Time Trend in Interest and Satisfaction Towards Clinical Training and Academic Activities Among Early-Career Cardiologists — The Japanese Circulation Society Post-Graduate Training Survey —

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Background: Satisfaction among early-career cardiologists is a key performance metric for cardiovascular (CV) educational programs. To assess the time trend in the interest and activities of early-career cardiologists regarding their training, we conducted web-based surveys in 2011 and 2015.

Methods and Results: Early-career cardiologists were defined as physicians who planned to attend Japanese Circulation Society (JCS) annual meetings within 10 years of graduation. A total of 272 and 177 participants completed the survey for the years 2011 and 2015, respectively. Survey questions were designed to obtain core insights into the workplace, research interests, and demographic profile of respondents. Main outcome measures were satisfaction levels with their training program. The overall satisfaction rate for training was lower in 2015 than 2011; this was largely affected by decreases in the rates of satisfaction for valvular heart disease, ischemic heart disease, advanced heart failure, and congenital heart disease. Moreover, satisfaction with CV training was associated with the volume of invasive procedures such as coronary angiography and percutaneous coronary interventions in 2011 but not 2015.

Conclusions: Early-career cardiologists' satisfaction with their training decreased during the study period, especially in the field of evolving subspecialties (e.g., valvular heart disease or advanced heart failure), suggesting that prompt reevaluation of the current educational curriculum is needed to properly adapt to progress in cardiology.

Key Words: Cardiovascular medicine; Medical training; Postgraduate education

The number of physicians specializing in cardiovascular (CV) medicine has increased worldwide in recent years. Reflecting the progress in diagnostic and therapeutic modalities of CV diseases, the field has diversified into various subspecialties, and the workload and necessary skills to be acquired during fellowship training has increased significantly. Subsequent evolution in these subspecialties has necessitated further revisions of CV training recommendations, particularly in novel catheter-based interventions, together with care in advanced heart failure patients. However, although these rapid advances have changed medical care systems globally, there is little dispute that there has been no significant change in the content of cardiology education.

The importance of medical trainees’ (i.e., residents and fellows) satisfaction with training is emphasized as a key performance metric in their training system. This is of no exception in CV training, which faces the need to identify the imbalance in the volume and composition of the training system and to assess its appropriateness through the trainees’ perspective. In 2011, we conducted a web-based survey of a total of 272 early-career cardiologists, and demonstrated that they had a positive perception of procedure-based subspecialty training, and that their training satisfaction was related to the volume of cardiac procedures.

Thus, in order to evaluate whether current CV training programs have adjusted to the continued advances in cardiology, we conducted a web-based survey for early-career cardiologists in 2015 and compared the satisfaction levels with their training with those in the 2011 survey. Our
primary goal was to highlight trends in early-career cardiologists’ satisfaction with their subspecialty training programs and evaluate whether current CV training programs are successfully satisfying the demand in conjunction with the continued advances in cardiology.

**Methods**

**Participants**

This study was based on analysis of data from a survey of CV trainees in Japan who were registered to attend the annual meetings of the Japanese Circulation Society (JCS) scheduled in March 2011 and April 2015. In the 2011 and 2015 surveys, 272 and 177 trainees, respectively, who had graduated within the preceding 10 years, completed the web-based anonymous survey upon registration. Approximately 50–60% of the participants identified themselves as currently working in academic university hospitals; in both surveys 80% of the participants received their training in university hospitals at some point during their career. Responses to the survey were collected without personally identifiable data.

**Data Collection**

The details of the survey questionnaire have been provided previously. The survey included questions related to current employment, including hospital information, and educational satisfaction level in subspecialty management and imaging studies. Questions related to education and training included past training patterns regarding hospital type and specialty (general internal medicine and clinical cardiology), areas of interest in CV subspecialty, experience of cardiology procedures; and career length since graduation from medical school.

The research was performed in compliance with the Helsinki Declaration. The Education/Post-Graduate Training Committee and Board of Directors of the JCS approved the survey. The survey was deemed to be a service evaluation, and was therefore exempted from ethical review. Respondents were informed that participation was voluntary, and confidentiality would be maintained.

Answers were required for all questions. Survey security was maintained by using secure servers to route participant responses over the internet and store data.

