

BMJ Open Correlation of patient complexity with the burden for health-related professions, and differences in the burden between the professions at a Japanese regional hospital: a prospective cohort study

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ABSTRACT

Objectives An ageing society includes high patient complexity. Various biopsychosocial problems result in a high burden for health-related professionals. The direct relationship between the burden and patient complexity, however, has not been reported. We aimed to examine correlations between the burden for the attending physicians and nurses, and Patient Centred Assessment Method (PCAM) scores of patient complexity.

Design Prospective cohort study.

Setting A regional secondary care hospital in Japan.

Participants We included all inpatients admitted to our acute care unit between 1 July 2014 and 30 September 2014. Exclusion criteria were age <20 years, refusal to participate in the study and length of stay fixed at the time of admission.

Main predictor PCAM total score in the initial phase of hospital admission.

Main outcome The burden for each profession (measured on a Visual Analogue Scale).

Results In total, 201 inpatients participated [female/male=98/103, mean (SD) age of 77.4±11.9 years]. Spearman's rank correlation coefficients between the burden and the PCAM score ranged from 0.23 to 0.32. All p values were <0.05. Multivariate analysis was conducted using multilevel mixed-effects linear regression to determine the association between the burden and the PCAM score in two models. Model 1 used the total PCAM score as the predictive variable. Model 2 used the PCAM factors, patient-oriented complexity and medicine-oriented complexity, as predictive variables. In Model 2, with the burden of physicians, medicine-oriented complexity was statistically significant, whereas with the burden of nurses, both age and patient-oriented complexity were statistically significant.

Conclusions PCAM scores correlated with the burden for physicians and nurses. Individual PCAM factors affected the burden for each profession differently.

Strengths and limitations of this study

- This study evaluated the burden from an individual patient, not the burden from the whole work.
- Because evaluator of the Patient Centred Assessment Method (PCAM) did not engage in patient care, the score was objectively judged.
- According to the analysis by the detected and labelled two factors, the interpretation of the difference between the physicians and nurses could be concrete.
- Neither the inter-rater variability in the PCAM scores nor the spectrum of diseases on admission to community-based hospitals was taken into account in the analysis.
- Although the suitability of using a Visual Analogue Scale for evaluating the perception of burden was uncertain, this measure was practical to administer.

INTRODUCTION

An ageing society gives rise to various health problems with biopsychosocial aspects which health-related professionals must resolve.¹ Many patient outcomes for a variety of complaints—such as low back pain, alcohol misuse and chronic pain—are affected by various biopsychosocial problems.^{2–5} These studies also showed that the introduction of the biopsychosocial model led to a more effective management of these problems.^{2–4} The comprehensive evaluation of biopsychosocial problems is important in clinical practice.⁶

We have used the concept of patient complexity to evaluate various biopsychosocial problems.⁷ The word ‘complexity’ was

used by Osborn and Cole instead of referring to difficult patients, believing that medical students and residents can acquire the necessary skills to assess areas of complexity.⁸ Difficult patients are defined as those who elicit strong negative emotions from their physicians.⁹ Typical characteristics of difficult patients include depressive or anxiety disorders, a greater number of somatic symptoms and greater symptom severity.¹⁰ Many biopsychosocial factors of difficult patients have been examined, including multiple medical issues, psychiatric diagnoses, low literacy and financial constraints.¹¹ Several instruments to measure patient complexity have been developed as a result of this concept—for instance, INTERMED, the Minnesota Complexity Assessment Method and the Patient Centred Assessment Method (PCAM).^{12–14} The PCAM—an advanced version of the Minnesota Complexity Assessment Method developed in Scotland—is a practical tool for use in the primary care setting. We examined, in a Japanese secondary care setting, the validity and reliability of the PCAM and the relationship between PCAM and the length of hospital stay.¹⁵ We found that health problems needing concrete intervention were detectable using this method.

In general, health-related professionals carry the burden resulting from difficult patients, suffering, in consequence, from ‘burn-out’, depression and so on.¹⁶ Studies have suggested that various factors affect the burden among health-related professionals, especially physicians and nurses,^{17–20} and that there were differences in the burden between physicians and nurses in the same situation.²¹ According to this study, when new decisions about the various problems were needed, the physicians and nurses tended to feel the burden. However, the types of problems were different from the biopsychosocial aspects. The PCAM contains these elements as items for evaluating patient complexity. Therefore, the results of PCAM evaluations could represent the degree of difficulty inherent in treating each patient. It is, however, unknown whether the simple addition of PCAM score for each item to provide a total score is meaningful in a clinical setting. As yet, there have been no reports on the direct relationship between these items.

