

ACEAT-0047

Estimation of Day Care Facility Demand in Yamaguchi Prefecture

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Abstract

Because of aging progress, elderly people with high degree of care are increasing, and many elderly people are waiting for entering a nursing home. A day care facility has a large role, because waiting elderly people use a day care facility until entering a nursing home. On the other hand, many day care facilities are established in urban area, so there is the disparity between urban and mountainous area.

This paper investigates establishment of day care facilities quantitatively by survey on the number of care-need certificated persons and a fulfillment rate in Yamaguchi prefecture, where aging is rapidly advanced and it is estimated to increase the demand of a day care facility.

The number of the care-need certificated persons of Yamaguchi prefecture has been calculated. The estimation accuracy is over 0.9, so parameter value is effective for estimating the number of the care-need certificated person of Yamaguchi prefecture. The facility demand of urban areas was higher than mountainous areas in 2010, because the new entries of a day care facility increased in urban areas after 2000. And, because of decreasing the number of the care-need certificated persons, the fulfillment rate of a facility demand in mountainous areas was higher than urban areas in 2015. In addition, there is the disparity among the municipalities specially in mountainous areas, so it is important to consider the method of facility establishment in the municipalities, where the fulfillment rate is low.

Keywords: Nursing-care insurance system, Day care facility, Care-need certificated person, Fulfillment rate

Background

Because of aging progress, aging rate of 2014 became 26% and elderly people with high degree of care has continued to increase. The elderly people can use the visiting type, type to go to a facility, short-stay type and housing type service after introducing the aged person welfare work, such as the nursing-care insurance system. A day care facility is the type to go to facility and has a large role that providing the place where the elderly people spend in the daytime.

A special nursing home is the housing type and receives the elderly people with high degree of care. It is a serious issue that 524,000 people were waiting for entering a special nursing home in 2014. However, it is not easy to establish the new facility, because the number of the facilities is limited by local governments. Therefore, the role of a day care facility will become bigger in the future, because

waiting elderly people use a day care facility until entering a special nursing home. On the other hand, many day care facilities are established in urban area, so there is the disparity between urban and mountainous area. Therefore, it is important to clarify the demand of a day care facility in detail.

In previous studies of the field of building and city planning, there are the accumulations of the study such as a grasp of the location actual, evaluation of the service level, consideration and suggestion of optimal location layout planning 1-3), and classifying the characteristics of the demand for the elderly 4). On the other hand, about the problems considering disparities of welfare services, there are the accumulations of the study such as the research pointing out uneven distribution and regional disparity of the facilities location 5-6). But there are few studies of analysis of the time-series change of facilities supply based on each small area for 15 years since nursing-care insurance system was introduced, as a target for whole area of the local prefecture including the urban region and rural region where the depopulation and aging is remarkable.

As mentioned above, this paper investigates establishment of day care facilities quantitatively by survey on the number of care-need certificated persons and a fulfillment rate in Yamaguchi prefecture, where aging is rapidly advanced and it is estimated to increase the demand of a day care facility.

Methods

Firstly, the number of care-need certificated persons of Yamaguchi prefecture has been estimated in 2000-2040, using the parameter values of before 2005 and after 2009. And the parameter value is calculated by survey on a ratio of the care-need certificated persons of all over Japan. The data used for analysis are compiled from All-Japan Federation of National Health Insurance Organizations: the number of care-need certificated persons by age group and a care-need level in all over Japan (2001-2015), result of national census and vital statistics (2000-2014) and National Institute of Population and Social Security Research: future population estimates (2015-2040).

Secondly, the estimation accuracy of the care-need certificated persons in Yamaguchi prefecture is calculated. The data used for analysis is compiled from WAM NET: the number of care-need certificated persons (Welfare and Medical Service Agency) (2001-2014).

Thirdly, a fulfillment rate of the facility demand has been calculated for every municipalities division before merger in the Heisei era, in order to analyze the states of facility establishment in detail. The fulfillment rate is a ratio of the facility capacity for the number of the care-need certificated persons. The data used for analysis is compiled from WEB site: insurance information Service Guide of Yamaguchi Prefecture / Database of Service Establishment / Day Care Facility (Elderly Citizens' Welfare Division in Yamaguchi Prefecture) (1985-2014).

