

# Estimation of the number of total and pediatric CT procedures based on a nationwide survey in Japan

Koji Ono<sup>1</sup>, Nobuhiko Ban<sup>2</sup>, Michiaki Kai<sup>1</sup>

1 Oita University of Nursing and Health Sciences, 2 Tokyo Healthcare University

## Abstract

In 2007, a nationwide survey was conducted to determine the frequency of CT procedures in Japan in order to compare the current use of CT among developed countries. The frequency of adult and pediatric CT scans was estimated using a model based on the results of the survey. Survey questionnaires were sent to 2,266 CT facilities: 1,068 government hospitals and 1,198 other hospitals and non-hospital medical centers. The questionnaire requested information including the number of beds, outpatients per day, type of CT scanner, various body regions scanned, and the number of scans performed. The results of the study indicate that the number of CT procedures was closely correlated with the number of hospital beds. We estimate that approximately 20.5 million procedures were performed in 2005 and 21.2 million in 2006. The number of pediatric CT procedures was calculated by multiplying the total number of CT procedures by the estimated fraction of pediatric (0–15 years) CT procedures. Annual pediatric CT procedures were estimated to have been approximately 580,000 in 2005 and 600,000 in 2006. The primary sources on the national use of medical service payments and national surveys of medical facilities have recently become available from the Japanese Government, Ministry of Health, Labour and Welfare (HMLW), according to laws regarding the disclosure of information. Using these sources, it is possible to estimate the annual number of total CT and pediatric CT procedures.

## Survey

Table 1 Percent contributions of various CT categories to total number of procedures for 2007.

Age Range	Region of Body (%)				
	Head	Neck	Chest	Abdomen	Pelvis
0 - 3 month old	58	4	18	14	6
4 - 11 month old	56	5	13	17	9
1 - 4 year old	59	5	12	15	9
5 - 9 year old	55	5	10	18	12
10 - 15 year old	43	5	12	24	16
Adult	14	5	25	38	18

The proportions of scans in adults were head, 14%; chest, 25%; and abdomen and pelvis, 56%. In children (aged 0-15 y), the proportions were head, 43-58%; chest, 10-18%; and abdomen and pelvis, 20-40%. Most CT procedures (97.15%) were performed on adults (>16 y). Percentages for other ages for 2007 were as follows; 0-3 mo, 0.23%; 4-11 mo, 0.19%; 1-4 y, 0.71%; 5-9 y, 0.73%; and 10-15 y, 0.99%. Approximately 3% of all CT procedures performed in Japan in 2007 were pediatric procedures.

