



日本を、もっと健やかに。

AMDD Medical Technology Policy Institute Report  
April 15, 2019

## Analysis of the relationship between the numbers of CT and MRI devices installed, the number of images taken and medical care expenses

Director, Medical Technology Policy Institute,  
American Medical Devices and Diagnostics Manufacturers' Association (AMDD)  
Special Professor, International University of Health and Welfare Graduate School  
Makoto Tamura

Director, Department of Radiology,  
Kohnodai Hospital, National Center for Global Health and Medicine  
Akihiro Machitori

# Summary

- It has been pointed out that the numbers of CT and MRI devices installed in Japan are larger than in other countries and that the numbers of CT and MRI devices installed in each prefecture vary.
- For this report, we analyzed the relationship between the number of devices installed, the number of images taken per capita, and medical care expenses per capita (estimate), and found the following:
  - The numbers of both CT and MRI devices installed are larger than in other countries, but fewer images are taken per capita than in countries such as America, etc.
  - By prefecture, there was less variation in the number of images taken than variation in the number of devices installed.
  - Among the four countries of Japan, America, France, and Germany, Japan had the lowest imaging fees per time.
  - Japan also had the lowest medical care expenses per capita for CT and MRI scans (estimate). In America, those expenses were about 2.5 to 3.5 times higher than in Japan, and in France and Germany, they were 1.4 to 1.6 times higher for MRI.
- It has been pointed out since the 1990s that the large number of MRI devices installed compared with other countries has not led to increased medical care expenses, and it is clear in this report that the situation has not changed that much since then.
- It was suggested that CT and MRI devices, which are said to be “essential for the medical care field”<sup>(\*)</sup> have realized operations that suppress increased medical care expenses while meeting the needs of the medical field.

\* Working Group on Regional Medical Initiatives (January 30, 2019)

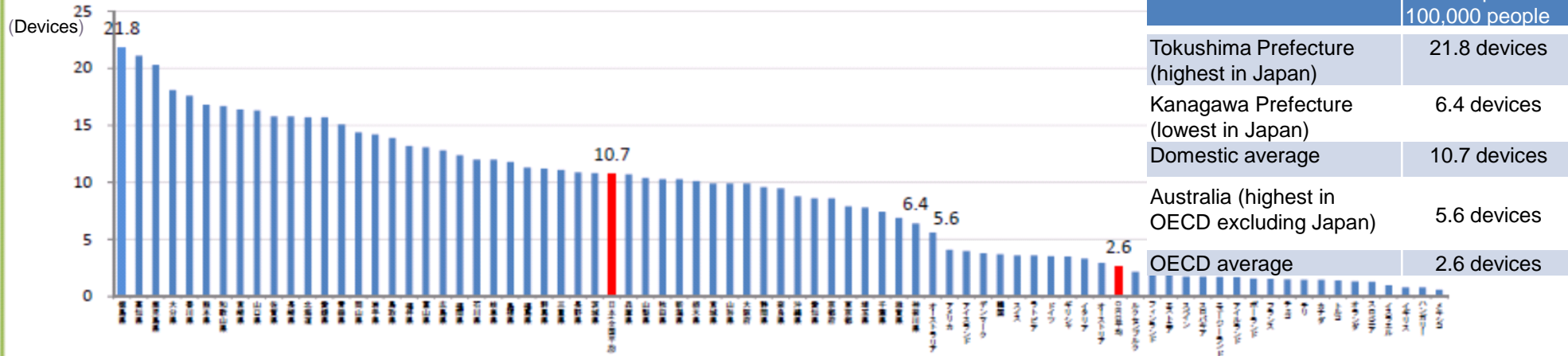
# Introduction

- It has long been known that there are variations in the numbers of CT and MRI devices installed per person domestically and overseas
- In particular, Japan has more devices installed than other countries and in Japan domestically, there is a certain amount of difference in the number of devices installed per capita when looked at by prefecture
- For this report, we investigated the two following points
  1. Analysis of the relationships between the number of devices installed domestically and overseas and the number of images taken per capita
    - ✓ Do countries or regions with large numbers of devices installed also have large numbers of images taken per capita?
  2. Analysis of the impacts variations in the number of devices installed have on medical care expenses
    - ✓ Do countries with large numbers of devices installed also have high medical care expenses?

