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ORIGINAL ARTICLE

Current status of anesthesia residency in Taiwan: a questionnaire survey

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Abstract
Purpose There are 26 teaching hospitals in Taiwan that provide anesthesia residency training programs (one program per hospital), and only an average of 40 medical graduates are accepted for residency training per year. The aim of this study is to understand how this situation affects the learning and working conditions of anesthesia residents in Taiwan.
Methods A self-structured survey was mailed to all 178 anesthesia residents receiving training in Taiwan in April 20, 2012. Survey questions included resident characteristics, working and learning conditions, satisfaction with resident training programs, and reasons for choosing anesthesiology as a career. In addition to descriptive statistics, linear regression was used to test correlation between working conditions and satisfaction with training programs.
Results The survey was completed by 136 residents. Although the residents' expected optimal working time was 54.1 ± 12.2 h per week, their actual working time was an average of 64.0 ± 15.7 h per week. In addition, the workload included managing 4.2 ± 1.3 operating rooms simultaneously. The ratio of working vs. learning time was 2.2 ± 1.1. Less than 40 % of the residents were satisfied with their training in critical care and pain management. Anesthesia residents with heavier workloads and higher ratios of work vs. learning time had significantly lower satisfaction with their training programs, especially with training environments ($R^2 = 0.169$). General interest in anesthesiology and related work (66.1 %) was the main factor in choosing anesthesia as their career.
Conclusions Anesthesia residents in Taiwan are treated as an integral part of hospital manpower. This may limit the effectiveness of their learning and cause dissatisfaction with their training environment. To improve the current status, anesthesia residents should perform anesthesia in one operating room at a time and some of the anesthesia training hospitals should be suggested for removal.

Keywords Anesthesia resident · Residency program · Satisfaction

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Introduction

Anesthesiologists in Taiwan usually manage four operating rooms at the same time and handle more than twice as many anesthesia cases as anesthesiologists in other developed countries [1]. The heavy workload of anesthesiologists may be responsible for the higher anesthesia-related death rate [2]. These unfavorable working conditions may also be detrimental for medical graduates receiving 4-year anesthesia residency training.

In Taiwan, since 2012, after completing 7 years of undergraduate medical education, all medical graduates are required to take a 1-year general medical training program

(PGY1), and then complete 3–6 years of training in specialties which they choose based on their personal interests. The quota for anesthesia residents authorized by Taiwan's Ministry of Health and Welfare has ranged from 40 to 60 vacancies per year during the past decade. An average of 40 medical graduates per year are accepted for anesthesia residency training programs offered by as many as 26 teaching hospitals (one program per hospital) [3]. As a result, 50 % of the hospitals offering residency training recruit one resident or none. In addition, because there are very limited subsidies (only training fees for first-year residents) available from the Ministry of Health and Welfare, hospitals must pay resident salaries (anesthesia or non-anesthesia residents) almost entirely out of pocket. It is therefore inevitable that hospitals treat anesthesia residents as a regular part of hospital manpower.

The goal of this study is to provide a better understanding of the current status of Taiwan anesthesia residents, including their working and learning conditions, satisfaction with residency programs (curriculum, instruction, and training environment), preparations for board examination, and factors associated with their choice of anesthesia for their future career.

Methods

The protocol for this study was approved by the institutional review board of Taipei Veterans General Hospital (2012-01-030BC).

A questionnaire was first reviewed by an expert panel composed of three anesthesiology professors, one surgery professor, and one public health professor for content validity. The questionnaire was then mailed to all 178 anesthesia residents in Taiwan, including 20 first-year residents (R1), 58 second-year residents (R2), 58 third-year residents (R3), and 42 fourth-year residents (R4), together with an explanation of the research goal, and a pre-stamped envelope to return the completed questionnaire.

The questions included resident characteristics, working and learning conditions, satisfaction with resident training programs (curriculum, instruction and training environment), and factors associated with the choice of anesthesia for their future career. Resident characteristics data included gender, age (25–29, 30–34, 35–39, and ≧40 years), marital status, year of anesthesia residency (R1, R2, R3, and R4), program location, and hospital accreditation level (tertiary hospital: academic medical center; secondary hospital: regional hospital).

For working conditions, actual and expected optimal working hours for an anesthesia resident were calculated as the total working hours per week, the number of night shifts per week, total duty hours on continuous shifts, as well as the expected optimal workload in operation anesthesia (number of operating rooms simultaneously attended).

Learning time refers to the number of hours residents receive training and instruction from anesthesiologist mentors, including anesthesia practice, resident seminars, morbidity and mortality conferences, morning meetings, journal meetings, and bed side teaching. Learning conditions include mentor instruction methods, interaction with mentors, residents' self-evaluation of their readiness to pass anesthesiology board examinations (both written and oral portions), willingness to begin careers as an anesthesiologist and to receive objective structured clinical examination (OSCE) training were assessed.

Satisfaction with residency training was evaluated using five-point Likert scales ranging from 1 "very dissatisfied" to 5 "very satisfied". Answers indicating either "very dissatisfied or "somewhat dissatisfied" were categorized as "dissatisfied", while those either somewhat satisfied or very satisfied were categorized as "satisfied".