Results

3.1 The number of the care-need certificated persons

Figure 1 shows the change of the care-need persons number by an age group and a care-need level in all over Japan. The care requiring state sections have been able to divide into three periods. The state section of requiring help had one level in 2000-2005 as to first period. The state section of requiring help had two level, and a temporary care level was added in 2006-2008 as to second period. The temporary care level was deleted after 2009 as to third period. The number of the care-need certificated persons was increased from 2,700,000 people in 2001 to 6,180,000 people in 2015. The number of the care-need persons was increased 2,700,000 people in 2001 to 4,217,000 people in 2005 in first period, because nursing care insurance system was just introduced. The number of them in 2008 was 4,638,000 people and the increase rate was low in second period. The increase rate was

1.6 times in third period. Therefore, the number of the care-need certificated person is increasing now, because of increasing the elderly people and prolonged life.

3.2 The estimation method of the number of the care-need certificated persons

The number of the care-need certificated persons of 2000-2040 in Yamaguchi prefecture has been estimated using the number of them in all over Japan. The data used for estimation are the number of them in 2001-2005 and 2009-2015, because the care requiring state sections is divided into three periods. And the number of the care-need certificated persons has been estimated separately for before 2005 and after 2009. Firstly, the ratio of the care-need certificated person is calculated by an age of group and a care-need level. Figure 2 and 3 show the ratio of the care-need certificated person with care level 1. Secondly, parameter values are calculated using the ratio of the care-need certificated person. In this paper, if the change of ratio of the care-need certificated person for 5 years is over 0.01, parameter value is calculated using a regression equation. And if it is under 0.01, parameter value is calculated using an average. The parameter value of after 2009 has been calculated in 2 types, because the ratio of the care-need person of some aged groups is close to 0.01. Table 1, 2 and 3 show the parameter value by an age group and a care-need level.

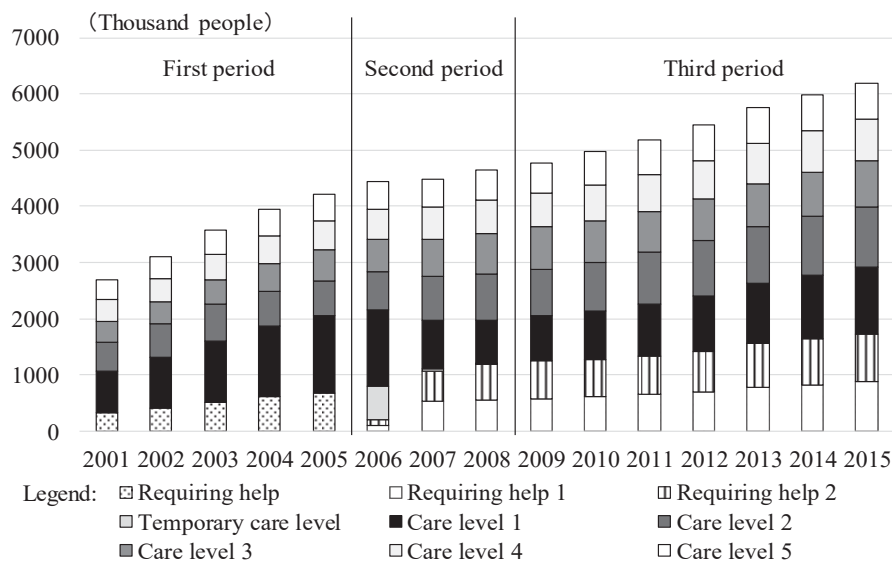


Fig. 1: Change of the care-need certificated person number in all over Japan

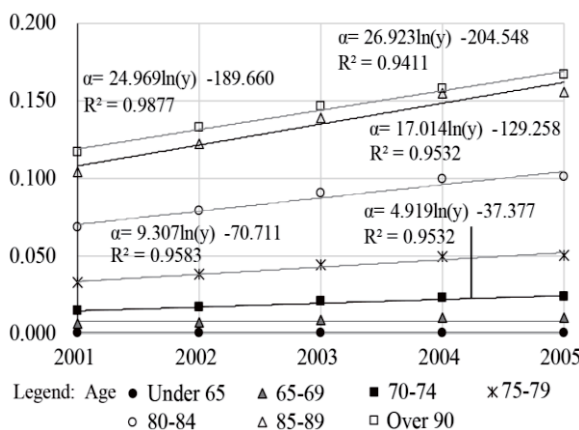


Fig. 2: The ratio of a care-need certificated person with care level 1 in 2001-2005