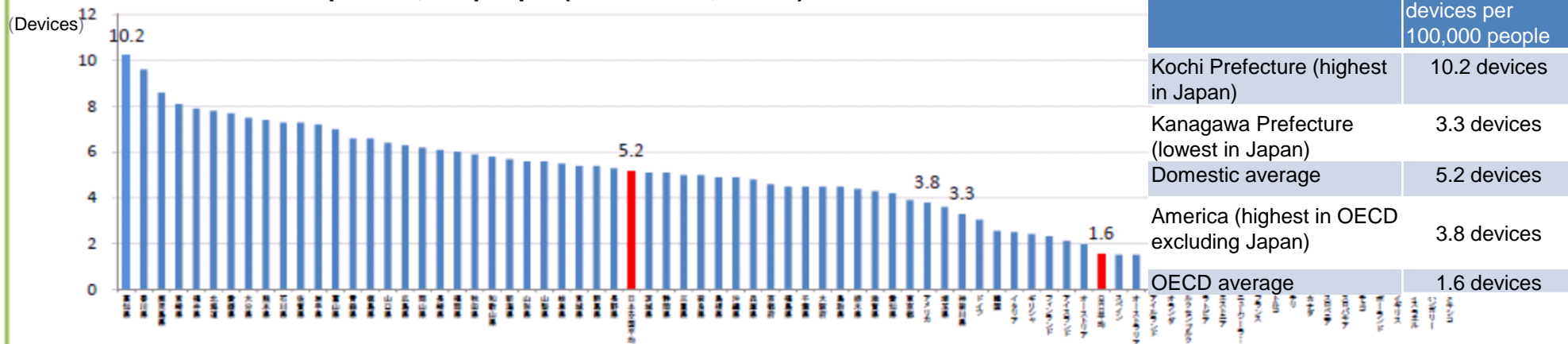
# Current status of installation of CT and MRI devices

- \* By prefecture, the highest numbers of CT and MRI devices per 100,000 people were 21.8 CT devices (Tokushima Prefecture) and 10.2 MRI devices (Kochi Prefecture), about twice the national average, and in the regional differences against the prefectures with the lowest numbers of CT and MRI devices installed, both figures were more than three times higher.
- \* In addition, when the numbers of CT and MRI devices installed per 100,000 people were compared with those in OECD countries, the numbers of CT devices in all prefectures were found to exceed those in all OECD countries, and the numbers of MRI devices were found to exceed those in all OECD countries excluding America.

## ◆ Number of CT devices per 100,000 people (Prefectures, OECD)



## ◆ Number of MRI devices per 100,000 people (Prefectures, OECD)



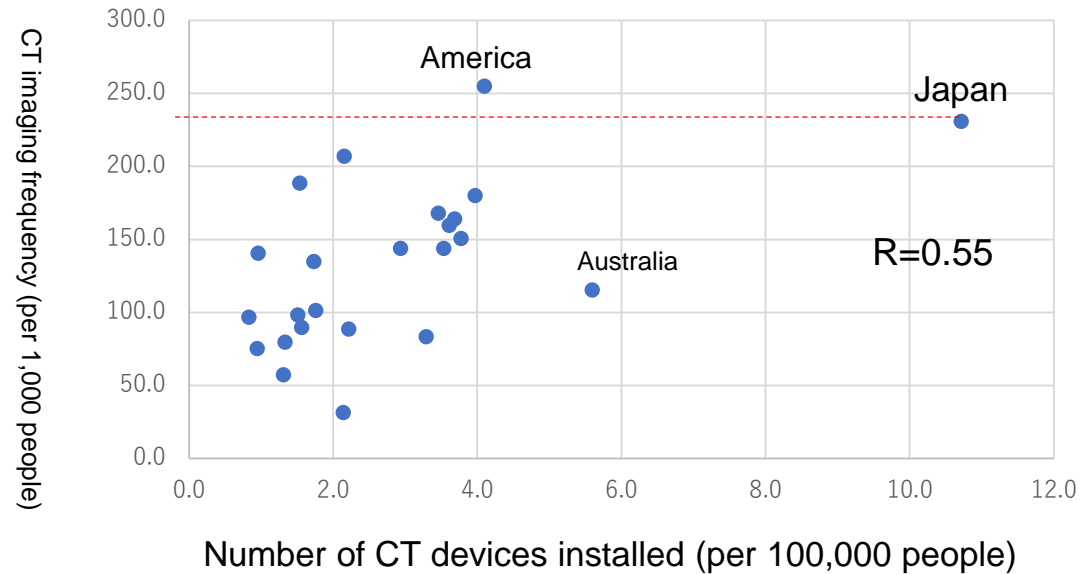
(Source) Prefectures: Ministry of Health, Labour and Welfare "Medical facility survey," OECD: OECD Health Statistics 2017

Analysis of the relationship between the numbers of CT and MRI devices installed per capita and the number of images taken, etc.