## Model

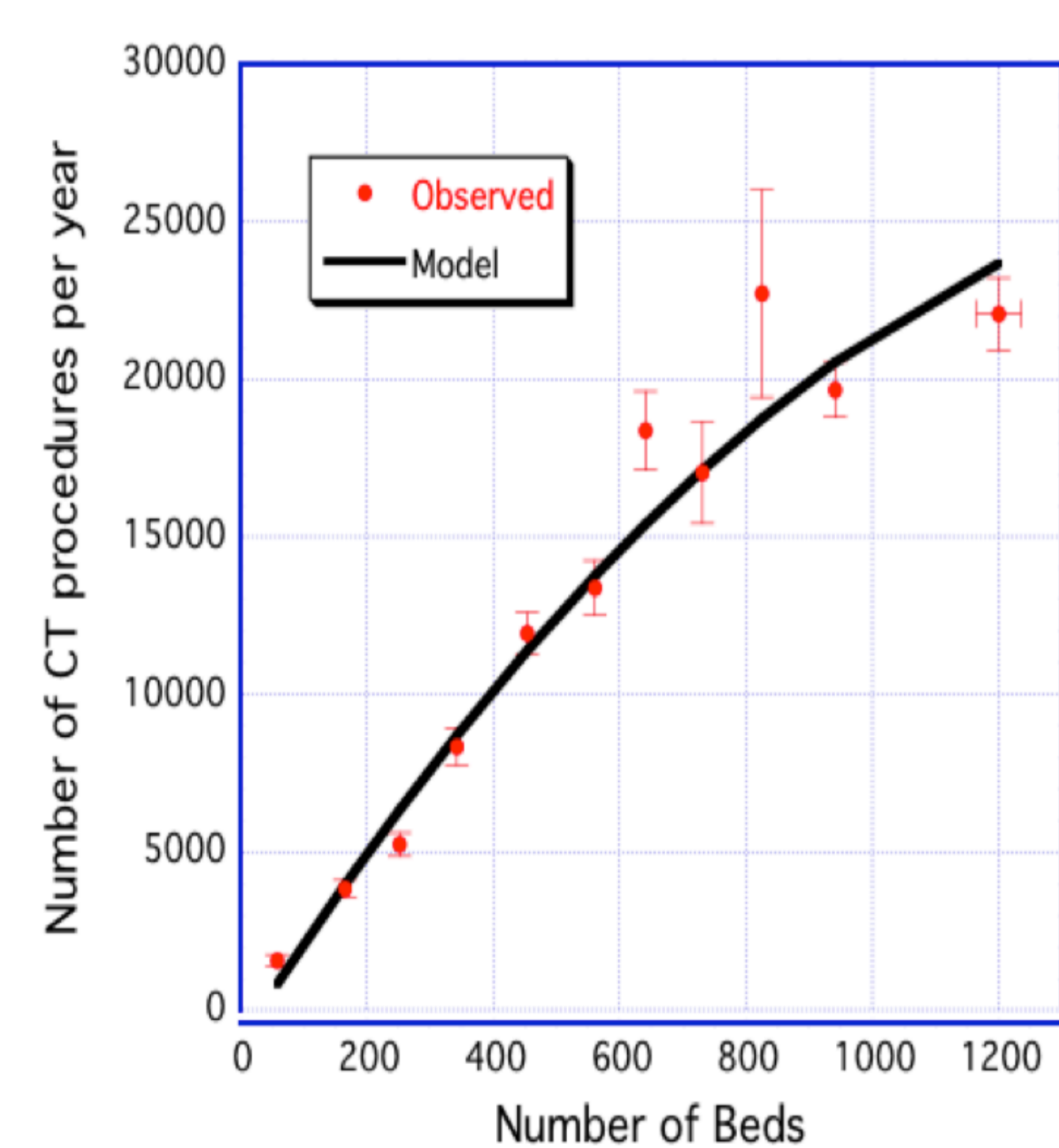


Fig.1. The relation between the number of annual CT procedures and the number of beds in hospital. The linear-quadratic model was well fitted to these data in 2006. This linear quadratic model was well fitted using SAS (SAS Institute Japan Ltd., Tokyo) with the estimated parameters listed in Table 2. Although the relationship between the number of CT procedures and other factors (e.g., the number of CT detectors, number of CT machines per facility, and the number of outpatients per day) was examined, no clear relations were found among these factors for prediction modeling. In addition, the number of CT procedures performed in psychiatric hospitals was much less than the number predicted by the model and remained very low irrespective of the number of beds. The preferred model was fitted to data excluding psychiatric hospitals.

Table 2 Preferred model for the number of CT procedures as a function of the number of beds.

Year	a		b		c	
	Estimate	SE	Estimate	SE	Estimate	SE
2005	-0.00896	0.00206	31.294	2.076	-970.17	418.03
2006	-0.00822	0.0021	31.812	2.109	-988.039	424.76

\*)The parameters listed show coefficients of a linear-quadratic model,  $y=ax^2 + bx + c$ .

## Comparison

Table 3 Age-specific proportions of CT procedures in Japan.

Year	Age Range	Present Study (%)		Statistics of Ministry of health, Labour and Welfare (%) <sup>*1</sup>		
		2007	2007	2007	2006	2005
	0 - 4 years old	1.13	0.58	0.77	1.15	
	5 - 9 years old	0.73	0.91	0.96	1.11	
	10 - 14 (15) years old	0.99 <sup>*2</sup>	1.14	1.22	1.19	
	Pediatric	2.85	2.63	2.95	3.45	
	> 15 (16) years old	97.15 <sup>*3</sup>	97.37	97.05	96.55	

\*1)Data from Ministry of Health, Labour and Welfare in Japan (2009a)