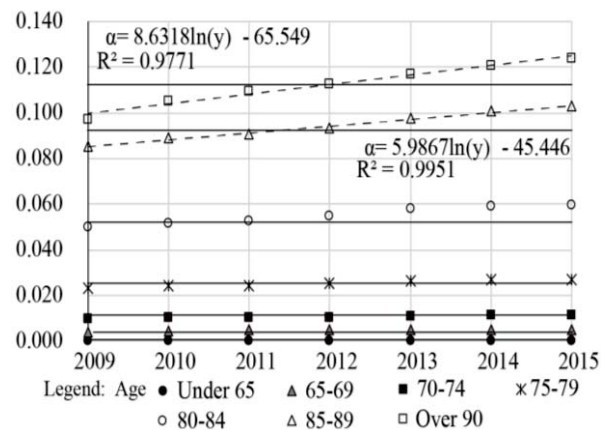


Fig. 3: The ratio of a care-need certificated person with care level 1 in 2009-2015

Thirdly, the number of the care-need certificated persons is estimated by based on the parameter

value. The number of the care-need certificated persons by a care-need level is given by the following equation,

$$P_j = \alpha_{ij} \times A_i \quad (1)$$

where P_j is the number of the care-need certificated persons by a care-need level, α_{ij} is the parameter value by an age group and a care-need level and A_i is the population by an age group.

Table 1: The parameter value by an age group and a care-need level before 2005

Age	Requiring help	Care level 1	Care level 2	Care level 3	Care level 4	Care level 5
-65	0.00008	0.00039	0.00030	0.00019	0.00016	0.00019
65-69	0.00363	0.00840	0.00519	0.00356	0.00315	0.00329
70-74	$3.523 \times \ln(y) - 26.776$	$4.919 \times \ln(y) - 37.377$	0.01056	0.00739	0.00671	0.00680
75-79	$7.424 \times \ln(y) - 54.153$	$9.307 \times \ln(y) - 70.711$	0.02052	0.01466	0.01350	0.01329
80-84	$12.462 \times \ln(y) - 94.695$	$17.014 \times \ln(y) - 129.258$	0.04171	0.03050	0.02877	0.02747
85-89	$13.754 \times \ln(y) - 104.505$	$26.923 \times \ln(y) - 204.548$	0.07576	0.05908	0.05850	0.05377
90-	$7.330 \times \ln(y) - 55.685$	$24.969 \times \ln(y) - 189.660$	0.11014	0.10030	0.11720	0.10760

Legend) y : Year

Table 2: The parameter value by an age group and a care-need level after 2009 type 1

Age	Requiring help 1	Requiring help 2	Care level 1	Care level 2	Care level 3	Care level 4	Care level 5
-65	0.00015	0.00026	0.00030	0.00041	0.00028	0.00022	0.00025
65-69	0.00370	0.00424	0.00481	0.00538	0.00378	0.00310	0.00305
70-74	0.00955	0.00943	0.01071	0.01087	0.00774	0.00645	0.00603
75-79	0.02370	0.02163	0.02534	0.02273	0.01648	0.01406	0.01272
80-84	0.04732	0.04384	0.05502	0.04670	0.03451	0.02970	0.02613
85-89	0.06164	0.06507	0.09426	0.08572	0.06747	0.05949	0.05116
90-	0.04417	0.05975	0.11229	0.13229	0.12649	0.13211	0.11405

Table 3: The parameter value by an age group and a care-need level after 2009 type 2