# Number of CT devices installed per capita and number of images taken (international comparison)

	Number of devices installed (Per 100,000 people)	Number of images taken (Per 1,000 people)
Australia	5.6	115.3
Austria	2.9	143.8
Czech Republic	1.5	98.3
Denmark	3.8	150.5
Finland	2.1	31.3
France	1.5	188.4
Germany	3.5	143.8
Greece	3.5	168.0
Hungary	0.8	96.7
Iceland	4.0	179.9
Israel	1.0	140.6
Italy	3.3	83.3
Japan	10.7	230.8
Korea	3.7	163.9
Latvia	3.6	159.5
Lithuania	2.2	88.6
Luxembourg	2.2	206.9
Netherlands	1.3	79.5
Poland	1.6	89.7
Slovak Republic	1.7	134.8
Slovenia	1.3	57.2
Spain	1.8	101.3
United Kingdom	0.9	75.1
United States	4.1	254.8

The number of CT devices installed in Japan is larger than in other countries, but the number of CT images taken per capita is smaller than America, and the difference is small compared to the number of CT devices installed



Average number of devices installed in 24 countries = 2.9 devices

↓ **3.7 times**

Number of devices in Japan = 10.7

Average number of images taken in 24 countries = 132.6

↓ **1.7 times**

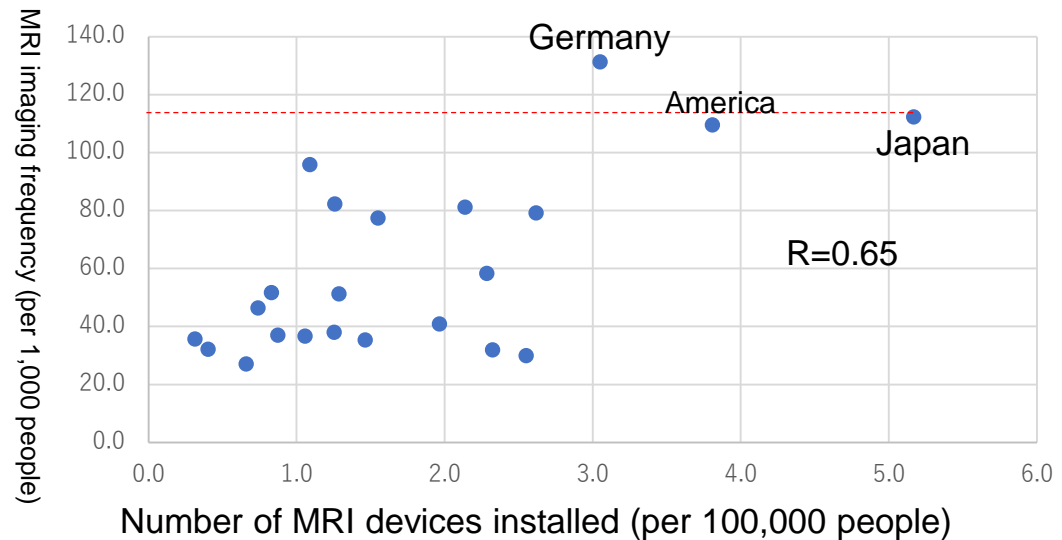
Number of images taken in Japan = 230.8

Source: OECD Health Statistics (24 countries that had data as of 2014 including data on the frequency of imaging in Japan)

# Number of MRI devices installed per capita and number of images taken (international comparison)

	Number of devices installed (Per 100,000 people)	Number of images taken (Per 1,000 people)
Australia	1.5	35.3
Austria	2.0	40.8
Czech Republic	0.7	46.3
Finland	2.3	31.9
France	1.1	95.8
<b>Germany</b>	<b>3.1</b>	<b>131.3</b>
Greece	2.3	58.3
Hungary	0.3	35.6
Iceland	2.1	81.1
Israel	0.4	32.1
Italy	2.6	79.1
Japan	5.2	112.3
Korea	2.6	29.9
Latvia	1.3	37.9
Lithuania	1.1	36.6
Luxembourg	1.3	82.2
Netherlands	1.3	51.2
Poland	0.7	27.0
Slovak Republic	0.8	51.6
Slovenia	0.9	36.9
Spain	1.6	77.4
United States	3.8	109.5