If it were possible to estimate the likely burden from patients at the start of care through evaluation using the PCAM, it might be possible to implement counter measures. The aim of our study was to evaluate the relationship between the total PCAM score on admission and the burden for health-related professionals, specifically physicians and nurses. In addition, we hoped, by evaluating the PCAM items, to detect the area in which each health-related profession felt the burden. An understanding of the existence of differences in the respective burdens for physicians and nurses could lead to improved mutual understanding. By investigating whether problems that can be anticipated from PCAM scores are related to outcomes in clinical practice, this study provides basic information for future studies on how to intervene in those problems.

METHODS

Study group and setting

We performed this prospective cohort study along with a study investigating the validity and reliability of the PCAM.¹⁵ As is the case with the validation study, we adopted all inpatients admitted to the acute care unit of O uji Coop Hospital between 1 July 2014 and 30 September 2014 as our participants. Because there had been no report on PCAM at the time of planning this study, we were not able to calculate an accurate required sample size. Instead, we set the study period to be 3 months, estimating that the total number of patients would be about 300 because the average number of admission in a month was 100. Kita-ku, Tokyo, Japan, is a district with a high population-ageing-rate and served by O uji Coop Hospital, a regional secondary care hospital and family physician teaching facility with 159 beds. Our hospital has no surgical facilities; patients needing surgical treatment are referred to other hospitals. During the study period, most inpatients were admitted to treat the following medical conditions: pneumonia, urinary tract infection, acute exacerbation of chronic illness (chronic obstructive pulmonary disease, diabetes), dermatological conditions such as decubitus ulcers and cellulitis, orthopaedic conditions such as lumbar compression and proximal femoral fractures that do not require surgery and cancer pain not being controlled in ambulatory or home medical care.¹⁵ Exclusion criteria were age below 20 years, refusal to participate in the study and length of stay fixed at the time of admission such as in colonic poplypectomy and gastric fistula exchange. No patient was excluded by the age criterion.

Measurement variables and evaluation process

The outcome measure was the burden perceived by physicians and nurses from each patient, measured by a Visual Analogue Scale (VAS). After the discharge of each patient, one of the authors (S.Y.) requested that the attending physician and nurse respond to the questionnaire within 1 week. S.Y. was not involved in the care of these patients. This questionnaire contained one question in Japanese language- ‘Please tell us the burden you perceived from this patient during hospitalisation.’ We subsequently distributed the VAS using this question. The length of the VAS was not exactly equal to 100mm once printed out. The length from 0 to the marked point was divided by the total line length. The notation of this result ranged from 0% to 100%, and two independent evaluators, with no connection to either the health-related profession or the authors, calculated the VAS score. We adopted the mean of each VAS score for use in statistical analysis.

Predictor variables and covariates

Complexity scales

When one of the authors was independent from other physicians, he evaluated the PCAM by interviewing patients and patients’ family members. Given that the PCAM was not available in Japanese, the interviewer translated and asked the questions in Japanese. The

interviewer, after judging the items on the PCAM, completed the assessment, bearing in mind the Japanese context and was able to employ the appropriate questions for each item from the sample questions included in the PCAM guide when translating into Japanese. For ethical reasons, we informed members of the staff who worked in the hospital and were involved in the care of the patients that they could have access to the results of these complexity scores if they wished; however, no one requested these results during the research period.

PCAM

The PCAM is a tool designed for action-based evaluation of complexity in primary care settings, developed by Pratt *et al* from the Minnesota Complexity Assessment Method.¹⁴ Intended for use in patients with comorbid conditions or multimorbidity, it evaluates patients' centredness in addition to their experience. Yoshida *et al* examined the validity and reliability of the PCAM and the relationship between the PCAM and the length of hospital stay in a Japanese secondary care setting.¹⁵ The PCAM comprises 12 items in four domains: 'Health and Well-being' (four items), 'Social Environment' (four items), 'Health Literacy and Communication' (two items) and 'Service Coordination' (two items). Each item is scored from 1 to 4 points, with the highest possible score of 48. Higher scores indicate greater patient complexity.