Trainees were queried regarding the number of cardiology procedures they performed as a primary operating physician. The procedures included coronary angiogram, percutaneous coronary intervention, percutaneous peripheral intervention, electrophysiological study, catheter ablation, transthoracic echocardiogram, transesophageal echocardiogram, pacemaker implantation, implantable cardioverter defibrillator, and cardiac resynchronization therapy (CRT; including CRT-defibrillators [CRT-D]). Each item had 9 categorical choices for procedural volume.

### Table 1. Demographics of the Early-Career Cardiologists Surveyed in 2011 and 2015

<table>
<thead>
<tr>
<th>Current training facility</th>
<th>2011 (n=272)</th>
<th>2015 (n=177)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>University hospital</td>
<td>145 (53)</td>
<td>110 (62)</td>
<td>0.206</td>
</tr>
<tr>
<td>Community hospital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200 beds</td>
<td>16 (6)</td>
<td>8 (5)</td>
<td></td>
</tr>
<tr>
<td>200–500 beds</td>
<td>59 (22)</td>
<td>24 (16)</td>
<td></td>
</tr>
<tr>
<td>&gt;500 beds</td>
<td>37 (14)</td>
<td>27 (15)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>15 (6)</td>
<td>8 (5)</td>
<td></td>
</tr>
</tbody>
</table>

Total training duration  
7.6±2.1 7.5±1.9 0.245

Training duration, type of specialty (years)  
- General medicine 2.1±1.1 2.1±1.3 0.582
- Clinical cardiology 3.9±2.3 3.9±2.1 0.726

Training duration, training facility (years)  
- Community hospital 3.6±2.4 3.7±2.3 0.748
- University hospital, clinical training 2.7±2.4 2.3±1.8 0.012
- University hospital, basic science 1.5±1.8 1.2±1.6 0.014

Area of interest  
- Ischemic heart disease (including interventional cardiology) 105 (39) 51 (29) 0.033
- Arrhythmia (including electrophysiological study and catheter ablation) 41 (15) 29 (16) 0.708
- Advanced heart disease (including management of left ventricular assist device and heart transplantation) 28 (10) 21 (12) 0.602
- General cardiology 26 (10) 25 (14) 0.136
- Imaging study; echocardiogram 25 (9) 18 (10) 0.731
- Basic research 18 (7) 10 (6) 0.679
- Imaging study; CT/MRI 9 (3) 5 (3) 0.773
- Valvular heart disease 4 (2) 3 (2) 0.568
- Imaging study; nuclear study 3 (1) 3 (2) 0.444
- Congenital heart disease 2 (1) 4 (2) 0.170
- Other 11 (4) 8 (5) 0.807

Data are shown as the mean±SD or numbers (%). CT/MRI, computed tomography/magnetic resonance imaging.
Trainees were also asked to rate the level of satisfaction with their training in 9 items using a 11-point Likert scale (i.e., 0=“dissatisfied, complete lack of experience” to 10=“satisfied, gained enough experience”). The items evaluated were ischemic heart disease, arrhythmia, severe heart failure, peripheral artery disease, valvular heart disease, congenital heart disease, and imaging studies (echocardiography, nuclear studies, and computed tomography/magnetic resonance imaging).

Finally, participants were asked to rate the most influential factors in their choice of program on a scale of 0 to 10 (i.e., 0=“not important at all” to 10=“most important”). Important cardiology training facility variables included hospital location, volume of patients and procedures, faculty and facility quality/reputation, and clinical and basic experimental research quality.

Statistical Analysis
Continuous data were summarized as mean value±standard deviation and discrete data as absolute values and percentages. Data were analyzed using SPSS statistical software version 23 (SPSS Inc., Chicago, IL, USA). Overall satisfaction score was calculated as the sum of satisfaction levels in each subspecialty. This score reflected satisfaction with career training in the management of 6 CV fields (ischemic heart disease, valvular heart disease, advanced heart failure, arrhythmia, peripheral artery diseases, and congenital heart diseases) and 3 types of non-invasive imaging studies (echocardiography, nuclear studies, and computed tomography/magnetic resonance imaging). In Japan, marketing approval for transcatheter aortic valve implantation and implantable ventricular assist devices was granted in 2013 and 2011, respectively; therefore, we divided the subspecialties into 2 groups: rapidly evolving subspecialties (valvular heart diseases and advanced heart failure) and control subspecialties (the other 7 subspecialties). We compared the satisfaction rate overall and for each subspecialty in the 2011 and 2015 surveys. Logistic regression analysis was used to assess the association (reported as odds ratios and 95% confidence intervals) of overall trainee satisfaction with procedural volume or training duration.