**The number of MRI systems installed in Japan is larger than in other countries, but the number of MRI images taken per capita is smaller than Germany, and the difference is small compared to the number of systems installed.**



Average number of devices installed in 22 countries = 1.8 devices

↓ **2.9 times**

Number of devices in Japan = 5.2

Average number of images taken in 22 countries = 60.0

↓ **1.9 times**

Number of images taken in Japan = 112.3

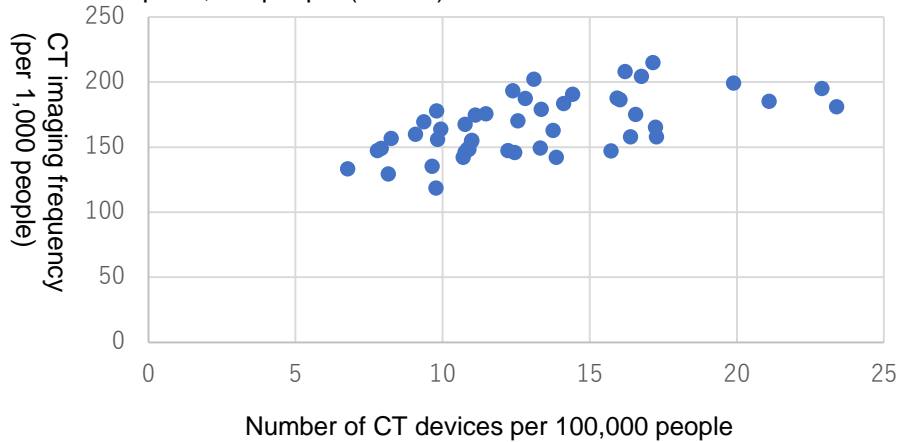
Source: OECD Health Statistics (22 countries that had data as of 2012 including data on the frequency of imaging in Japan)



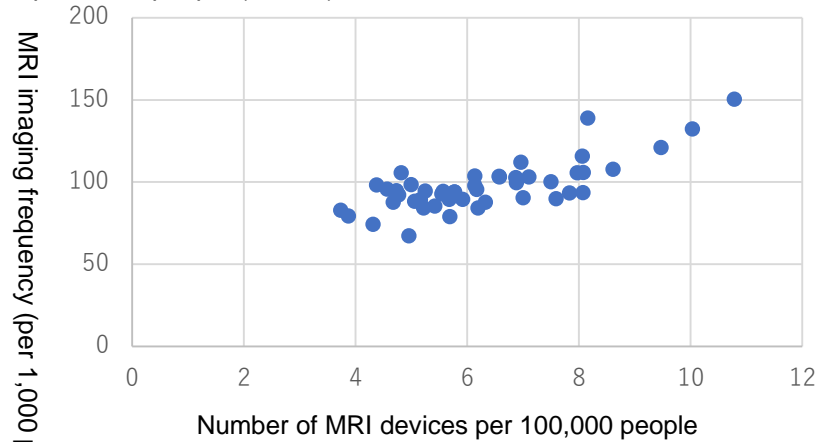
# Numbers of CT and MRI devices and numbers of images taken by prefecture

It can be seen that in prefectures where there are a lot of CT and MRI devices, the frequency of imaging per person also tends to be high. However, the difference in the frequency of imaging is smaller than the difference in the number of imaging devices. It should be noted that this difference in the frequency of imaging by prefecture can also be seen in regard to other technologies (general urinalysis, etc.)

Number of CT devices per 100,000 people and number of CT images taken per 1,000 people (annual)



Number of MRI devices per 100,000 people and number of MRI images taken per 1,000 people (annual)



	Top 5 prefectures
Number of CT devices	20.9
Average number of images taken	183.6

2.7 times



1.3 times

	Bottom 5 prefectures
Number of CT devices	7.8
Average number of images taken	143.1

< Examples of variations in the frequencies of other inspections (comparison between the top 5 prefectures and bottom 5 prefectures) >

	Top 5 prefectures
Number of MRI devices	9.4
Average number of images taken	130,2

2.3 times



1.5 times

	Bottom 5 prefectures
Number of MRI devices	4.2
Average number of images taken	86.1