In a previous study, we used exploratory factor analysis and showed that the 12 PCAM items could be divided into two factors which we named patient-oriented complexity (the patient's internal factors, such as mental condition and literacy) and medicine-oriented complexity (external factors such as the care environment and service).¹⁵ Patient-oriented complexity comprised items 2, 3 and 4 from the Health and Well-being domain, 2 and 3 from Social Environment and 1 and 2 from Health Literacy and Communication. Of these, the items with the highest and second highest factor loadings were Health Literacy and Communication item 1: 'How well does the client now understand their health and well-being (symptoms, signs or risk factors) and what they need to do to manage their health?' and Health Literacy and Communication item 2: 'How well do you think your client can engage in health-care discussions? (Barriers include language, deafness, aphasia, alcohol or drug problems, learning difficulties and concentration)' (cited from PCAM online).²² Medicine-oriented complexity comprised item 1 from Health and Well-being, 1 and 4 from Social Environment and 1 and 2 from Service Coordination. Of these, the items with the highest and second highest factor loading were Service Coordination item 1: 'Do other services need to be involved to help this client?' and Service Coordination item 2: 'Are services involved with this client well coordinated?'.²²

Participants' characteristics

We obtained age, sex, number of medications, length of hospital stay and discharge destination from electronic

medical records.²³ Ancillary staff members, who administered the Charlson Comorbidity Index (CCI) and Mini Nutritional Assessment–Short Form (MNA-SF)], also asked patients or family members about the number of family members living with the patients, whether they had a principal caregiver, and whether they had received public assistance.^{24–27}

CCI

Developed in 1987, the CCI evaluates comorbidities by allocating scores to 16 medical conditions.²⁴ Most conditions are given scores of either 1 point or 2 points, although moderate-to-severe liver disease receives 3 points, and metastatic solid tumours and AIDS receive 6 points. The individual scores are summed to give a single overall score. A study in 2014 of elderly patients admitted to acute hospitals reported that the CCI score on admission correlated with subsequent mortality.²⁵ The study showed that, compared with patients with a CCI of 0, those with a CCI of ≥ 5 had much higher 3-month, 1-year and 5-year mortality (with OR of about 3.5, 7 and 52, respectively).

MNA-SF

We assessed the nutritional status using the MNA-SF, which comprises six questions covering declining food intake, recent weight loss, mobility, recent psychological stress or an acute disease, neuropsychological problems and either body mass index or a calf circumference measurement.^{26–28} Each question is scored from 0 to 2 or 0 to 3, with lower scores representing a greater risk of malnutrition. The highest possible score is 14. The overall score is interpreted as follows: 12–14 points - 'normal nutritional status', 8–11 points - 'at risk of malnutrition' and 0–7 points - 'malnourished'. A study in a Japanese community hospital confirmed that MNA-SF score was a predictor of health-related outcomes.²⁹

Analysis and statistical methods

The correlation between the burdens for the physicians and nurses and that between the PCAM scores and the burden were calculated using Spearman's rank correlation coefficient after establishing these data were non-parametric using the Shapiro–Wilk test.

Multivariate analysis using multilevel mixed-effects linear regression was performed to investigate the association between the burden for health-related staff and the PCAM. The evaluators for the burden were included in the model as a random effect and patient-level covariates were included as fixed effects. We chose the covariates through a literature review and discussion, taking into consideration important aspects of the Japanese clinical setting.^{15 28–31} The chosen covariates were comorbidity, nutritional status, polypharmacy, length of hospital stay and discharge destination, in addition to basic information such as sex and age. Two models were developed. In Model 1, the predictive variable was the total PCAM score and the covariates were age, sex, MNA-SF score, CCI score,

total number of medications, length of hospital stay and discharge destination. In Model 2, the predictive variables were the two factors of the PCAM and the covariates were age, sex, MNA-SF score, CCI score, total number of medications, length of hospital stay and discharge destination. The scores of total PCAM and each factor were centred around the evaluator mean (centring within cluster). To check for multicollinearity, we calculated the correlations between predictors using the pairwise Pearson's correlation coefficient and variance inflation factors.

We performed all statistical analyses using STATA/SE V.14 (StataCorp, 2017). In the multivariate analysis, we considered $p < 0.025$ to be statistically significant: each PCAM item and two factors of the PCAM were examined twice with multivariate analysis. In other cases, we considered $p < 0.05$ to be statistically significant.

