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Original article

Japanese anesthesiologists' knowledge of the cost of medicines and their attitudes toward cost containment: a cross-sectional survey

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Abstract

Objectives: This study surveyed Japanese anesthesiologists' knowledge of the cost of medicine and their attitudes toward cost containment to determine how these factors may affect their choice of medication and provide insight into reducing healthcare expenditures.

Materials and Methods: In this cross-sectional study, Japanese anesthesiologists' knowledge of medicine prices and their attitudes toward cost containment were surveyed to identify barriers in lowering the cost of anesthesia. The proportion of participants who correctly guessed the cost of the five most frequently used types of drugs within 25% of the actual price was determined, and their attitudes regarding drug prices and barriers to achieving cost containment were analyzed.

Results: In total, responses to 60 questionnaires were analyzed. The proportion of participants correctly guessing the price within 25% of the actual price for each of the five drug categories, including neuromuscular blocking agents, inhaled anesthetics, intravenous anesthetics, opioids, and neuromuscular blockade reversal agents, was 30% (n=18), 18.3% (n=11), 6.67% (n=4), 30.0% (n=18), and 63.3% (n=38), respectively. Participants believed they had adequate access to information on prices, that the cost of a product influenced their decisions regarding product use, and that more information about cost might change their use of the drugs but did not believe that they had adequate knowledge about product prices.

Conclusion: The proportion of participants with acceptable price estimates is small. Educating anesthesiologists about the cost of anesthetic agents may be required to encourage cost-containing behaviors. This study is the first survey to assess Japanese anesthesiologists' knowledge of the cost of medicines.

Key words: anesthesia, workforce, health expenditure

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Introduction

Healthcare expenditures must be considered to maintain sustainable public healthcare. However, increasing medical expenditures have recently become a serious problem[1]. Total healthcare spending per capita ($) in 2015 was 5,551 in high-income countries, 246 in upper middle-income countries, 266 in low middle-income countries, and 110 in low-income countries, with high-income countries having the greatest proportion of healthcare-related expenditures[1]. In high-income countries, the enormous capacity of the biomedical industry to create new and costly medical interventions greatly contributes to this increase[2]. The mean pharmaceutical expenditure in OECD countries was reportedly 16.08% of the total healthcare spending in 2017[3], and increased

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more quickly than in other areas of medicine[4]. Containing the cost of pharmaceutical expenditure is crucial to prevent further increases in public health-related expenditures[5].

Various efforts have been made to reduce the cost of pharmaceutical expenditures, and action at policy level is required[1]. Previous studies have shown that healthcare workers choose cheaper medicines when they are provided information about the cost of drugs[6], suggesting that such information may have a positive effect on cost-containment efforts. However, knowledge of pricing may be required to overcome barriers to cost containment specific to a discipline or group. Many studies conducted on the cost of medicine in general practice and anesthesia have shown that anesthetic agents account for at least 3% of the total cost of inpatient surgical care, and between 10% and 13% of the total cost of medications in hospitals. Thus, the cost containment of anesthetics is an important issue[7]. Nevertheless, few studies have explored anesthesiologists' knowledge and attitudes about the cost of medicines, which may affect decision-making regarding which anesthetic agents to use and methods of containing their cost[8].

Asia is expected to have the highest medical expenditure in the near future[1]. The increase in medical expenses is already a social problem in Japan, where total health spending was equivalent to 11.1% of the GDP in 2019 and pharmaceutical spending comprised 18.3% of healthcare-related spending in 2017[3]. Japan has one of the highest healthcare-related expenditures among the OECD countries[3]. Moreover, numerous surgical procedures are performed annually in Japan, making cost containment of anesthetic agents an urgent issue. Thus, Japan is highly suitable to investigate anesthesiologists' knowledge and attitudes regarding the cost of medicines.

This study aimed to survey anesthesiologists' knowledge of the cost of medicines and their attitudes toward cost containment to reduce healthcare-related expenditures in Japan, where cost containment has become an urgent need.

Materials and Methods

This study was a cross-sectional, observational study.

Setting

Under the national health insurance system in Japan, people are required to pay a portion of their medical expenses according to their insurance classification. Anesthesia during surgery is mainly administered by physicians and certified dentists in Japan, and the choice of anesthetic agent is left to each hospital. The prices of medicines are publicly available on websites and books.

Questionnaire validation

A survey was conducted to examine Japanese anesthesiologists' knowledge, attitudes, and barriers to the use of anesthetic agents. First, data were obtained on age, sex, specialty, years of experience, number of working days, hospital location, full-time or part-time employment status, and total amount of inhalation anesthetic used.

