5) and (ii) number of doctors per 1000 citizens.

Three variables related to regional economic status were included: taxable income per taxpayer, regional differences in the extra charges for LTC expenses (regional levels 1–8) and location (metropolitan vs. non-metropolitan). Here, metropolitan areas included basic unit blocks with a population density of 4000 or more per square kilometre with 5000 or more population at the time of the Population Census of Japan.²¹

Finally, the variables capturing medical spending²² were included. These were medical expenditure per capita, inpatient medical spending per citizen ≥ 75 years old and outpatient medical spending per citizen ≥ 75 years old.

Statistical analysis

We conducted a descriptive analysis to review the distributions of dependent and independent variables. We developed generalized linear models (GLM) to determine the effects of the factors associated with LTC expenditures on facility care, home and community care and total care (the sum of both). Box-Cox tests were performed to select appropriate link functions and modified Park tests were conducted for the distribution family.²³ The preferred GLM specification was the square root link with Gaussian family in total care and home and community care expenditures; whereas facility expenditure preferred Gama family with no transformation. The robust standard variance estimator that accounts for clustering within regions was also applied.²⁴

Data management and analysis were performed using STATA version 14. *P*-values of <0.05 are regarded as statistically significant.

Results

Participants

In the initial dataset, there were 3 992 671 individuals from 1702 municipalities in care-need levels 1–5 who used LTCI services at least once in FY 2016. We excluded 92 122 (2.3%) individuals younger than 65. After linking with municipality level data, 5548 (0.14%) individuals were excluded from five municipalities that did not exist in FY 2016 due to earlier municipal mergers. The final sample included 3 876 068 individuals from 1697 municipalities.

Descriptive analysis

Tables 1 and 2 present the characteristics of individuals and municipalities and per capita price-adjusted expenditure (i.e. adjusted for different regional extra LTC charges) in specific groups. Higher care-need levels (3–5) accounted for 78.1% of the facility services users; in contrast, these levels accounted for only 37.2% of home and community care service use. As expected, mean per capita expenditure in the facility setting (2493 thousand yen) is far higher than that in home and community service setting (1343 thousand yen).

At the municipality level, mean expenditure was higher in metropolitan areas than that in non-metropolitan areas. In addition,

Table 1 Description of outcomes and demographic characteristics of participants, April 2016

Outcome variable	Total LTC services (sum of facility, home and community services)		Facility services		Home and community services	
	n (%)	Per capita expenditure (thousand yen)	n (%)	Per capita expenditure (thousand yen)	n (%)	Per capita expenditure (thousand yen)
LTC expenditure	387 6068	1730 ± 1264	1 009 662	2493 ± 1225	3 119 227	1343 ± 1109
Independent variables						
Age (mean±SD)	84.5 (7.6)	–	86.4 (7.5)	–	84.00 (7.6)	–
Sex						
Male	1 231 668 (31.8)	1458	251 814 (25.0)	2232	1 055 517 (33.8)	1169
Female	2 644 400 (68.2)	1857	757 808 (75.1)	2580	2 063 710 (66.2)	1433
Care-need level						
Level 1	1 137 355 (29.3)	983	86 663 (8.6)	1795	1 098 259 (35.2)	877
Level 2	937 313 (24.2)	1430	134 606 (13.3)	2094	861 336 (27.6)	1229
Level 3	698 440 (18.0)	2102	230 177 (22.8)	2433	533 920(17.1)	1700
Level 4	636 326 (16.4)	2402	302 280 (29.9)	2640	388 093 (12.4)	1882
Level 5	466 634(12.0)	2683	255 896 (25.4)	2819	237 619 (7.6)	2233
Co-payments (%)						
0	15 915 (0.4)	1768	4974 (0.5)	2569	12 091 (0.4)	1270
10	3 491 300 (90.1)	1758	945 441 (93.6)	2512	2 776 777 (89.0)	1355
20	368 853 (9.5)	1470	59 207 (5.9)	2185	330 362 (10.6)	1249

LTC: long-term care.