\*2)This shows a number corresponding to 10-15 years old

\*3)This shows a number corresponding to >16 years old

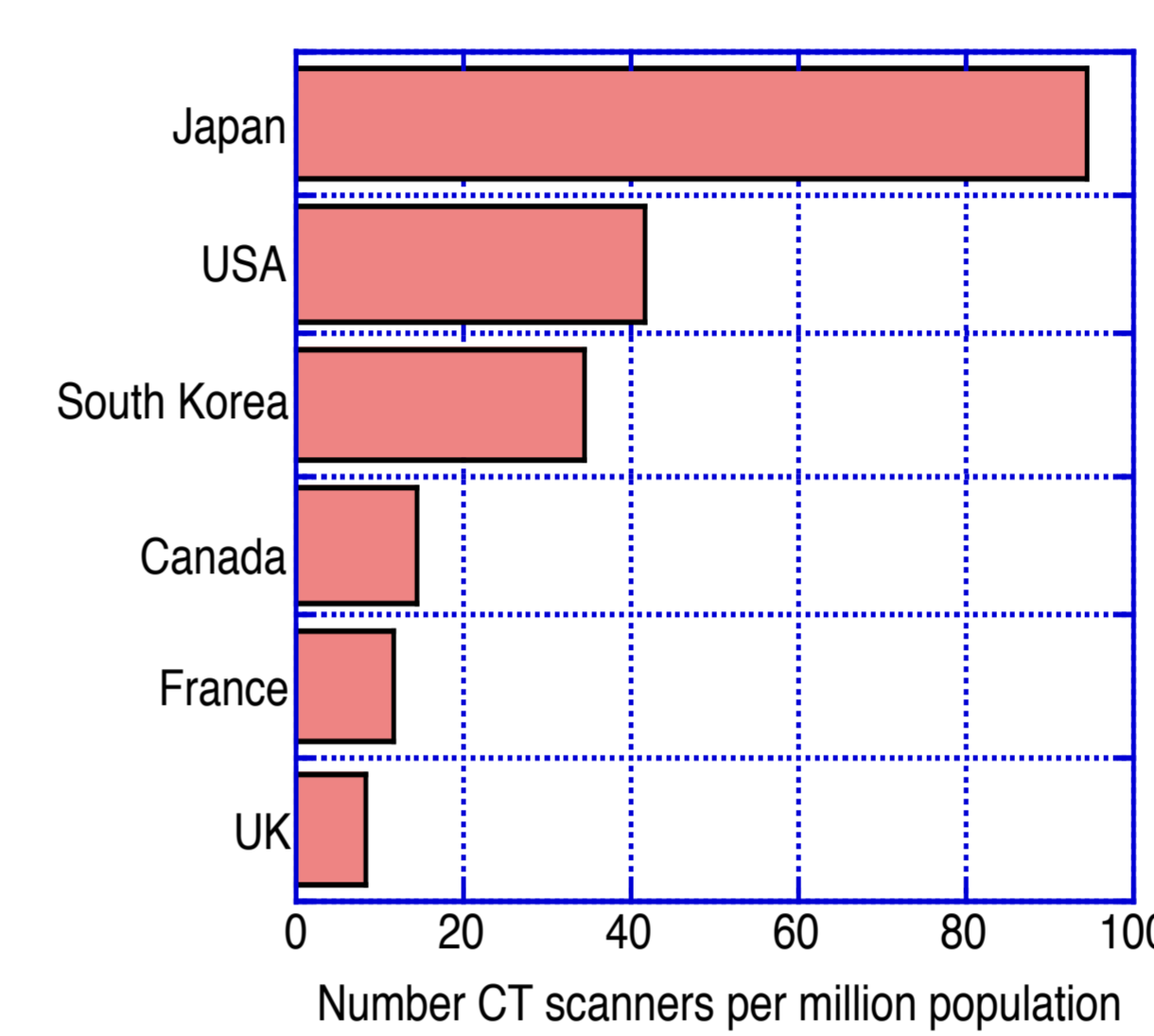


Fig.2. Comparison of the number of CT scanners per million people among developed countries in 2010. The number of CT units per million people in Japan is 94.1, which is the highest among developed countries.

