

# Financial relationships between board-certified neurologists and pharmaceutical industry in Japan

Anju Murayama<sup>1</sup>, Kenichi Higuchi<sup>1</sup>, and Yuki Senoo<sup>1</sup>

<sup>1</sup>Affiliation not available

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Anju Murayama<sup>1,2\*</sup>; Kenichi Higuchi<sup>1</sup>; Yuki Senoo, MD, MUDr<sup>3</sup>

### Affiliations:

<sup>1</sup> School of Medicine, Tohoku University, Sendai City, Miyagi, Japan

<sup>2</sup> Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York City, NY, USA

<sup>3</sup> Department of Internal Medicine, Higashitotsuka Memorial Hospital, Yokohama, Kanagawa, Japan

\*Corresponding author

### Correspondence

Anju Murayama

School of Medicine, Tohoku University, 2-1 Seiryomachi, Aoba ward, Sendai City, Miyagi, 980-0872, Japan

Telephone: 81-22-717-8006

Email address: [anju.murayama.s8@dc.tohoku.ac.jp](mailto:anju.murayama.s8@dc.tohoku.ac.jp)

### Background

Neurologist-industry financial interactions could lead to conflicts of interest.

### Objectives:

To evaluate extent and trends in personal payments to neurologists from pharmaceutical companies in Japan.

### Methods:

Using publicly available payment data collected from pharmaceutical companies, this study examined the extent and trends of personal payments to board-certified neurologists between 2016-2020. Trends in payments to neurologists were analyzed using generalized estimating equation models.

### Results

Of 6107 board-certified neurologists, 3,615 (59.2) received personal payments totaling \$45.7 million over the five years. Of neurologists receiving payments, the median payments per neurologist was \$2,423 (IQR: \$765–\$9,076), with a mean of \$12,649 (SD: \$35,012). Only top 1% and 10% of these neurologists received

30.3% and 78.8% of all payments, respectively. The payments to neurologists significantly increased by 3.2% each year between 2016-2019, but decreased by 21.1% in 2020.

## Conclusion

The majority of neurologists received personal payments. Payments increased annually until 2020.

## Keywords:

Conflicts of interest, ethics, health policy, medical ethics, Japan, Japanese Society of Neurology, industry payments

## List of abbreviations

95% CI: 95% confidence interval; GEE: generalized estimating equation; IQR: interquartile range; JPMA: Japanese Pharmaceutical Manufacturers Association

## Main body of the manuscript

### Introduction

Financial interactions between physicians and pharmaceutical companies could foster healthcare innovation and improve patient care through research collaboration. However, these interactions introduce financial conflicts of interest (COIs) among physicians[1-3], potentially biasing physicians' decision-making such as clinical practice[4-6], guideline recommendations[7-10], health policy[11], and integrity of scientific research[12,13]. Pharmaceutical companies made more than \$236.0 million per year to physicians and healthcare organizations for consulting and speaking compensations in Japan[14]. The majority of these payments were directly made to individual physicians. Previous studies reported that the majority of all physicians received these personal payments for speaking and consulting services other than food and travel payments in Japan[7,8,15-32], surpassing those in other developed countries such as the United States[3,33-44], Australia[45,46], and France[47].

Among several disease areas, there is increasing attention to neurological disorders from pharmaceutical industry. The number and prevalence of patients with dementia is critically increasing in Japan. There were 4.62 million patients with dementia as of 2012[48], and it is predicted that more than 20% of all people aged 65 years and older will have dementia by 2030[49]. The healthcare spending related to Alzheimer's disease drug were US\$1.0 billion (JPY 1,073 billion) in Japan in 2018[48]. The sales of antidementia drugs including memantine (Memary from Daiichi Sankyo), donepezil (Aricept from Eisai), and galantamine (Reminyl from Takeda Pharmaceutical) was \$437, \$220, and \$160 million in 2017, respectively. Previous research found that there were substantial financial relationships between dementia clinical guideline authors and the antidementia drug manufacturers. However, the whole picture of the financial relationships between pharmaceutical companies and all neurologists has never been investigated. Using a publicly accessible transparency database, we investigated the extents and trends of personal payments from pharmaceutical companies to all neurologists in Japan.

### Methods

#### Study design setting, and participants

This study is a retrospective analysis of payment data publicly disclosed by major pharmaceutical companies in Japan. The analysis included all neurologists certified by the Japanese Society of Neurology (JSN) as of February 2022. The JSN, established in 1960, is the preeminent professional medical society for neurologists and is the sole credentialing body for neurologists in Japan since 1967. As of the specified date, 6107 neurologists were recognized as board-certified by the JSN[50].