Table 2 Characteristics of municipalities in fiscal year 2016 (N=1,697)

Characteristics	n	%	Per capita expenditure
Metropolitan status			
Metropolitan	813	52.1	1767
Non-metropolitan	884	47.9	1723
Eight levels of regions (differing extra LTC expenses: %) ^a			
Level 1 (20%)	14	0.8	1584
Level 2 (16%)	24	1.4	1655
Level 3 (15%)	70	4.1	1687
Level 4 (12%)	148	8.7	1683
Level 5 (10%)	1170	69.0	1785
Level 6 (6%)	28	1.7	1708
Level 7 (3%)	31	1.8	1670
Level 8 (0%)	212	12.5	1722
	Mean	SD	
Taxable income per taxpayer (million yen)	2.8	0.6	
Proportion of elderly single households (%)	10.6	4.3	
Number of LTC welfare facilities per 100,000 LTC users (care-need levels 1 to 5)	4.0	6.0	
Number of doctors per 1,000 citizens	1.6	1.8	
Annual mortality rate (per 1,000 person)	12.6	3.9	
Inpatient medical spending per citizen ≥75 years old (thousand yen)	462.9	112.3	–
Outpatient medical spending per citizen ≥75 years old (thousand yen)	399.8	51.0	–
Annual mortality rate (per 1,000 people)	12.6	3.9	

a: The government defined eight levels in which different extra LTC expenses are charged (i.e. 0–20%) to adjust for regional labour costs among local government employees.

LTC: long-term care.

among the eight regional levels based on extra charges for LTC expenses, level 1 (i.e. the region with the highest extra charges) had the lowest mean LTC expenditure.

Individual and municipality characteristics associated with LTC expenditure

Table 3 presents the factors associated with annual LTC expenditure. The variable of inpatient medical spending per citizen ≥75 years was not included in the multivariable analysis because there was a high Pearson's correlation ($r=0.79$) with medical expenditures per capita. Individuals who are older, are female, with a higher care-need level, were associated with higher LTC expenditure. Facility service users spent 851 thousand yen more than home-community care service users. The highest income individuals with 20% co-payments were associated significantly with less expenditure compared with others only in terms of total care and facility expenditure. Municipalities with more doctors per 1000 citizens and a higher proportion of single elderly households or being located in metropolitan areas were associated with higher LTC expenditure. The number of nursing home facilities per 100 000 LTC users was strongly associated with higher total LTC and home and community care, but not with facility care expenditures. The annual mortality rate was negatively associated with LTC expenditure.

Discussion

We examined individual and municipality characteristics associated with LTC expenditure using national LTC claims data. At the individual level, a higher care-need level and facility service use are associated strongly with higher expenditure. At the municipality level, municipalities in metropolitan areas, having more nursing homes per 100 000 LTC users, are associated strongly with higher expenditure. This analysis is an important step in identifying factors to help deal with the rapidly growing LTC expenditure in Japan.

At the individual level, being older and female were associated with higher LTC expenditure, in accordance with previous studies.^{5,10} Here, we should mention that the higher mortality of male may lead to an underestimation of annual LTC expenditures for them, because the calculation of annual expenditure is only summarized for the months when they are alive.

Consistent with studies in Germany,²⁵ Canada²⁶ and the USA,²⁷ our results indicate that facility service users spend more than home and community service users. One reason for this difference is that facility service users are more likely to experience deterioration in care-need levels than home and community service users.²⁸

Table 3 Marginal effects of individual and municipality characteristics on annual per capita LTC expenditure (thousand yen)