Results
Baseline characteristics of the 272 and 177 participants in the 2011 and 2015 surveys are shown in Table 1. There were no significant differences in total training duration or type of current training facility, but participants in the 2011 survey had longer training duration in a university hospital than those in the 2015 survey. In the area of interest in cardiology subspecialty, there were no significant differences between surveys, except that the proportion of those who were interested in ischemic heart disease was lower in the 2015 survey than in the 2011 survey. The 2 most selected areas of interest in CV medicine were interventional cardiology and electrophysiology in both surveys, and the 3rd most selected area of interest was advanced heart failure in the 2011 survey and general cardiology in the 2015 survey.

Figure S1 shows a comparison between the 2011 and 2015 surveys for the volume of procedures performed by participants as a primary operating physician. The distributions of volumes of coronary angiography and percutaneous coronary intervention differed between the 2011 and 2015 surveys; there were 21 trainees (8%) who performed more than 2000 coronary angiograms in the 2011 survey.
but not in the 2015 survey. The majority of the participants experienced less than 50 cases of implantation of implantable cardioverter defibrillators (97% and 96%) or CRT/CRT-D (99% and 99%) in the 2011 and 2015 surveys.

We surveyed the satisfaction levels in the management of 6 CV subspecialty areas (ischemic heart disease, valvular heart disease, advanced heart failure, arrhythmia, peripheral artery diseases, and congenital heart diseases) and 3 types of non-invasive imaging (echocardiography, nuclear studies, and computed tomography/magnetic resonance imaging) (Figure 1). Overall satisfaction score was calculated from the sum of satisfaction levels in each of the previously described 6 CV subspecialty areas and the 3 types of non-invasive imaging. Overall satisfaction score significantly decreased from 2011 to 2015 (39.2±15.0 vs. 34.4±15.6, P=0.001; Figure 1A). The trends in satisfaction level with the CV training programs developed differently across subspecialties, and satisfaction levels significantly decreased for ischemic heart disease (6.1±2.8 vs. 5.4±2.6, P=0.005), valvular heart disease (5.2±2.3 vs. 3.5±2.6, P<0.001), advanced heart failure (4.0±2.6 vs. 3.3±2.7, P=0.014), and congenital heart diseases (2.5±2.2 vs. 2.1±2.4, P=0.024), whereas those in other subspecialties had stable trends (Figure 1B). The satisfaction score in rapidly evolving subspecialties (sum of scores for valvular heart diseases and advanced heart failure) significantly decreased (9.2±4.2 vs. 6.8±4.7, P=0.001), whereas those for the control subspecialties (sum of scores for the other 7 subspecialties) decreased modestly (30.0±11.8 vs. 27.6±12.0, P=0.042).

Overall, the participants above the first tertile for overall satisfaction score (>45 points) were defined as the satisfied group. In the 2011 survey, years of physician’s training duration in clinical cardiology or general internal medicine, years of training duration at university and community hospitals, and the volume of coronary angiograms, percutaneous coronary interventions, transthoracic echocardiograms, and implantation of pacemakers were significant contributors to participants’ satisfaction. On the other hand, in the 2015 survey, most of these factors were not associated with participants’ satisfaction, and longer training duration at a university hospital and the volume of echocardiograms contributed to their satisfaction (Table 2). The participants below the last tertile for overall satisfaction (<32 points) were defined as the unsatisfied group. In the 2011 survey, years of physician’s training in clinical cardiology, years of training at a university hospital, and volume of transthoracic echocardiograms and implantation of pacemakers were significant contributors to participants’ dissatisfaction. In the 2015 survey, volume of catheter ablation contributed to dissatisfaction. In both the 2011 and 2015 surveys, the volume of coronary angiograms and percutaneous coronary interventions significantly contributed to respondents’ satisfaction, but the effect was more significant in the 2011 survey than in the 2015 survey (Table S1).