Anesthetic agents were classified into five categories, namely, neuromuscular blocking agents, inhaled anesthetics, intravenous anesthetics, opioids, and neuromuscular blockade reversal agents. Of these, the product names and most frequently used quantities (by ampule or bottle) were investigated, and the anesthesiologists' estimate of the price of each item was examined. The correct product prices were obtained from the product insert or the Internet. The proportion of participants with estimates within 25% of the actual price was determined.

Next, the attitudes of anesthesiologists toward drug prices were investigated. The questionnaire, developed by Allan *et al.*, was modified and used in three sections[6]. The items were scored using a Likert scale from one to ten to indicate the respondents' degree of agreement with a statement, and the median scores were compared.

Finally, the barriers to achieving cost containment were investigated. The questionnaire developed by Ginsburg *et al.* was modified and used in four sections[2]. The responses were assigned a score between one and ten to assess how strongly respondents felt about each type of barrier, and the median values were compared.

Data definition

The questionnaire was administered between September 2019 and November 2020 to anesthesiologists mainly employed at hospitals in the Kanto area, where one of the co-authors worked, for the convenience of sampling. The inclusion criteria were more than two years of employment as an anesthesiologist and working as an anesthesiologist for at least two days per week. Dentists were excluded.

The questionnaire was administered either on paper or online. The subjects completed the paper-based survey approximately 20 minutes after receiving oral and written explanations about the purpose of the study and consenting to participate. Participants responded to the items on the online survey after receiving an online explanation. The responses were gathered from a database.

Three values for age were missing. The median value obtained by subtracting years of employment from age was calculated and used to compensate for missing data.

Primary outcome

Previous studies on drug pricing showed that the most common outcome was the proportion of participants who estimated the price of a drug to be within 25% of the actual prices[4]; thus, this was set as the primary outcome in this study.

Analysis

Firstly, participant characteristics were determined. Secondly, the proportion of respondents who submitted an appropriate estimate was analyzed by sex and specialty using the χ^2 test. Thirdly, the median value of the attitude toward the cost of medicines was descriptively analyzed by gender and license of specialty using the Mann–Whitney U test. Fourthly, the median value of the scores for barriers to medical cost containment was descriptively analyzed. Finally, the score of the correct medicine price, as the number of medicines answered within 25% of the correct prices, was generated. Then, a multivariate multiple regression analysis was performed to determine the association between the scores of correct medicine price and their attitude toward the cost of medicines, adjusted by age, gender, and specialty. Multivariate multiple regression was performed to analyze the relationship between the respondents' scores on attitude toward the cost of the medicines and participant characteristics. Statistical significance was set at P=0.05. STATA IC (Lightstone, TX, USA, version 15) was used for all the analyses.

Ethical considerations

The aims and content of this study were explained in writing or verbally to the participants. This study was approved by the Ethics Committee of the Tokyo Tama Medical Center (approval number 31-92).

Results

Sixty-four questionnaires were completed, of which four were excluded because they failed to meet the inclusion criteria or because of missing data. Sixty questionnaires were included in the analysis. Table 1 presents the characteristics of the participants. The proportion of male patients was 55% (n=33). The median number of years of employment was ten, and the proportion of participants with a specialty was 63%. The questionnaire was distributed mainly to non-university general hospitals in the Kanto region.

Table 2 shows the proportion of participants who provided appropriate estimates of drug prices. The proportions of correct guesses for neuromuscular blocking agents, inhaled anesthetics, intravenous anesthetics, opioids, and reversal agents were 30% (n=18), 18.3% (n=11), 6.67% (n=4), 30.0% (n=18), and 63.3% (n=38), respectively. The proportion of appropriate estimates for inhaled drugs was significantly lower among female respondents (P<0.05 on the χ^2 test). For intravenous anesthetics, the proportion was significantly higher among respondents with a specialty (P<0.05 on the χ^2 test).