	LTC services (sum of facility, home and community care services)			Facility services			Home and community services		
	dy/dx	95% CI	P-value	dy/dx	95% CI	P-value	dy/dx	95% CI	P-value
Individual characteristics									
Age	70.1	(67.6–72.5)	<0.001	24.4	(19.2–29.7)	<0.001	59.5	(56.8–62.3)	<0.001
Age ²	–0.4	(–0.4 to –0.4)	<0.001	–0.2	(–0.2 to –0.1)	<0.001	–0.3	(–0.3 to –0.3)	<0.001
Female (ref.: male)	272.9	(270.4–275.5)	<0.001	273.5	(267.5–279.5)	<0.001	260.5	(257.9–263.2)	<0.001
Care-need level (ref.: Level 1)									
Level 2	425.9	(423.4–428.4)	<0.001	206.5	(196.3–216.7)	<0.001	377.3	(374.9–379.7)	<0.001
Level 3	922	(918.9–925.1)	<0.001	401.5	(392.2–410.7)	<0.001	889.6	(886.3–893)	<0.001
Level 4	1058.5	(1054.9–1062.1)	<0.001	472.8	(463.7–481.8)	<0.001	1084.3	(1080–1088.5)	<0.001
Level 5	1232	(1227.5–1236.5)	<0.001	530.1	(520.8–539.4)	<0.001	1416.5	(1410.5–1422.4)	<0.001
Service type (ref.: only facility services)									
Only home and community services	–851	(–854.3 to –847.8)	<0.001	–	–	–	–	–	–
Both facility and home and community services	–51.7	(–56.1 to –47.4)	<0.001	–	–	–	–	–	–
Co-payments (ref.: 0%)									
10	3.3	(–13.5 to 20)	0.700	–25.3	(–58.6 to 8)	0.100	16.1	(–3.8 to –36.1)	0.112
20	–22.9	(–40.1 to –5.7)	<0.001	–93	(–128.2 to –57.9)	<0.001	–0.002	(–20.3 to –20.3)	1.000
Municipality characteristics									
Metropolitan (ref.: non-metropolitan)	13.3	(9.7–16.9)	<0.001	22.5	(15–30)	<0.001	9.6	(5.5–13.8)	<0.001
Eight regional levels^a (extra charge rate: % (ref.: Level 1(20%))									
Level 2 (16%)	100.5	(91.2–109.9)	<0.001	23.4	(2.1–44.6)	<0.001	104.8	(94.5–115.1)	<0.001
Level 3 (15%)	76.6	(67.9–85.3)	<0.001	4.9	(–14.2 to 23.9)	0.600	81.2	(71.6–90.9)	<0.001
Level 4 (12%)	92.7	(84.1–101.3)	<0.001	33.2	(13.9–52.5)	<0.001	97.4	(87.9–106.9)	<0.001
Level 5 (10%)	133	(123.9–142.1)	<0.001	26.3	(6.2–46.5)	<0.001	157.3	(147.1–167.4)	<0.001
Level 6 (6%)	101.2	(91–111.4)	<0.001	2.2	(–20.4 to 24.9)	0.800	119.9	(108.7–131)	<0.001
Level 7 (3%)	78.5	(70.6–86.4)	<0.001	–16.6	(–35.1 to 1.9)	0.100	95.4	(86.8–104)	<0.001
Level 8 (0%)	98.8	(90–107.7)	<0.001	21.2	(1.4–41)	<0.001	110.6	(100.7–120.4)	<0.001
Number of LTC welfare facilities per 100 000 users (care-need levels 1–5)	81.8	(67.5–96.2)	<0.001	3.2	(–29 to 35.3)	0.800	101.3	(85.4–117.1)	<0.001
Taxable income per taxpayer (million yen)	11.2	(8.8–13.6)	<0.001	–5.8	(–11.4 to –0.2)	<0.001	16.6	(14–19.2)	<0.001
Proportion of single elderly households (%)	2.6	(1.8–3.4)	<0.001	0.6	(–1.1 to 2.2)	0.500	3.2	(2.2–4.1)	<0.001
Number of doctors per 1000 citizens	2.8	(2.1–3.5)	<0.001	3.0	(1.4–4.7)	<0.001	2.3	(1.5–3.1)	<0.001
Outpatient medical spending per citizen ≥75 years old (thousand yen)	0.7	(0.7–0.8)	<0.001	0.04	(–0.1 to 0.1)	0.400	1.0	(1–1.1)	<0.001
Medical expenditure per capita (thousand yen)	–0.3	(–0.3 to –0.3)	<0.001	0.02	(0.0–0.1)	0.500	–0.4	(–0.4 to –0.4)	<0.001
Annual mortality rate (per 1000 people)	–11	(–12 to –10)	<0.001	–6.3	(–8.4 to –4.3)	<0.001	–13.1	(–14.3 to –11.9)	<0.001

a: The government defined eight levels with different extra charges for LTC expenses (i.e. 0–20%) to adjust for their regional labour costs among local government employees.

LTC: long-term care

Alternatively, another possibility is that LTC cost for home and community care may be underestimated since no benefits for informal care are captured in the Japanese LTCI system. In Japan, most residential aged care (i.e. care in facilities) is provided through formal care, although a large part of care for older adults (i.e. home and community services) is provided through informal care. In Spain, there is a great reliance on informal care, with a cultural willingness of older dependents to stay at home as much as possible.²⁹ Obviously, informal care plays a crucial role as supplementary to formal care, yet direct benefits for informal care are not available in Japan.

Those in the highest income group, whose co-payments are 20%, had lower LTC expenditure compared with general users (10% co-payments) and the lowest income users (0% co-payments). This

implies that the lowest income group may fully utilize LTC services under the policy of 100% financial support for low-income individuals. The other possible interpretation is that higher income individuals may have better health conditions and better access to outpatient care,³⁰ resulting in less LTC expenditure.

Municipalities with more taxable income per taxpayer were significantly associated with higher total and home and community care expenditures but negatively associated with facility expenditures. According to a previous study, supply of LTC facilities is less sufficient in urban areas that in general have individuals with more taxable income³¹ and it is also possible that those live in urban areas may have better access to home and community care than facility care.