#### Payment data reported by pharmaceutical companies

To improve transparency in financial relationships between pharmaceutical companies and healthcare professionals, the Japanese Pharmaceutical Manufacturers Association (JPMA), representing of more than 70

leading pharmaceutical companies, demands its member companies to disclose payments for lecturing, consulting, and manuscript drafting made to physicians, including the recipients' names and affiliations on their websites, as previously explained[22,23]. However, according to the JPMA guidance, payment categories, such as meals, travel and accommodations, and other gifts, are disclosed in aggregated amounts and could not be analyzed at individual physician level[23,51]. Thus, we focused on lecturing, consulting, and drafting payments to neurologists in this study.

We retrieved the names and affiliated hospitals of all board-certified neurologists from the JSN website. Then, we collected the personal payments made for lecturing, consulting, and drafting services to these neurologists by JPMA-affiliated companies from a publicly accessible payment database from 2016 to 2020[52], as conducted in prior studies[15-17,20].

### Statistical analyses

We calculated mean and median payments per neurologist and proportion of neurologists receiving payments. We assessed the concentration of payments among neurologists using the Gini index, a measure traditionally applied to analyze income inequality in economics[53]. The index ranges from 0 (indicating uniform payment distribution) to 1 (where a single neurologist receives all payments), with higher values signaling greater disparity. We also analyzed payment data by category and the pharmaceutical companies making these payments. Trends in the number of neurologists receiving payments and the payment amounts from 2016 to 2020 were evaluated using generalized estimating equation (GEE) models. Due to the non-normal distribution of payments, the analyses were conducted using a log-linked GEE model with a Poisson distribution and a negative binomial GEE model[20-23]. The study period was divided into two intervals (2016-2019 and 2020) to evaluate impact of COVID-19 pandemic on the payment patterns, as indicated in previous studies in the United States[33,35-37,39]. For trend analysis, we adjusted for inflation, converting all payment values to 2020-Japanese yen value with consumer price index. Statistical significance was set at a p-value of less than 0.05.

### Ethical clearance

As all data used in this study were publicly available and met the definition of non-human subjects research, no institutional review board approval was required.

### Results

Of the 6,107 board-certified neurologists, 3,615 (59.2%) received personal payments from the pharmaceutical companies over the five years between 2016 and 2020 (Table 1). The total amounts of personal payments were in \$45,726,920 entailing 37,337 payments. For neurologists who received at least one payment, the median amount per neurologist was \$2,423 (interquartile range [IQR]: \$765–\$9,076), in contrast to a mean of \$12,649 (standard deviation [SD]: \$35,012) over the five-year span. The Gini index, used to measure payment distribution among neurologists, was 0.871, suggesting that a small proportion of neurologists received the majority of personal payments over the five years. Specifically, the top 1% (61 neurologists), 5% (305 neurologists), and 10% (611 neurologists) of these neurologists received 30.3%, 52.8%, and 78.8% of all personal payments, respectively. Of the three payment categories, lecturing payments occupied 84.4% of overall payments to the neurologists (\$38,612,931). Additionally, 58.1% of all neurologists received at least one lecturing payments from the pharmaceutical companies between 2016 and 2020. Mean value per payment was \$1,243 for lecturing payments, \$1,236 for consulting payments, and \$915 for writing payments.

Of 78 pharmaceutical companies making payments to the neurologists, Daichi Sankyo made the largest amounts of personal payments totaling \$6.3 million, followed by Eisai (\$5.0 million), Takeda Pharmaceutical (\$4.5 million), Otsuka Pharmaceutical (\$3.8 million), and Kyowa Kirin (\$3.2 million). The top 5 and 10 companies with the largest payment amounts were responsible for 50.2% (\$22.9 million) and 74.5% (\$34.1 million) of all payments over the five years.

The total annual amounts of personal payments to neurologists showed an increasing trend from \$8.8 million

in 2016 to \$10.0 million in 2019 (Table 2), but decreased to \$8.1 million in 2020. There was a similar trend in the number of payments over the five years. Of all neurologists, 33.0% to 36.8% received at least one personal payment each year. The number of neurologists receiving payments significantly increased by 1.5% (95% confidence interval [95% CI]: 0.4%–2.6%,  $p < 0.001$ ) each year from 2179 in 2016 to 2292 in 2019. Among neurologists receiving payments, median annual payments per neurologist were from \$1,077 to \$1,356 in monetary value and 2.0 in the number of payments. Payments per neurologist annually increased by 3.2% (95% CI: 0.9%–5.5%,  $p = 0.006$ ) in monetary value and by 3.5% (95% CI: 2.4%–4.7%,  $p < 0.001$ ) in the number of payments between 2016 and 2019. Contrarily, there was significant decreases of 14.3% (95% CI: -16.4% to -10.1%,  $p < 0.001$ ) in the number of neurologists receiving payments and 21.1% (95% CI: -25.3% to -16.7%,  $p < 0.001$ ) in payments per neurologist in 2020 when compared to those in the previous years.