Age	Requiring help 1	Requiring help 2	Care level 1	Care level 2	Care level 3	Care level 4	Care level 5
-65	0.00008	0.00026	0.00039	0.00041	0.00028	0.00022	0.00025
65-69	0.00363	0.00424	0.00840	0.00538	0.00378	0.00310	0.00305
70-74	0.00955	0.00943	0.01071	0.01087	0.00774	0.00645	0.00603
75-79	0.02370	0.02163	0.02534	0.02273	0.01648	0.01406	0.01272
80-84	$3.985 \times \ln(y) - 30.266$	0.04384	0.05502	0.04670	0.03451	0.02970	0.02613
85-89	$3.778 \times \ln(y) - 28.688$	0.06507	$5.987 \times \ln(y) - 45.446$	0.08572	0.06747	0.05949	0.05116
90-	$5.019 \times \ln(y) - 38.115$	0.05975	$8.632 \times \ln(y) - 65.549$	0.13229	0.12649	0.13211	0.11405

Legend) y : Year

And the number of the care-need certificated persons is given by the following equation,

$$P = \sum_{j=1}^7 (P_j) \quad (2)$$

where P is the number of the care-need certificated persons.

The number of the care-need certificated persons of all over Japan has been calculated using the above equations and compared with actual values. Table 4 and 5 show the estimation accuracy. The estimation accuracy is over 0.95 in almost years as to 2001-2005, but the estimation accuracy of 2001 is 0.93 and a little low. However, the estimation accuracy is over 0.9 in all years, so parameter

value is effective for estimating the number of the care-need certificated persons. The estimation accuracy is over 0.95 in all years in case of using an average as to 2009-2015. And the estimation accuracy is over 0.99 in all years in case of using a regression equation. So, the estimation accuracy using a regression equation is higher than the estimation accuracy using an average. The estimation accuracy is over 0.9 in case of everything, so parameter value is effective for estimating the number of the care-need

Table 4: The estimation accuracy of all over Japan type 1

Year	2001	2002	2003	2004	2005
Estimate	2,879,633	3,171,344	3,471,153	3,785,895	4,160,577
Actual figure	2,700,541	3,110,391	3,567,165	3,944,010	4,216,929
Estimation accuracy	0.93	0.98	0.97	0.96	0.99

Year	2009	2010	2011	2012	2013	2014	2015
Estimate	4,765,384	4,897,286	5,103,159	5,308,634	5,505,691	5,701,676	6,133,802
Actual figure	4,769,464	4,966,682	5,180,436	5,447,653	5,762,609	5,974,193	6,179,948
Estimation accuracy	1.00	0.99	0.99	0.97	0.96	0.95	0.99

Table 5: The estimation accuracy of all over Japan type 2

Year	2009	2010	2011	2012
Estimate	4,814,391	4,976,825	5,215,609	5,455,997
Actual figure	4,769,464	4,966,682	5,180,436	5,447,653
Estimation accuracy	0.99	1.00	0.99	1.00

Year	2013	2014	2015
Estimate	5,689,762	5,923,989	6,248,619
Actual figure	5,762,609	5,974,193	6,179,948
Estimation accuracy	0.99	0.99	0.99

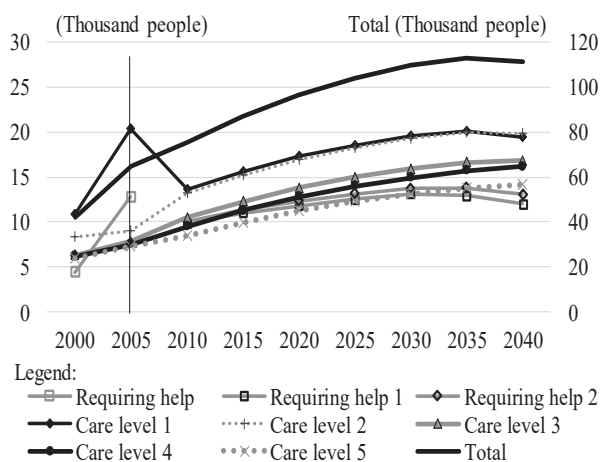


Fig. 4 The number of care-need certificated persons of Yamaguchi prefecture type 1 certificated person.