Both surveys consistently demonstrated that the 3 CV training program variables considered most important by the participants were the number of cases managed at the site, the number of procedures available at the site, and the quality and reputation of the attending staffs. The quality of basic research was rated relatively low (Figure 2).

### Discussion

Continuing advances in medical management, procedures, and imaging modalities in medical science have led to a continuous debate regarding the most appropriate educational program for trainees. Typically, physician satisfaction during the training period is associated with a patient’s outcome, but it also provides reliable information on the quality of their educational program. However, despite much research on residents’ perspectives and satisfaction with their training, to our knowledge there are no reports of surveys of the temporal trends in training in recent years concurrent with the advances in CV medicine. In this study, we evaluated the trends in the satisfaction level within CV overall and for each subspecialty training program as well as related factors for cardiology trainees or early-career CV specialists based on web-based surveys.

| Table 2. Factors Related to Early-Career Cardiologists’ Satisfaction With Their Job Skills |
|---------------------------------------------|-----|-------|-----|
| Training duration, type of specialty*       | 2011 | OR    | 95% CI | P value | 2015 | OR    | 95% CI | P value |
| Clinical cardiology                         | 1.23 | 1.10–1.37 | <0.001 | 1.07 | 0.92–1.26 | 0.37 |
| General internal medicine                   | 1.29 | 1.02–1.63 | 0.036  | 1.05 | 0.82–1.35 | 0.68 |
| Training duration, type of training facility* |       |       |       |       |       |       |       |       |
| University hospital                         | 1.15 | 1.04–1.27 | 0.008  | 1.26 | 1.05–1.52 | 0.013 |
| Community hospital                          | 1.14 | 1.04–1.27 | 0.009  | 0.94 | 0.81–1.09 | 0.42 |
| Volume of procedures†                       |       |       |       |       |       |       |       |       |
| Coronary angiograms                         | 1.35 | 1.18–1.55 | <0.001 | 1.12 | 0.92–1.34 | 0.26 |
| Percutaneous coronary interventions         | 1.51 | 1.26–1.82 | <0.001 | 1.06 | 0.78–1.42 | 0.73 |
| Percutaneous peripheral interventions        | 1.41 | 0.93–2.14 | 0.11  | 1.40 | 0.69–2.84 | 0.35 |
| Electrophysiological studies                | 1.24 | 0.89–1.73 | 0.21  | 1.40 | 0.96–2.04 | 0.079 |
| Catheter ablation                           | 1.19 | 0.80–1.76 | 0.39  | 1.43 | 0.98–2.08 | 0.061 |
| Pacemaker implantations                     | 1.45 | 1.01–2.09 | 0.043  | 1.34 | 0.89–2.03 | 0.16 |
| ICD implantations                           | 1.20 | 0.40–3.63 | 0.75  | 1.46 | 0.74–2.86 | 0.28 |
| Transthoracic echocardiograms               | 1.24 | 1.09–1.41 | 0.001  | 1.28 | 1.07–1.53 | 0.007 |
| Transesophageal echocardiograms             | 1.16 | 0.94–1.42 | 0.17  | 1.35 | 0.99–1.82 | 0.06 |

*per 1-year increment, †per increment per category. CI, confidence interval; ICD, implantable cardioverter defibrillator; OR, odds ratio.
conducted at the 2011 and 2015 annual meetings of the JCS. Early-career cardiologists’ overall satisfaction with their training had decreased, particularly in the fields of valvular heart disease, ischemic heart disease, advanced heart failure, and congenital heart disease; disciplines in which novel diagnostic/therapeutic techniques and devices have been introduced in recent years. In the 2011 survey the satisfaction with CV training was associated with the completed volume of invasive procedures such as coronary angiograms and percutaneous coronary interventions, but not in the 2015 survey.