On the demand side, municipalities with a higher probability of single elderly households spent more on LTC expenditure. One possible interpretation is that elderly singles are more likely to reside in facilities,³² resulting in higher expenditure. Municipalities with higher mortality rates are also associated with lower LTC expenditure. There are several reasons regarding this. We calculated annual LTC expenditure (i.e. expenditure for 12 months). Thus, for anyone who died during the middle of the year, LTC spending was only summarized for the months they were alive; this potentially underestimates the annual LTC expenditure for such individuals. Another reason could be that high hospitalization rates are reported towards the end of life. A previous study has indicated that the hospitalizations of nursing home residents are particularly frequent in the period preceding death; 41% of residents are hospitalized within 6 months before their deaths.³³ Therefore, with increasing medical needs at the end of life, LTC services are likely to shift to medical services.

Medical expenditure per capita was negatively associated with LTC expenditure for total care and home and community care. Indeed, the previous studies based on claims data from one city in Japan suggested that there is a trade-off between medical and LTC expenditures; hence, it is important to include both medical and LTC expenditures when the societal financial burden from multiple diseases is evaluated.^{22,34} At the time of this analysis, however, national medical insurance claims data could not be merged with national LTCI claims data in Japan. If such a procedure is available in the future, further study, including both medical insurance and LTCI claims data, would be warranted.

On the supply side, users living in metropolitan areas were linked to higher expenditure than those living in non-metropolitan areas, even after adjusting for regional differences in extra charges for LTC expenses. Similar trends are observed in previous studies³⁵ and a possible explanation is that non-metropolitan individuals have less access to LTC services.³⁶ An alternative explanation is that fewer individuals in metropolitan areas live with extended family members, which may increase the probability of receiving LTC services³⁷ even after adjusting for single elderly households.

Municipalities with more LTC facilities per LTCI user (care-need levels 1–5) spent significantly more both in terms of total expenditures and for home and community care services. Reports indicate that there is an inadequate supply of nursing facilities covered by LTCI in Japan. Indeed, according to the Ministry of Health, Labour and Welfare, more than 292 000 older adults have been waiting to be admitted to LTC nursing facilities as of 2016.³⁸ Under such a situation, we assume that the supply of LTC facilities acts as a proxy for the supply of LTC services including not only LTC facilities but also home and community care services to meet the demand for total LTC services in the municipalities. This assumption could explain the association that areas with more LTC facilities per LTCI users spend more on total LTC expenditure as well as on home and community care services. To the best of our knowledge, this is the first study to report an association between the supply of LTC nursing facility services and higher home and community LTC expenditure.

A number of limitations should be considered when interpreting our results. First, we used five LTC-need levels as a proxy for functional status, but the activity of daily living score (e.g. Barthel Index) used in previous studies³⁹ could provide more comprehensive information regarding one's functional status. Despite this, care-need level is the key factor in LTCI spending that determines the amount of LTC services in Japan. Second, morbidity status is not adjusted due to a lack of medical information in the LTCI claims data, even though morbidity status is known to be an important factor in LTC demand.³⁴ Third, only those who have LTC certifications are included in our study, even though the large variation in LTC certification among regions is an issue.⁴⁰ Future study is needed to systematically investigate whether access to LTCI services is equitable. Fourth, annual LTCI expenditures for individuals who moved to other regions could not have fully captured, leading to an

underestimation. Fifth, the cross-sectional approach of the dependent variables limits our ability to make causal inferences from our findings. Sixth, as we discussed above, informal care is not considered in our study.

This study also has several strengths worth noting. First, our national data covers almost the entire population of LTC users in Japan owing to the universal coverage of LTCI. Second, we find that LTC expenditure closely relates to LTC utilization, as service type, co-payment and unit price are nationally standardized in Japan. Third, we linked our national LTC claims data to municipality data, and, thus, can include both individual and municipality characteristics in our analysis.

In conclusion, this national-level study identified several individual and municipality characteristics associated with higher LTC expenditure. The findings of this study will be useful to deal with the rapidly growing LTC expenditure in Japan and to further advance the LTCI policy.

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Key points

- This study identifies both the individual and municipality characteristics associated with long-term care (LTC) expenditure by analyzing national LTC claims data that cover the entire population of LTC users in Japan.
- Individuals require greater LTC care needs, use facility service, or have the lowest incomes are strongly associated with higher LTC expenditure.
- There is a strong association between those living in metropolitan areas and higher LTC expenditure and the magnitude of the association is larger in facility settings than in home and community settings.
- Informal care is not included in the LTC expenditure calculations, as informal care is not covered under the LTCI system in Japan. Further studies that include both informal and formal care are warranted.

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