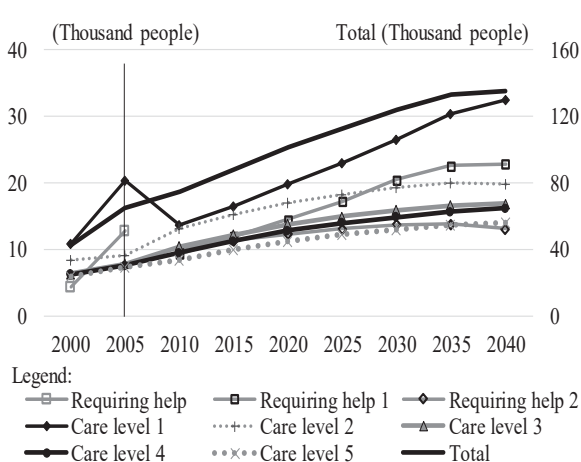


Fig. 5 The number of care-need certificated persons of Yamaguchi prefecture type 2

3.3 The estimation of the number of the care-need certificated persons of Yamaguchi prefecture

The number of the care-need certificated persons of Yamaguchi prefecture has been calculated. Figure 4 and 5 show the results. The increasing rate of the care-need certificated persons between 2000 and 2040 is about 3 times. And increasing rate between 2000 and 2005 is high especially. However, it has turned constant after 2035. According to a care level, increasing rates of them with care level 3 and 4 are about 2.6 and high.

The estimation results have been compared with actual values. Table 6 and 7 show the estimation accuracy. The estimation accuracy is over 0.9 in all years as to 2001-2005, but the estimation accuracy of 2002-2004 is a little low. The estimation accuracy is over 0.95 in all years in case of using an average as to 2009-2015. And the estimation accuracy is over 0.98 in except for 2012 in case of using a regression equation.

Therefore, parameter value is also effective for estimating the number of the care-need certificated person of Yamaguchi prefecture, because the estimation accuracy is over 0.9 in all years. However,

the parameter value of 2040 using a regression equation is twice the parameter value using an average, and 90% of the people aged over 90 are estimated to be care-need certificated persons. So, the parameter value using an average is used in this paper.

3.4 The fulfillment rate of a day care facility demand in Yamaguchi prefecture

The fulfillment rate of a day care facility demand in Yamaguchi prefecture is calculated by each self-government body in 2000, because the facility demand is clarified in detail. The fulfillment rate is capacity of a day care facility to the number of the care-need certificated persons, and is effective for comparing the facility establishment conditions among the local governments. And the fulfillment rate of a day care facility is given by the following equation,

Table 4: The estimation accuracy of Yamaguchi prefecture type 1

Year	2001	2002	2003	2004	2005
Estimate	46,166	50,443	53,816	58,266	64,415
Actual figure	46,929	53,433	58,575	62,506	64,943
Estimation accuracy	0.98	0.94	0.92	0.93	0.99
Year	2009	2010	2012	2013	2014
Estimate	70,137	73,167	77,812	79,727	81,791
Actual figure	69,981	72,531	76,984	82,678	85,959
Estimation accuracy	1.00	0.99	0.99	0.96	0.95

Table 5: The estimation accuracy of Yamaguchi prefecture type 2

Year	2009	2010	2012
Estimate	70,757	74,234	79,856
Actual figure	69,981	72,531	76,984
Estimation accuracy	0.99	0.98	0.96
Year	2013	2014	
Estimate	82,287	84,883	
Actual figure	82,678	85,959	
Estimation accuracy	1.00	0.99	

$$F = C_m / P_m \tag{3}$$

where F is the fulfillment rate of a day care facility, C_m is the facility capacity by the local government and P_m is the number of care-need certificated persons by the local government.

Figure 6 shows the number of the day care facilities and the facility capacities. In 1990s, a day care facility with a special nursing home was established in each local government by introducing gold plan, so the facility capacity was same level in both of urban and mountainous areas in 2000. The facility capacity increased about three times in 2005 in urban area, because the facility supply rapidly progressed after 2000. On the other hand, the facility capacity increased only 1.5 times between 2000 and 2005 in mountainous area. After that, the facility supply progressed in both areas, so facility capacity increased to 11,352 people in urban area and to 3,532 people in mountainous area in 2015.