Data sources: Medical facility survey, NDB (2016)

General urinalysis	1.9 times
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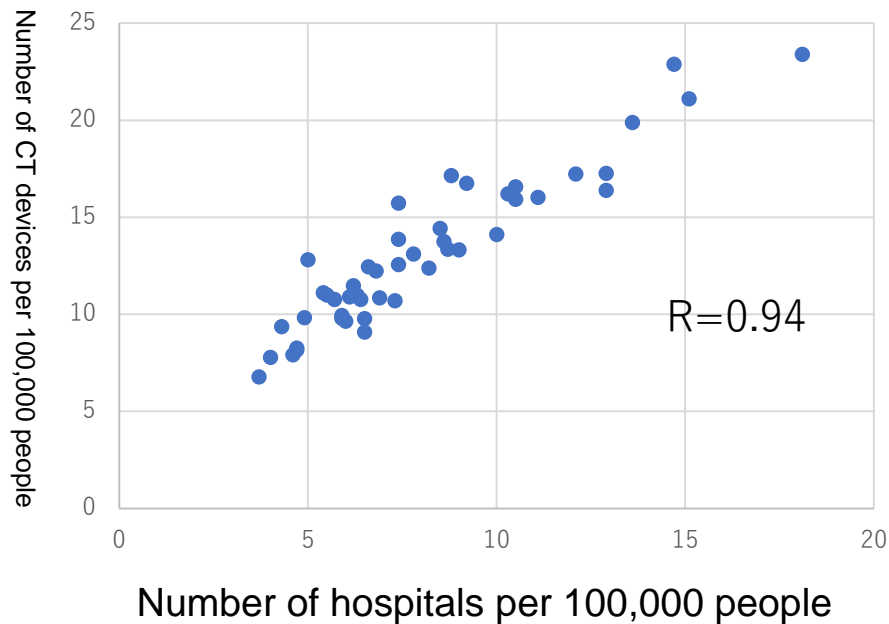
Influenza test	1.4 times
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CRP test	2.2 times
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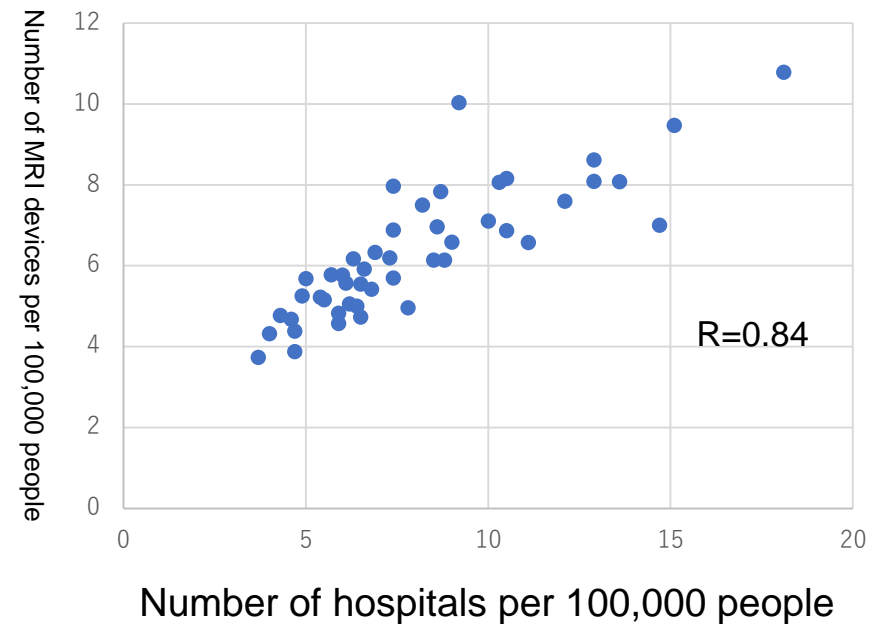
# Analysis of the Numbers of CT and MRI devices and number of hospital beds by prefecture

A high correlation was apparent between the numbers of CT and MRI devices and the number of hospitals in each prefecture.