## Discussion

This study investigated the financial relationships between the pharmaceutical companies and all board-certified neurologists in Japan. We found that 59.2% of all board-certified neurologists received personal payments for lecturing, consulting and writing services from the pharmaceutical companies in Japan between 2016 and 2020. The total amounts of personal payments were more than \$45.8 million over the five years. Only the small number of neurologists received the substantial amounts of personal payments from the pharmaceutical companies. Furthermore, there were significant increasing trends in the payment amounts and number of neurologists receiving personal payments over the study period. To the best of our knowledge, this is the first analysis examining the whole picture of financial relationships between the pharmaceutical companies and neurologists in Japan.

Comparing with previous research, there were several important insights from the study findings. First, Ahlawat et al. reported that 51% of all neurologists received non-research payments including meal and travel payments from the healthcare industry in the United States (US) in 2015[3]. The median annual payments per neurologist was \$81 and only 14.5% of neurologists received more than \$500 in the US. Compared to this previous study, our elucidated that both the proportion of neurologists receiving payments and payment amounts per neurologists were much higher in Japan than those in the US. Furthermore, the total non-research payments made to all US neurologists in 2015 were \$6.2 million including meal, travel, entertainment, consulting, honoraria, royalties & licenses, and lecturing payments, while we found that at least \$8.1 million to \$10.0 million per year were made for just the three personal payment types including lecturing, consulting, and writing fees. These findings indicate stronger and more widespread financial ties between neurologists and pharmaceutical companies in Japan.

However, the substantial and widespread financial relationships between physicians and pharmaceutical companies was not only among neurologists but also among other specialists in Japan. Previous studies in Japan showed that the proportion of specialists receiving personal payments were 45.3% for dermatologists[22], 52.8% for gastroenterologists[23], 62.0% for pulmonologists[17], 64.7% for hematologists[18], 65.4% for infectious disease specialists[16], 70.7% for rheumatologists [21], and 70.7% for urologists[20]. Additionally, the payment amounts to the neurologists were also within the ranges reported in previous studies[15,17,18,20-23,26].

Furthermore, we demonstrated that there were significant increasing trends in personal payments to the neurologists between 2016 and 2019. The significant decrease in payments to neurologists in 2020 would be due to the COVID-19 pandemic and behavioral restrictions of physicians and pharmaceutical company representatives to prevent SARS-CoV-2 infection, as highlighted in previous studies[54]. Considering that these personal payments to physicians are associated with physicians' clinical practice such as increased likelihood of prescribing brand-name drugs rather than generic alternatives and increased healthcare costs[4-6,55], the increasing trend in payments to neurologists is an alarming finding. Future research should evaluate the associations between payments to neurologists and their prescribing patterns in Japan.

This study has several limitations including possibilities of errors in payment data reported by the companies

and in the database. Additionally, because of unavailability of several payment types such as meal, travel, royalty, and gift payments in Japan, the financial relationships between the neurologists and the pharmaceutical companies would be underestimated in this study. Also, as this study only included payments from JPMA-affiliated pharmaceutical companies, there would be unmeasured financial relationship between the neurologists and non-JPMA affiliated companies.

Despite these limitations, this study demonstrated that nearly 60% of neurologists certified by the Japanese Society of Neurology received personal payments related to lecturing, consulting, and writing from the pharmaceutical companies between 2016 and 2020. Notably, these personal payments concentrated on the small number of neurologists and significantly increased before the COVID-19 pandemic period.

## **Declarations**

### **Data availability statement**

All data used in this study is available from Yen For Docs database run by Medical Governance Research Institute (<https://yenfordsocs.jp/>) and each pharmaceutical companies belonging to the Japan Pharmaceutical Manufacturers Association. The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

### **Conflicts of interest:**

The authors have no conflicts of interest for this study.

### **Funding statement:**

The authors declare that there were no funding sources for this study.

### **Ethics approval statement:**

As this study was a retrospective analysis of publicly available data and met the definition of non-human subjects research, no institutional board review and approval were required. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline.