Figure 7 shows the change of the fulfillment rate of a day care facility. The fulfillment rate of

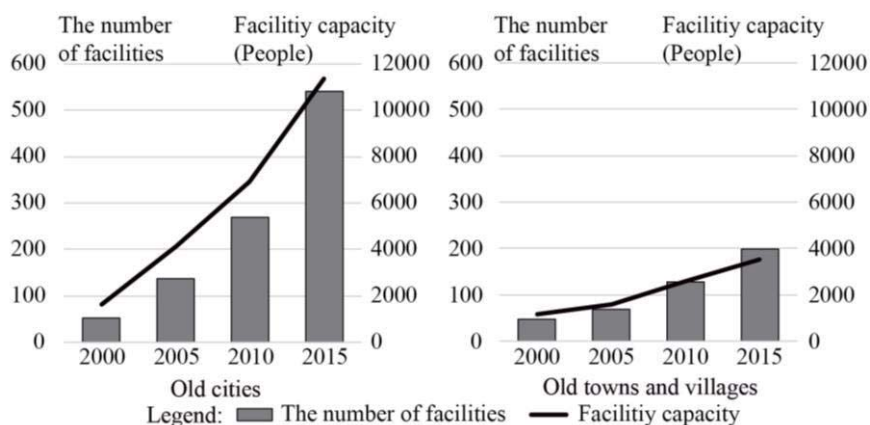


Fig.6: Change of the number of the facilities and the facility capacities

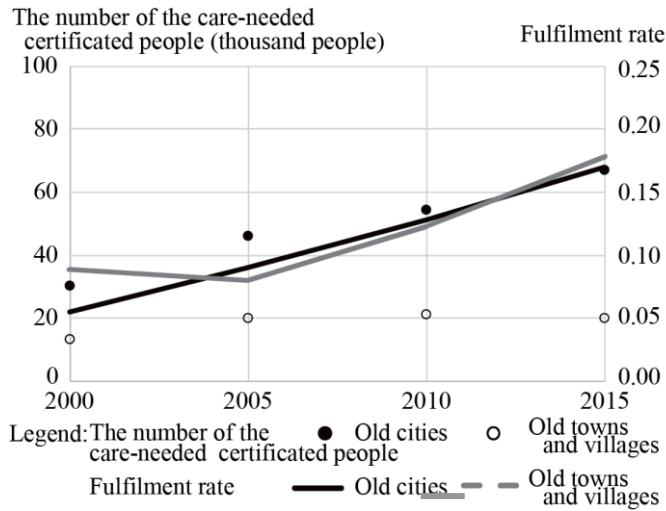


Fig.7: Change of the fulfillment rate of a day care facility

2000 is 0.05 in urban area and 0.09 in mountainous area, and it tends to high in the area where the number of the care-need certificated persons is small. In 2005, the fulfillment rate raised by proceeding the facility supply in urban area. On the other hand, the fulfillment rate declined in mountainous area. After that, the fulfillment rate raised in both areas, and he fulfillment rate of 2010 was 0.13 in urban area and was 0.12 in mountainous area. The fulfillment rate of 2015 is 0.17 in urban area, because the number of the facility capacities and the care-need certificated persons increased. The fulfillment rate of 2015 is 0.18 in mountainous area and higher than urban area, because the number of the care-need certificated persons decreased.

Figure 8 shows the number of the local governments by the fulfillment rate, and figure 9 shows distribution map of the fulfillment rate in 2015. The fulfillment rate of the local