Patient and public involvement

No patient or member of the public was involved in developing the research question or outcome measures or in developing plans for the study design or implementation of the study. We intend to disclose and summarise the results of this study on the homepage of our website (Department of Community-Based Medical System, Graduate School of Biomedical and Health Sciences, Hiroshima University).³²

RESULTS

Participant characteristics on admission

As was the case with the validation study, among 263 admissions, 46 patients met the exclusion criteria: one person refused to participate in the study and on admission, 45 patients had a pre-determined, fixed length of hospital stay. In addition, owing to cognitive impairment, two patients could not be interviewed and there was no possibility of interviewing their families; four individuals were immediately referred to other hospitals for emergency operations; 10 patients had no score for the MNA-SF owing to missing values. Thus, 201 inpatients participated in this study. Their characteristics are shown in table 1.

The mean (SD) PCAM score was 25 ± 7.3 . The participants (and their characteristics) were the same as in the previous validation study; details of the participants' main diseases can be found in the report to that study.¹⁵

The burden evaluators' characteristics

The characteristics of the attending physicians and nurses who responded to the question about the burden are presented in table 2.

The correlation of the burden between the attending physician and the attending nurse

Responses to the questionnaire were received for 84% (169/201) of the patients from the attending physicians and for 98.5% (198/201) of the patients from the attending nurses. Figure 1 shows the distribution of the

Table 1 Participants' characteristics at admission

Age: years, mean (SD)	77.4 (11.9)
Female, n (%)	98 (48.8)
Number of medications: mean (SD)	6.4 (4.1)
Cancer, n (%)	36 (17.9)
Diabetes mellitus, n (%)	44 (21.9)
Receiving public assistance, n (%)	38 (18.9)
Charlson Comorbidity Index score, mean (SD)	2.0 (2.2)
Mini Nutritional Assessment-Short Form score, mean (SD)	7.9 (3.8)
Length of stay (days), mean (SD)	34.1 (40.9)
Number of family members, n (%)	
0	66 (32.8)
1	83 (41.3)
2	31 (15.4)
≥3	21 (10.5)
Not married, n (%)	35 (17.4)
Principal caregiver, n (%)	
None	45 (22.4)
Husband or wife	62 (39.0)
Son or daughter	75 (47.1)
Female	99 (62.3)
Discharge destination, n (%)	
Home	148 (73.6)
Nursing home	19 (9.4)
Other hospital	33 (16.4)
Others	1 (0.6)

VAS. Each attending physician and nurse drew a line on the VAS scale as their perception of the burden from patients. The physicians answered the questionnaire for 169 participants and the mean (SD) of the VAS was 41.4 ± 22.4 (%). The nurses answered the questionnaire for 198 participants and the mean (SD) of the VAS was 60.7 ± 20.8 (%). Figure 2 shows the correlation between the VAS of the physicians and that of the nurses. Spearman's rank correlation coefficient was 0.28.

Table 3 shows the correlation between the PCAM and the burden and between each PCAM factor and the burden. The range of Spearman's rank correlation coefficient was from 0.23 to 0.32. All p values are < 0.05 .

Table 4 shows the results, after adjusting the covariates, of the multivariate linear regression analysis examining the associations between the total PCAM score and the burden and between each PCAM factor and the burden. In Model 1, we found both age and the total score of the PCAM to be statistically significant, both for physicians and for nurses. In Model 2, we found age and medicine-oriented complexity to be statistically significant for the burden for physicians. In contrast, we found age and patient-oriented complexity to be statistically significant

Table 2 Characteristics of the burden evaluators

Physicians	
Number of physicians: n	10
Age: years, mean (SD)	30.8 (4.9)
Female, n (%)	6 (60.0)
Years of working experience, mean (SD)	5.2 (2.9)
Nurses	
Number of nurses, n	23
Age: years, mean (SD)	32.5 (8.2)
Female, n (%)	21 (91.3)
Years of working experience, mean (SD)	10.1 (7.4)

for the burden for nurses. We examined variance inflation factors to ascertain whether there was multicollinearity among predictor variables. Since the variance inflation factors of each variable in our two models ranged between 1.05 and 1.43, we were able to rule out the existence of multicollinearity.