In recent years, many reports have been published regarding fellows’ perception across various medical specialties, providing important insights from self-reported assessment by fellows in training. The strength of this study is repeating a survey that quantified the satisfaction level of residents based on procedures and knowledge in several cardiology subspecialties. The most notable aspect was the significant decrease in satisfaction in the fields of valvular heart diseases and advanced heart failure, which suggests a gap between the knowledge that trainees feel they should have and what actually was delivered after the marketing approval of various structural catheter-based interventional devices and implantable ventricular assist devices. Revision of CV training recommendations, particularly for novel catheter-based interventions, is a major interest globally. Therefore, recognizing the residents’ and/or fellows’ perspectives has particular importance in this area given the small number of rarer structural procedures. The directors of educational programs need to be proactive in advocating a nimble educational program that fits the continued progress in CV management. The opportunity for exposure to these novel therapeutic measures could also intensely affect trainees’ satisfaction in the fields of valvular heart diseases or advanced heart failure; however, with the limited number of hospitals eligible for such therapies, the question arises whether appropriate education in these rapidly evolving subspecialties can be guaranteed in all teaching hospitals. Along the same lines, trainees’ satisfaction levels with peripheral artery diseases and congenital heart diseases were also low, which is a persistent problem because of the limited number of institutions where such patients are actively managed. In order to overcome these unmet needs, we must design national or international training networks to provide adequate training experiences for all trainees.

Moreover, significant changes have occurred in medical student career choices in recent years. No published data exist regarding the trends in interest in subspecialty among cardiology residents; however, in our study, the distribution of trainees interested in coronary artery diseases decreased during the 4 years between surveys. The increases in satisfaction with the other subspecialties were modest and not statistically significant, suggesting that trainees’ interest in subspecialties might have diversified. Further, the satisfaction of cardiology trainees was associated with the completed volume of coronary angiograms in the 2011 survey but not in the 2015 survey, which might be related to the diversification of their interests. We need to reconsider the educational curriculum in order to promote management in the broader field of CV diseases rather than focusing on procedural volumes.

Generally, residents had positive perceptions of and interest in procedure-based subspecialties, but non-procedure-based subspecialties lost appeal across the specialties. However, general cardiology was the 3rd selected area of interest among CV subspecialties in the 2015 survey. Because of the uniquely long life expectancy in Japan, an increase in patients with multiple CV comorbidities is becoming more apparent, which could drive the growing demand for general cardiology. Efforts towards developing attractive educational programs for general cardiology are needed to ensure management of the multiple targets of CV comorbidities (i.e., aggressive systemic treatment and lifestyle intervention).

Previous studies have clarified the reasons for the choice of a particular training resident program; the quality of the educational program and faculty as well as clinical
experience were important factors in their choices.28 Perhaps not surprisingly, we found that in both survey the 3 highest ranked items were “the number of cases managed at the site,” “the number of procedures available at the site,” and the “quality and reputation of the attending staffs.” Similarities to other studies suggest that these training program factors are values that are stable in residents across specialties. “Quality of basic research” was ranked relatively low on the importance scale. The unique perspective of physicians that is inspired by their clinical experience has a central role in advancing medical science. Although relatively low on the importance scale. The unique perspective

Study Limitations

First, we surveyed early-career physicians who participated in annual scientific meetings of the JCS. It was beyond the scope of this study to clarify the perspectives of non-participating residents, who may exhibit different attitudes. Second, our survey included only Japanese cardiology residents and thus may not be applicable to all residents. Finally, our survey was only conducted twice. The satisfaction with training could change in the future, and a regular survey may be needed to design effective responses to the challenges in modern CV training programs. However, our study presented trends in attitudes, experiences, and expectations of young physicians in cardiology. We believe the data from this study provide meaningful information for optimizing the cardiology resident training system.

Conclusions

The satisfaction of early-career cardiologists with their training decreased during the study period, particularly in the fields of valvular heart disease and advanced heart failure, suggesting that the current CV training programs are failing to satisfy the demands of trainees in these rapid evolving subspecialties. Additional efforts are needed to encourage training in these subspecialties, which still have unmet needs.

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References

Early-Career Cardiologists’ Perceptions of Training


Supplementary Files

**Supplementary File 1**

**Figure S1.** Comparison of the number of procedures performed by early-career cardiologists in Japan as the primary operator between the 2011 and 2015 surveys.

**Table S1.** Factors related to early-career cardiologists’ dissatisfaction with their job skills

Please find supplementary file(s): http://dx.doi.org/10.1253/circj.CJ-17-0398