Table 3 shows the anesthesiologists' attitudes toward the cost of medicines. The participants thought that they had adequate access to information on cost, that cost influenced their choice of which medicine to order, and that better knowledge of cost would affect their ordering; that is, they

Table 1 Participant characteristics

	N=60
Age (years, median, [interquartile range])	38 [34–46]
Sex (n, %)	
Male	33 (55.00)
Years of experience (median, [interquartile range])	10 [5–23]
License (n, (%))	
Basic license	22 (36.67)
Specialty license	33 (55.00)
Heart anesthesia specialty license	4 (6.67)
Other specialty license	1 (1.67)
Work days (median, [interquartile range])	5 [4–5]
Employment status (n, (%))	
Full-time	48 (80.00)
Part-time	12 (20.00)
Hospital location (n, (%))	
Tokyo	45 (75.00)
Fukushima	13 (21.67)
Saitama	2 (3.33)
Hospital type	
University	15 (25.00)
Other	45 (75.00)
Total flow of oxygen and air (median, [interquartile range])	3 [2.25–4]

Table 2 Proportion of participants with price estimates within 25% of the actual price (n (%))

	Total	Gender		License	
		Male	Female	Basic	Specialty
Neuromuscular blocking agents	4 (6.67)	1 (1.67)	3 (5.00)	2 (3.33)	2 (3.33)
Inhaled anesthetics	18 (30.00)	14 (23.33)	4 (6.67)**	6 (10.00)	12 (20.00)
Intravenous anesthetics	11 (18.33)	4 (6.67)	7 (11.67)	1 (1.67)	10 (16.67)**
Opioids	18 (30.00)	11 (18.33)	7 (11.67)	5 (8.33)	13 (21.67)
Neuromuscular blockade reversal agents	38 (63.33)	23 (38.33)	15 (25.00)	14 (23.33)	24 (40.00)

**P value <0.05 on the χ^2 test.

Table 3 Attitude toward medicine cost

	Median, [interquartile range]
Items	
Medicine cost influences my decision when ordering medicine.	6 [3–7]
I have adequate knowledge of the costs.	3 [2–5]
I have been educated in the costs.	2 [1–3]
I have adequate access to information about the costs.	8 [5–8]
Better knowledge of the costs would affect my ordering practices.	7 [5–8]
Total	25 [20–30.5]
By sex**	
Male	26 [22–34]
Female	24 [15–26]
By license**	
Basic license	22.5 [17–26]
Specialty license	26 [22–33]

***P* value <0.05 on the Mann–Whitney U test.

Table 4. Barriers to cost containment

	Median, [interquartile range]
Items	
Society's unwillingness to acknowledge the limits of health care resources	9 [7–10]
Patients' failure to carry their fair share of the cost of health care interventions	8 [5–9.5]
Physicians' unawareness of the cost of medical interventions	8 [7–9]
Coverage decisions considering only short-term benefits for patients	7 [5–8]
Patients' unrealistic expectations of what medicines can do	7 [5–8]
Physicians' unwillingness to refuse patients' demands for unnecessary interventions	7 [5–8]
Physicians' need to practice defensively to protect themselves against lawsuits	7 [5–8]
Inadequate information on the cost-effectiveness of medical interventions	5 [4–7]
Doctors' need to explain medicines and treatments to patients directly	4 [3–6]
Total	60 [51–67]
By gender	
Male	56 [48–65.5]
Female	62 [59–68]
By license	
Basic license	63 [50–67]
Specialty license	59 [51–66]

did not believe that they had adequate knowledge or education of the cost of medicines.

Table 4 presents the barriers to cost-effective medical use. The barriers identified in the study were, "Society's unwillingness to acknowledge limited resources", "Patients' failure to carry a fair share of healthcare costs", and "Physicians' unawareness of the cost of medical interventions". Most participants did not see the following barriers: "Physicians' need to explain drugs and treatment to patients directly" and "Inadequate information on the cost-effectiveness of medical interventions".

Table 5 shows the results of the multiple regression analysis of the number of correct medicine prices. No significant association between the number of correct medicine prices, as predicted by the prices within 25% of the correct prices, and the score for attitude toward the cost of the medicines was found on multivariate multiple regression analysis. Table 6 shows the results of the multiple regression analysis of the attitude score, which was significantly higher among male than among female respondents.