DISCUSSION

Our study revealed a relationship between patient complexity at admission and the burden for physicians and nurses. We also discovered the potential of different factors of patient complexity to exert an effect on the perception regarding burden by each health-related professional.

In Model 1, we found a statistically significant correlation between the total score of the PCAM at admission and the burden perceived by physicians and nurses. A high PCAM total score indicates high patient care complexity, which might be expected to result in a high burden for health-related professionals. The accumulation of factors relating to encounters with difficult patients increased the physicians' and nurses' burden. Through the evaluation of PCAM scores at admission, we were able estimate

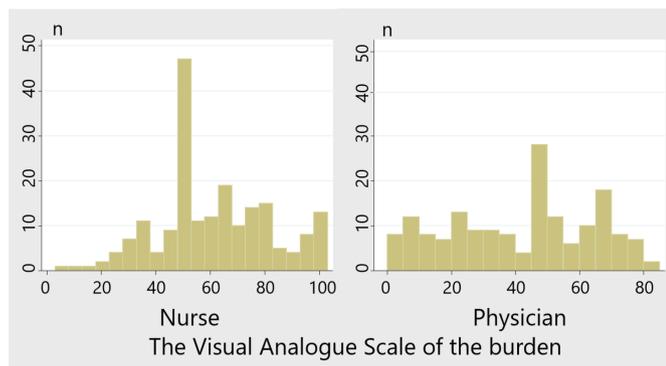


Figure 1 The distribution of Visual Analogue Scale (VAS) of the burden The physicians answered the questionnaire for 169 participants and the mean (SD) of the VAS was 41.4±22.4 (%). The nurses answered the questionnaire for 198 participants and the mean (SD) of the VAS was 60.7±20.8 (%).

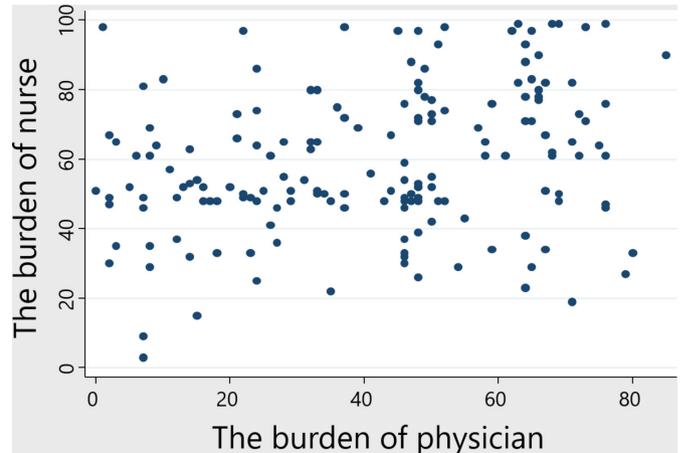


Figure 2 Visual Analogue Scale of the burden between physician and nurse Spearman's rank correlation coefficient was 0.28.

the burden for health-related professionals evaluated at the time of discharge.

Using Spearman's rank correlation coefficients, we found a weak correlation between the physicians' burden and nurses' burden. Furthermore, in Model 2, we found a correlation between patient-oriented complexity and the burden for nurses, but not for physicians. Similarly, in Model 2, we found a correlation between medicine-oriented complexity and the burden for physicians, but not for nurses. Given that patient-oriented complexity relates to patients' internal factors, such as their mental condition and literacy, and medicine-oriented complexity relates to external factors, such as the care environment and service, the health-related professionals recognised different types of health problems as difficult. Previous qualitative research has revealed differences in burden between physicians and nurses.^{33 34} Another study highlighted the differences between the views of nurses and those of physicians concerning communication.³⁵ Such differences can result from various factors. One factor would be how each profession views its role. Physicians see their role as medical plan managers, decision-makers or coordinators who oversee all aspects of the patient's care.¹⁹ Conversely, nurses see their role as compassionate

Table 3 Univariate analysis: the correlation between the Patient Centred Assessment Method (PCAM) scores and the burden

	Visual Analogue Scale scores for the burden			
	Nurse		Physician	
	ρ	P value	ρ	P value
PCAM	0.29	<0.001	0.29	<0.001
Patient-oriented complexity	0.31	<0.001	0.23	0.003
Medicine-oriented complexity	0.23	0.003	0.32	<0.001

Table 4 Multivariate analysis: correlation between Patient Centred Assessment Method (PCAM) scores and the burden