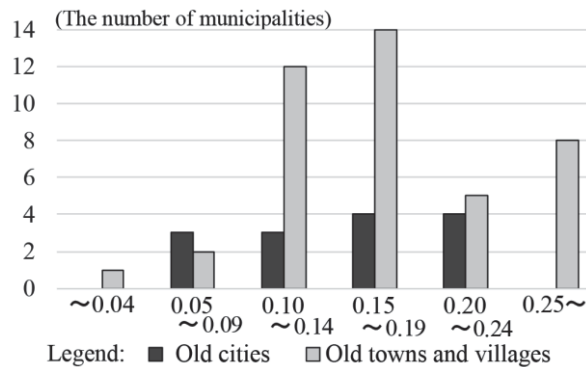


Fig.8: The number of the local governments by the fulfillment rate in 2015

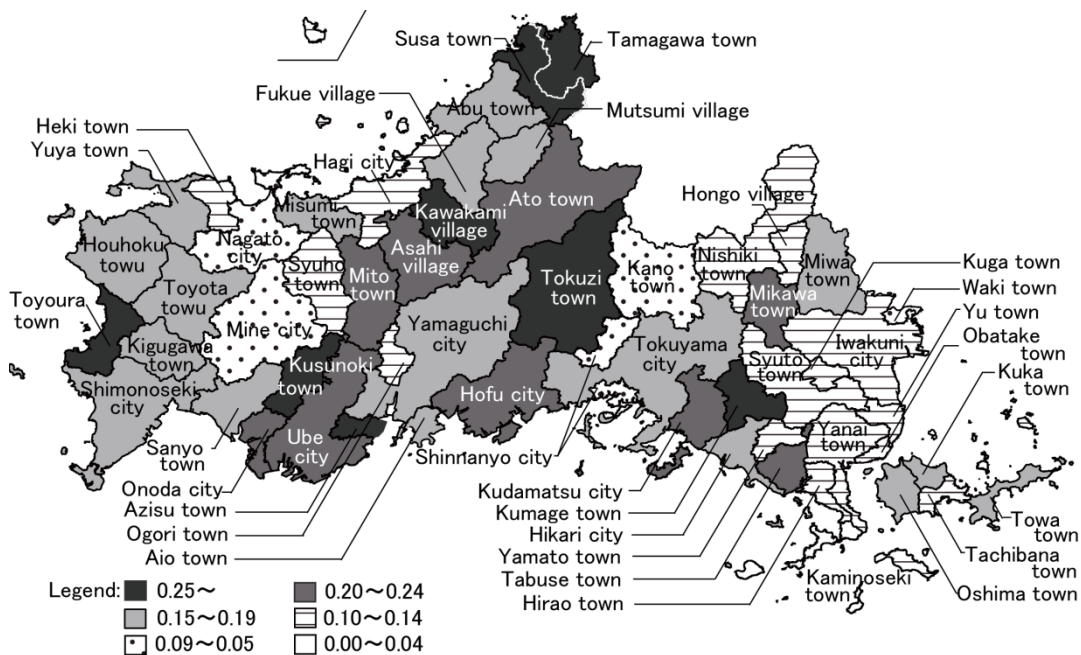


Fig.9: Distribution map of the fulfillment rate in 2015

governments is distributed in the same number between 0.05 and 0.24 in urban area. The number of the local governments where the fulfillment rate is between 0.15 and 0.19 is 14 and the most in mountainous area. And the number of the local governments where it is between 0.05 and 0.09 is 12 and the second most. However, there are the local governments where it is 0.04 or less and 0.25 or more, so there is the disparity among mountainous area. The fulfillment rate tends to be high in the area where the number of the care-need certificated persons is small in the northwestern part of the prefecture.

3.5 knowledges

- 1) The care requiring state sections have been able to divide into three periods. As for first period, the state section of requiring help had one level in 2000-2005. As for second period, the state section of requiring help had two level, and a temporary care level was added in 2006-2008. As for third period, the temporary care level was deleted after 2009. The number of care-need certificated persons was increased from 2700,000 people in 2001 to 6180,000 people in 2015 in all over Japan.
- 2) The number of the care-need certificated persons of Yamaguchi prefecture has been calculated. The estimation accuracy is over 0.9, so parameter value is effective for estimating the number of the care-need certificated person of Yamaguchi prefecture. The increasing rate of the care-need certificated persons between 2000 and 2015 is about 2 times and the increasing rate of it between 2000-2040 is about 3 times. The increasing rate of it between 2000 and 2005 is the highest, when nursing care insurance was introduced just after. However, it has turned constant after 2035.
- 3) The fulfillment rate of the facility demand in 2000 was high in mountainous areas, because the number of the care-need certificated persons was small. However, the facility demand of urban areas was higher than mountainous areas in 2010, because the new entries of a day care facility increased in urban areas after 2000. And, because of decreasing the number of the care-need certificated persons, the fulfillment rate of a facility demand in mountainous areas was higher than urban areas in 2015.

As mentioned above, the number of the care-need certificated persons of Yamaguchi prefecture has been calculated, and good results have been obtained. It is possible to analyze the states of facility establishment in detail by calculation of the fulfillment rate. And it is clarified that the fulfillment rate of mountainous areas was high in 2015, because the care-need certificated persons decreased. In

addition, there is the disparity among the municipalities specially in mountainous areas, so it is important to consider the method of facility establishment in the municipalities, where the fulfillment rate is low.

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