Discussion

Increasing pharmaceutical expenditure has become an urgent problem. Knowledge of the cost of medicines and Japanese anesthesiologists' attitude toward cost contain-

Table 5 Multiple regression analysis for the score of correct medicine price

	Univariate analysis Unadjusted coefficient (95% CI)	Multivariate analysis (N=60) Adjusted coefficient (95% CI)
Age	0.00 (−0.02 to 0.02)	−0.02 (−0.05 to 0.01)
Gender		
Male	Reference	Reference
Female	−0.27 (−0.76 to 0.22)	−0.23 (−0.78 to 0.32)
Years of experience	0.00 (−0.02 to 0.02)	
Work days	−0.02 (−0.31 to 0.27)	
License		
Basic	Reference	Reference
Specialty	0.33 (−0.17 to 0.84)	0.49 (−0.16 to 1.15)
University		
No	Reference	
Yes	0.16 (−0.41 to 0.72)	
Attitude score	0.03 (0.00 to 0.06) **	0.03 (−0.01 to 0.06)

***P* value <0.05. CI: confidence interval.

Table 6 Multiple regression analysis of the attitude score

	Univariate analysis Unadjusted coefficient (95% CI)	Multivariate analysis (N=60) Adjusted coefficient (95% CI)
Age	0.23 (0.06 to 0.39)**	0.06 (−0.16 to 0.28)
Gender		
Male	Reference	Reference
Female	−5.82 (−9.46 to −2.19)**	−4.26 (−8.20 to −0.31)**
Years of experience	0.21 (0.05 to 0.38)**	
Work days	2.20 (−0.06 to 4.47)*	1.44 (−0.72 to 3.61)
License		
Basic	Reference	Reference
Specialty	4.90 (1.04 to 8.77)**	3.20 (−1.55 to 7.95)
University		
No	Reference	
Yes	−1.38 (−5.89 to 3.14)	
Medicine price score	2.02 (0.00 to 4.04)**	

**P* value <0.1, ***P* value <0.05. CI: confidence interval.

ment were assessed to gain insight into achieving cost-effective medical care.

The proportion of participants with an appropriate estimate was small; more than half of the respondents answered incorrectly for most medicines except neuromuscular blockade reversal agents. The proportion was also low in previous studies but comparing the results of disparate studies was difficult because the definition of an appropriate or "correct" response differed[7, 8]. Education on anesthetic agents may be needed to improve anesthesiologists' knowledge of the price of the medicines they use.

Anesthesiologists might be able to choose drugs in a cost-effective manner if they have the correct knowledge of the prices. The participants tended to respond that they lacked knowledge and education about drug prices, despite having easy access to this information. In addition, respondents tended to answer that more knowledge of costs would change their ordering practices. This response is apparently related to insufficient education about drug prices in Japanese medical education, despite the information being readily available on the Internet and in patients' electronic medical records. A previous study reported that displaying the price of a drug on packaging or labels helped reduce medical costs[9]. Providing information on prices rather than the means of accessing this information may help encourage cost-effective drug use decisions.

More female than male respondents had a negative attitude toward seeking knowledge about medicine prices, with a multivariate analysis of the attitude score between the genders showing a significant difference. Further studies are required to identify the causes of this difference.

Insufficient knowledge of medical costs among both patients and medical professionals might be a barrier to cost-effective decision-making in healthcare. The results of our study suggested that the significant barriers were "Society's unwillingness to acknowledge limited resources", "Patients' failure to carry their fair share of the cost of healthcare", and "Physicians' unawareness of the cost of medical interventions". These barriers, which might signify a lack of interest in medical expenditure in society as a whole, including physicians and patients, appear to hinder the cost-effective use of medicines. A previous study reported that providing anesthesiologists with knowledge of the price of anesthetics through lectures and furnishing them with a price list led to a reduction in medicine-related costs[10]; however, this study suggests that society as a whole may need to be educated about medical costs, including drug prices, to realize cost-effective medical care.

This study has several limitations. The main limitation of this study is the small sample size. Second, the choice of facilities is biased. Third, the survey was conducted both on paper and online. Fourth, in the questionnaire of this study, it is unclear whether the anesthesiologists usually choose inhalation anesthesia or TIVA, and it is not possible to mention how the difference in anesthesia methods affected the correct answer rate. Despite these limitations, this study is the first survey of Japanese anesthesiologists' attitudes and knowledge of the cost of the medicines they commonly use.

Conclusions

This study demonstrated that Japanese anesthesiologists had little knowledge of the cost of the medicines they used, and that education on this matter was inadequate in the current medical education system in Japan despite easy access to information on the Internet or in patient records. Improving anesthesiologists' knowledge of medicine prices rather than having mere ease of access to this information may be a better method to increase awareness of the importance of cost containment in healthcare.

Author contributions: All authors made substantial contributions to the research. AH, YK, and MH drafted the manuscript. YK contributed to the study design, and AH, YK, MH, YS, KA, and YH contributed to the data collection. MT, YS, and HY provided advice regarding the manuscript. All the authors have checked the manuscript.

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