Numbers of hospitals and CT devices per 100,000 people



Numbers of hospitals and MRI devices per 100,000 people



## Relationship between the number of devices installed per capita and the number of images taken

- The numbers of both CT and MRI devices installed are larger than in other countries, but fewer images are taken per capita than in countries such as America, etc.
- By prefecture, there was less variation in the number of images taken than variation in the number of devices installed.
  - The variation in the number of images taken between the top 5 prefectures and bottom 5 prefectures was 1.3 times for CT and 1.5 times for MRI.
  - In the top 5 prefectures and bottom 5 prefectures for other technologies, variation of 1.9 times could be seen for general urinalysis, variation of 1.4 times for influenza tests, and variation of 2.2 times for CRP tests.
- A high correlation was apparent between the number of devices installed and the number of hospitals in each prefecture.
  - The correlation coefficient between the number of devices installed and the number of hospitals was 0.94 for CT and 0.84 for MRI.

# International comparison of imaging fees (per time)

Unit: US dollars

1 dollar = 111.7 JPY

		Japan	America	France	Germany
CT	Head and neck	80.6	170.0	106.1	101.1
	Abdomen	80.6	189.6	106.1	123.6
MRI	Head and neck	119.1	464.1	193.6	177.9
	Abdomen	119.1	436.8	193.6	161.1

Note 1) Imaging fees do not include image interpreting fees in any of the countries

Note 2) Figures for Japan are diagnostic imaging fees for 16 row multi-slice CT and 1.5 tesla MRI

Note 3) For America and Germany, the weighted averages of the imaging fees for public and private insurance were used. Based on the proportions of medical care expenses and insured persons, and hearing from companies (CT and MRI manufacturers), the proportions of public and private insurance in America were 60% public insurance (Medicare/Medicaid) and 40% private insurance, and in Germany were 90% public insurance and 10% private insurance

< Data sources for imaging fees >

- From each HP of CMS for America, ameli.fr for France and KBV for Germany
- For private insurance, International Federation of Health Plans 2015 / 2012 Comparative Price Report and U.S. versus European healthcare costs: the data (by EpiAnalysis).
- Proportions of public and private medical expenses: CMS HP for America; from the results of Nissay Institute for Basic Research: Private Healthcare Insurance and Private Healthcare Insurers in Germany - 2017

# Medical care expenses for CT and MRI Imaging

- Among the four countries of Japan, America, France, and Germany, Japan had the lowest imaging fees per time.
- Japan also had the lowest medical care expenses per capita for CT and MRI scans (estimate) with a very few exceptions. In America, those expenses were about 2.5 to 3.5 times higher than in Japan, and in France and Germany, they were 1.4 to 1.6 times higher for MRI.

	Imaging fees * (Per time: US dollars)		Imaging fee (Japan set to 100)		Average medical care expenses (estimate) ** (Annual / per person: US dollars)		Average medical care expenses (Japan set to 100)	
	CT	MRI	CT	MRI	CT	MRI	CT	MRI
Japan	80.6	119.1	100	100	18.6	13.4	100	100
America	179.8	450.5	223	378	45.8	49.3	246	368
France	106.1	193.6	132	163	20.0	18.5	107	138
Germany	112.4	169.5	139	142	16.2	22.3	87	166

\* Imaging fees per time calculated by averaging the fees for head and neck and abdomen imaging on the previous page

\*\* Average medical care expenses per person were calculated by multiplying the number of images taken per 1,000 people by imaging fees per time as described on pages 6 and 7

# Conclusion

- In this report, we analyzed the relationship between the number of devices installed, the number of images taken per capita and medical care expenses and found the following.
  - The numbers of both CT and MRI devices installed are larger than in other countries, but fewer images are taken per capita than in countries such as America, etc.
  - By prefecture, there was less variation in the number of images taken than variation in the number of devices installed.
  - Among the four countries of Japan, America, France, and Germany, Japan had the lowest imaging fees per time.
  - Japan also had the lowest medical care expenses per capita for CT and MRI scans (estimate). In America, those expenses were about 2.5 to 3.5 times higher than in Japan, and in France and Germany, they were 1.4 to 1.6 times higher for MRI.
- A high correlation was apparent between the number of devices installed and the number of hospitals in each prefecture.
- It was pointed out by Niki in the 1990s that the large number of MRI devices installed in Japan compared with other countries has not led to increased medical care expenses, and it was suggested that the situation has not changed since then.
  - Ryu Niki: Medical Expenses in Japan (from an international comparative perspective) Igakushoin, 1995
- It was suggested that CT and MRI devices, which are said to be “essential for the medical care field”<sup>(\*)</sup> have realized operations that suppress increased medical care expenses while meeting the needs of the medical field.
  - \* Working Group on Regional Medical Initiatives (January 30, 2019)