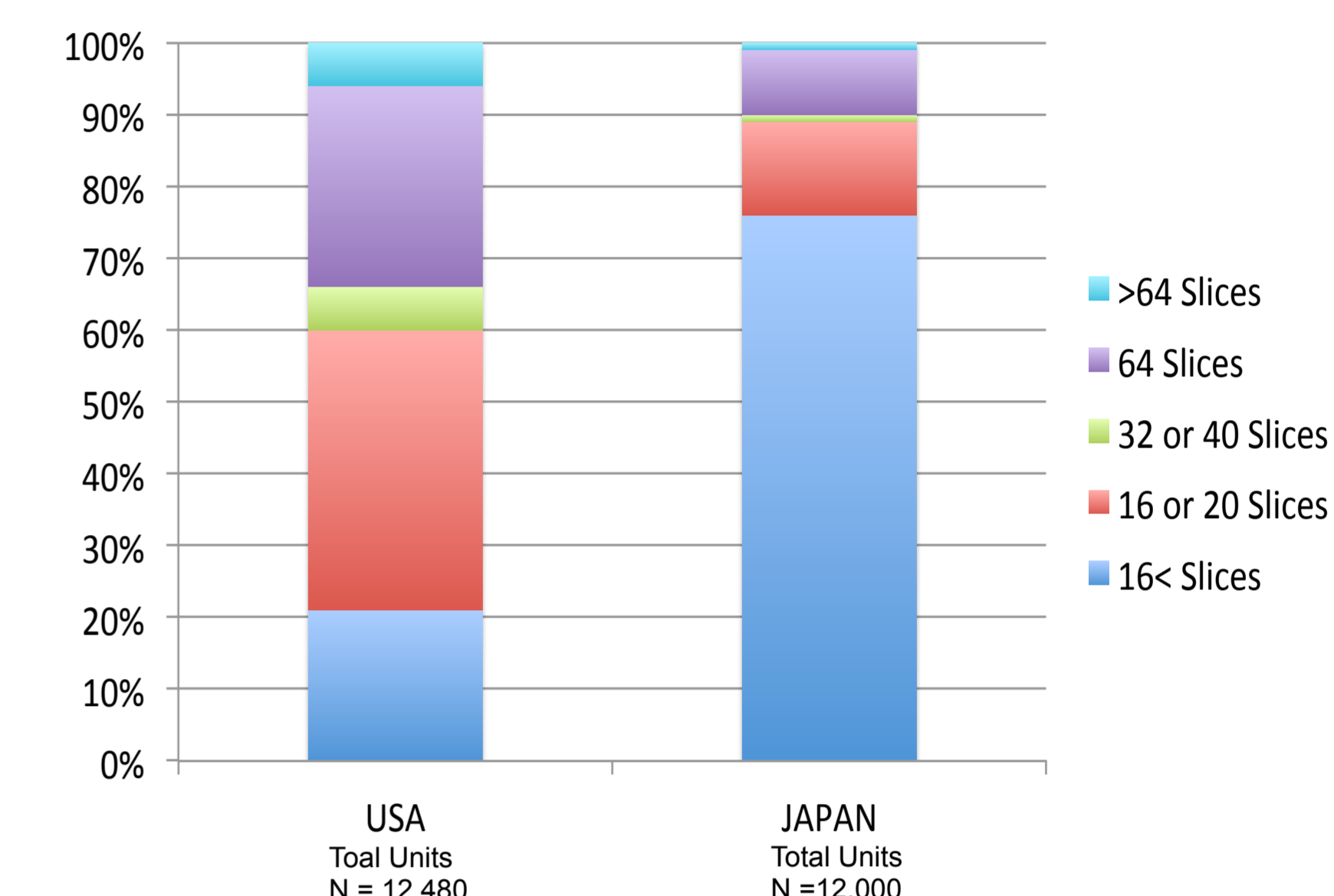


Fig.3. Comparison of CT scanners, by number of slice in 2010. Data from Gekkan-shinyou, Ltd. Medical Devices & System Data Book 2010-2011. 2010 and IMV Medical Information Division, Inc. IMV Benchmark Reports. Des Plaines, IL: IMV Medical Division; CT 2011.