### **Patient consent statement**

Not applicable

### **Permission to reproduce material from other sources**

Not applicable

### **Clinical trial registration**

Not applicable

### **Declaration of generative AI in scientific writing**

During the preparation of this work, the authors used ChatGPT version 4.0 to check and correct grammatical and spelling errors. After using this tool, the authors carefully reviewed and edited the content as needed and takes full responsibility for the content of the publication.

### **Author contribution:**

A.M.: conceptualization; methodology; resource; software; formal analysis; investigation; writing - original draft; writing - review & editing; visualization; study administration

K.H.: conceptualization; methodology; resource; software; formal analysis; investigation; writing - review & editing

Y.S.: conceptualization; methodology; resource; formal analysis; investigation; writing - original draft; writing - review & editing

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Table 1. Summary of personal payments to board-certified neurologists

Variables	Value
Total amounts of payments	
Payment values, \$	45,726,920
Number of payments, No.	37,337
Payments per neurologist	
Mean (standard deviation) <sup>a</sup>	
Payment values, \$	12,649 (35,012)
Number of payments, No.	10.3 (14.5)
Median (interquartile range) <sup>a</sup>	
Payment values, \$	2,423 (765 – 9,076)
Number of payments, No.	4.0 (2.0 – 13.0)
Maximum <sup>a</sup>	
Payment values, \$	616,257
Number of payments, No.	147.0
Gini index	0.871
Neurologists with specific amounts of payments (N=6107), n (%)	
No payment	2,492 (40.8)
Any payments	3,615 (59.2)
\$1-\$1,000	1,083 (17.7)
\$1,001-\$10,000	1,703 (27.9)

Variables	Value
\$10,001-\$50,000	636 (10.4)
\$50,001-\$100,000	98 (1.6)
\$100,001-\$200,000	64 (1.1)
\$200,001 or more	31 (0.5)
Payment categories	
Lecturing payments	
Monetary value	38,612,931
Number of payments	31,073
Number of neurologists receiving payments	3,548 (58.1)
Consulting payments	
Monetary value	5,325,411
Number of payments	4,310
Number of neurologists receiving payments	1,297 (21.2)
Writing payments	
Monetary value	1,788,578
Number of payments	1,954
Number of neurologists receiving payments	818 (13.4)

Legends: <sup>a</sup> Payments per neurologist were calculated among neurologists who received one or more payments, as 40.8% of neurologists did not receive any payments over the five years.

Table 2. Trend in personal payments from pharmaceutical companies to board-certified neurologists between 2016 and 2020.

Variables	2016	2017	2018	2019	2020	Average relative yearly change between 2016 and 2019 (95% CI), %	Relative change rate between 2016-2019 and 2020 (95% CI), %
Total payments							
Monetary value, \$	8,810,976	9,403,513	9,410,890	10,003,094	8,098,447	–	–
Number of payments, No.	7,251	7,534	7,802	8,041	6,709	–	–
Payments per neurologist							
Monetary value, \$							
Mean (standard deviation)	4,044 (9,633)	4,194 (9,875)	4,192 (9,328)	4,364 (9,453)	4,015 (8,613)	3.2 (0.9 – 5.5)*	-21.1 (-25.3 to -16.7)**
Median (interquartile range)	1,077 (521–3,388)	1,251 (521–3,337)	1,356 (521–3,650)	1,359 (531–3,852)	1,290 (532–3,529)		

Variables	2016	2017	2018	2019	2020	Average relative yearly change between 2016 and 2019 (95% CI), %	Relative change rate between 2016-2019 and 2020 (95% CI), %
Maximum	112,859	137,685	141,689	147,166	107,707		
Gini index	0.898	0.894	0.890	0.887	0.896		
Number of payments, No.							
Mean (standard deviation)	3.3 (3.5)	3.4 (3.4)	3.5 (3.5)	3.5 (3.5)	3.3 (3.3)	3.5 (2.4 – 4.7)**	-19.6 (-22.4 to -16.7)**
Median (interquartile range)	2.0 (1.0 – 4.0)	2.0 (1.0 – 4.0)	2.0 (1.0 – 4.0)	2.0 (1.0 – 5.0)	2.0 (1.0 – 4.0)		
Maximum	27.0	29.0	31.0	34.0	32.0		
Gini index	0.811	0.805	0.805	0.799	0.820		
Physicians with payments (%) (N=6107), n	2,179 (35.7)	2,242 (36.7)	2,245 (36.8)	2,292 (37.5)	2,017 (33.0)	1.5 (0.4 – 2.6)**	-14.3 (-16.4 to -10.1)*

Abbreviation: 95% confidence interval (95% CI). \*p<0.01. \*\*p<0.001.