Predictive variable	Nurses				Physicians			
	Coefficient	95% CI		P value	Coefficient	95% CI		P value
		Lower	upper			lower	upper	
Model 1								
PCAM	0.62	0.17	1.06	0.007	0.89	0.38	1.40	0.001
Age	-0.43	-0.68	-0.18	0.001	-0.48	-0.77	-0.18	0.001
Sex	-3.94	-9.60	1.71	0.17	-0.92	-7.51	5.67	0.78
Charlson Comorbidity Index	0.051	-1.26	1.36	0.94	0.51	-0.98	2.01	0.50
Mini Nutritional Assessment-Short Form	-0.96	-1.79	-0.12	0.025	-0.12	-1.12	0.87	0.81
Number of medications	0.29	-0.42	0.99	0.42	-0.014	-0.85	0.83	0.97
Length of hospital stay	0.014	-0.054	0.082	0.69	-0.032	-0.12	0.055	0.47
Discharge destination	0.43	-1.50	2.36	0.66	2.32	0.018	4.62	0.048
Model 2								
Patient-oriented complexity	0.84	0.10	1.58	0.024	-0.52	-0.80	0.90	0.91
Medicine-oriented complexity	0.23	-0.86	1.33	0.68	2.17	1.01	3.34	<0.001
Age	-0.43	-0.68	-0.18	0.001	-0.50	-0.78	-0.21	0.001
Sex	-3.68	-9.37	2.02	0.21	-1.79	-8.31	4.74	0.59
Charlson Comorbidity Index	0.13	-1.20	1.45	0.85	0.17	-1.32	1.66	0.83
Mini Nutritional Assessment-Short Form	-0.94	-1.78	-0.11	0.027	-0.26	-1.24	0.73	0.61
Number of medications	0.26	-0.45	0.96	0.48	-0.064	-0.76	0.89	0.88
Length of hospital stay	0.014	-0.054	0.082	0.69	-0.037	-0.12	0.049	0.40
Discharge destination	0.44	-1.49	2.36	0.66	2.39	0.12	4.66	0.04

care providers who administer medication, take care of all of the patients' needs, follow physicians' orders and sometimes question those orders.¹⁹ These different perceptions of roles may have resulted in the two professions associating a different level of burden with the two types of complexity (patient-oriented and medicine-oriented). Different professional and education systems may also have affected these results.³⁶⁻³⁸ This realisation could serve to improve communication between physicians and nurses.

Our study had some limitations. Only one researcher evaluated the PCAM scores, whereas in clinical situations, this task would be performed by various care providers. Neither the inter-rater variability of the PCAM scores nor the spectrum of diseases at admission to community-based hospitals was taken into account. The PCAM scores may also have been affected by differences in care setting, type and severity of disease, insurance systems and other factors. In addition, the outcome measure was a self-reported VAS. The length of the VAS line was not exactly equal to 100 mm after printing. The results of the VAS score were therefore calculated by division. The suitability of the VAS for calculating the perception of burden was uncertain. However, no other valid and reliable tool would have sufficed for the aim of this study. In addition, patient and public involvement was not considered while

planning and conducting this research, as is the case with many other Japanese studies.

The problems revealed in this study provided an initial evaluation for a start to the next steps. The findings of this study provide basic information for interventions in those problems in future studies. With this objective in mind, we plan to develop a Japanese version of PCAM to facilitate its widespread use as a complexity assessment tool in Japan. We also intend to examine and explore the availability of PCAM to address the problems revealed in this study.

CONCLUSION

Our findings indicate that the PCAM correlates with the burden for two medical professions: physicians and nurses. Moreover, different factors exist among each profession in the way in which they perceive these burdens.

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Contributors SY reviewed and edited the manuscript, conducted the research study and was primarily responsible for data collection, integrity, and analysis. MM reviewed and edited the manuscript and was primarily responsible for data collection, integrity, and analysis. HW, RM, YS, TY, RH, TW and YF reviewed and edited the manuscript, contributed to the discussion of the data and performed critical review of the manuscript. All authors contributed the conception of this work. All authors revised it critically for important intellectual content. All authors approved the final version for publication. All authors agree to be accountable for all aspects of the work.

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Patient consent Obtained.

Ethics approval The Ethics Committee at Tokyo Hokuto Health Co-operative approved the present protocol. The approval number was 70.

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Data sharing statement Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

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