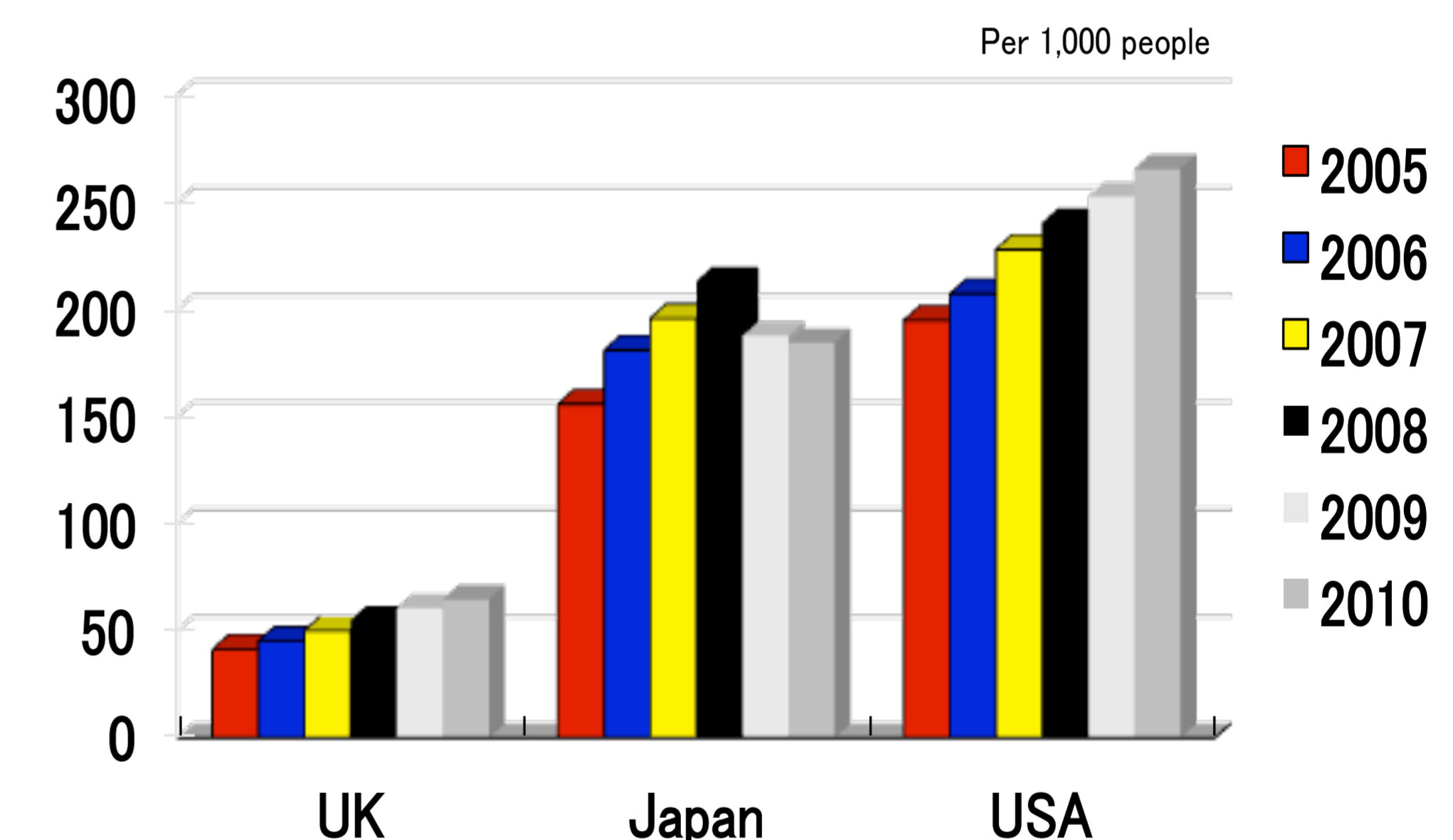


Fig.4. Comparison of the numbers of total CT procedures per 1,000 people among the UK, USA, and Japan.

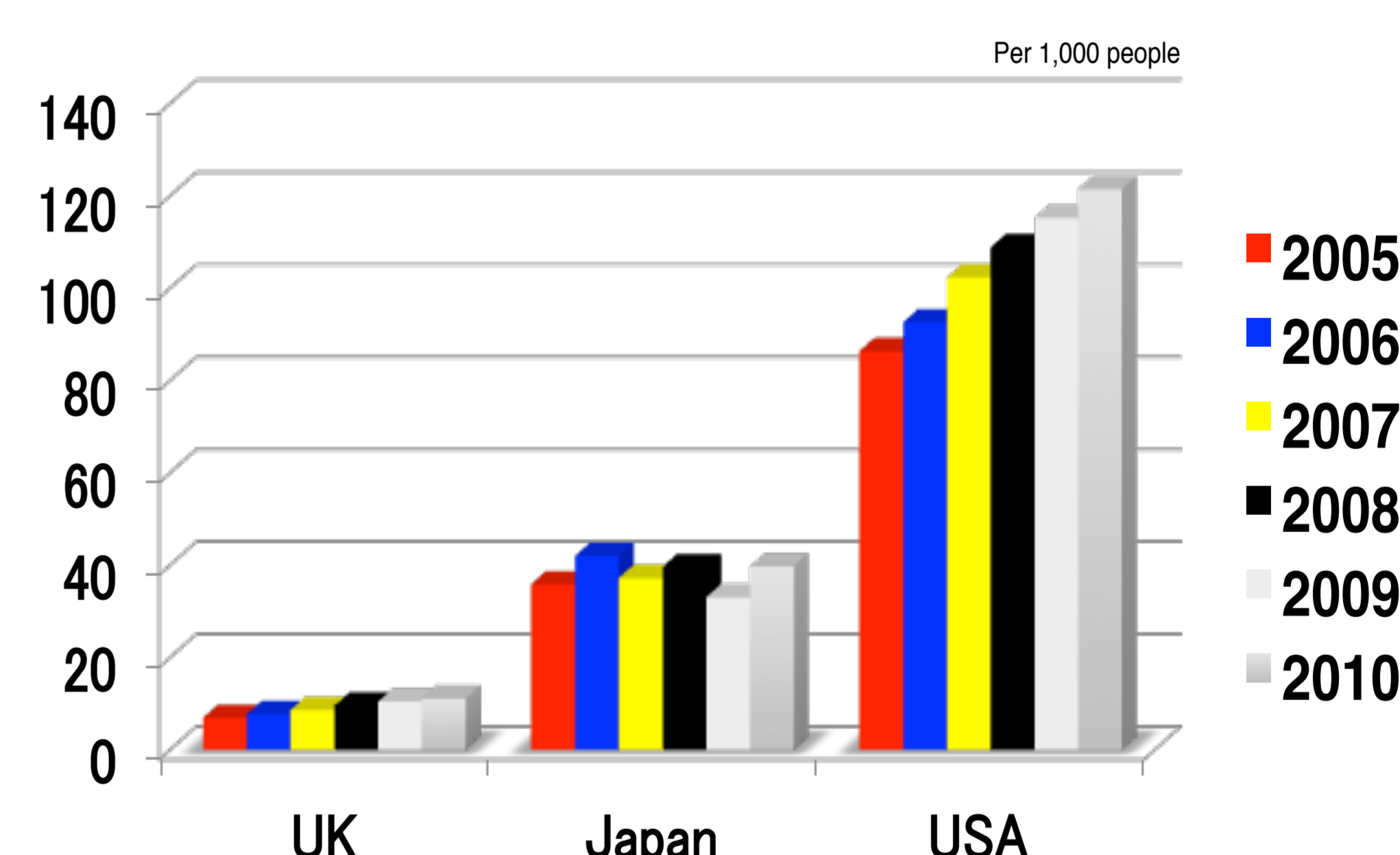


Fig.5. Comparison of the numbers of pediatric CT procedures per 1,000 people among the UK, USA and Japan.

In Japan, no annual increase in CT procedures is observed, whereas an increase is seen for the UK and USA. In addition, the number of procedures per capita for both total CT and pediatric CT is lower in Japan than in the USA.

Population are based on the data: Data from U.S. Census Bureau.

<http://www.census.gov/population/www/socdemo/age/>

Data from National Institute of Population Social Security Research in Japan.

<http://www.ipss.go.jp>

The numbers of CT procedures are estimated based on the data:

Data from: Ministry of Health, Labour and Welfare. Remuneration for medical service, and Medical facilities.

[www.mhlw.go.jp/toukei/list](http://www.mhlw.go.jp/toukei/list)

Data from IMV Medical Information Division. Inc. IMV Benchmark Reports. Des Plaines, IL: IMV Medical Information

Division; 2011. Department of Health, UK. Hospital activity statistic.

[http://www.dh.gov.uk/en/Publicationsandstatistics/Statistics/Perfomedataandstatistics/HospitalActivityStatistics/DH\\_077487](http://www.dh.gov.uk/en/Publicationsandstatistics/Statistics/Perfomedataandstatistics/HospitalActivityStatistics/DH_077487). Regarding the pediatric CT, 2.7% of CT procedures was assumed to be undertaken.

## Concluding Summary

- The total number in Japan is lower than in the USA although the reverse in CT units per people.
- 3-4% in children receive CT exposure in Japan.
- The number of pediatric CT in Japan is lower than in the USA.

Regarding CT information in UK, the authors thank Dr. Steve Ebdon-Jackson of Health Protection Agency. This work was supported by Grant-in-Aid for Scientific Research(C) of the Ministry of Education, Culture, Sports, Science and Technology(MEXT).