Data were analyzed using SPSS for Windows version 18.0 (SPSS Inc. Chicago, IL, USA). Descriptive statistics are displayed as percentages or numbers, mean ± standard deviations. Linear regression was used to test correlation between work hours, number of operation room managed simultaneously, ratio of work hours vs. learning hours and overall satisfaction with their training programs. A p value of <0.05 was considered statistically significant.

Results

Questionnaires were sent to 178 anesthesia residents, and 136 replied, giving a response rate of 76.4 % (R1: 75 %, R2: 74.1 %, R3: 65.5 % and R4: 95.2 %). Table 1 shows that 58.8 % of the respondents were male, only 2.2 % were 35 years old or older, and 65.4 % unmarried. Eleven percent of the respondents were R1, 31.6 % R2, 27.9 % R3 and 29.4 % R4. Based on hospital location, 53.7 % of the respondents worked in northern Taiwan, 23.5 % in central Taiwan, 20.6 % in southern Taiwan, and 2.2 % in eastern Taiwan. In terms of accreditation level, 93.4 % worked in tertiary hospitals.

The survey results showed that the respondents worked an average of 64.0 ± 15.7 h per week, but their self-estimated optimal working time was 54.1 ± 12.2 h per week. Respondents worked 1.9 ± 0.7 duty shifts weekly: 29.6 % worked 24-48 duty hours on continuous shifts during weekdays and 61.6 % worked during holidays (Table 2). For operating room management, 94.9 % of the respondents were in charge of multiple operating rooms simultaneously, with an average of 4.2 ± 1.3 rooms at the same time (3.9 ± 1.1 rooms managed by R1, 4.0 ± 1.3 by R2, 4.1 ± 1.2 by R3 and 4.5 ± 1.3 by

Table 1 Characteristics of anesthesia residents in Taiwan

Variables	*N*	%
Gender ($n = 136$)		
Male	80	58.8
Female	56	41.2
Age group (years) ($n = 136$)		
25–29	85	62.5
30–34	48	35.3
35–39	1	0.7
≥40	2	1.5
Marital status ($n = 134$)		
Single	89	65.4
Married	45	33.1
Year of training ($n = 136$)		
Year 1 resident (R1)	15	11.0
Year 2 resident (R2)	43	31.6
Year 3 resident (R3)	38	27.9
Year 4 resident (R4)	40	29.4
Geography ($n = 136$)		
Northern	73	53.7
Middle	32	23.5
Southern	28	20.6
Eastern	3	2.2
Accreditation level ($n = 136$)		
Tertiary hospital	127	93.4
Secondary hospital	9	6.6

Table 2 Working conditions of anesthesia residents in Taiwan

Variables	Working conditions
Work hours per week	
Actual work hours	64.0 ± 15.7
Perceived optimal work hours	54.1 ± 12.2
Single operating room	7 (5.1)
Multiple operating rooms	129 (94.9)
Number of managed operation rooms	4.2 ± 1.3
Year 1 residents (R1)	3.9 ± 1.1
Year 2 residents (R2)	4.0 ± 1.3
Year 3 residents (R3)	4.1 ± 1.2
Year 4 residents (R4)	4.5 ± 1.3
Duty shifts per week	1.9 ± 0.7
Ratio of working vs. learning	2.2 ± 1.1
Duty hours per week	
Weekdays (h)	
12–24	88 (70.4)
24–48	37 (29.6)
Weekend or holidays (h)	
12–24	48 (38.4)
24–48	77 (61.6)

Data expressed as mean ± SD or *N* (%)

R4). The overall ratio of work time vs. learning time was 2.2 ± 1.1.

During training, 97.8 % of the respondents were supervised by mentors (anesthesiologists) and 85.3 % reported receiving learning support from their mentors. If difficulties arose, 94.9 % felt they could receive assistance from their mentors. Only 19.9 % of the respondents felt confident of passing Taiwan Anesthesiology Board Examination. OSCE training was provided to 78.7 % of the respondents and 59.8 % of them expressed satisfaction with it (Table 3).

For clinical competence training, most respondents were satisfied with the training they received, with satisfaction

Table 3 Learning condition of anesthesia residents in Taiwan

	N	%
An anesthesiologist as the mentor		
Yes	133	97.8
No	3	2.2
Assistance from mentors		
Yes	116	85.3
No	20	14.7
Teaching model		
One mentor to one resident	84	75.0
One mentor to more than one residents	28	25.0
Searching help if confront with difficulties		
Yes	129	94.9
No	7	5.1
Passing rate from self-perception (%)		
≤49	3	2.2
50–74	32	23.5
75–94	74	54.4
≥95	27	19.9
Willingness of being an anesthesiologist in the future		
Yes	117	86.1
No response	17	12.5
No	2	1.5
Receiving OSCE training		
Yes	107	78.7
No	29	21.3
Satisfied with OSCE training		
No	3	2.8
No comments	40	37.4
Yes	64	59.8
Receiving OSCE examination		
Yes	91	66.9
No	45	33.1
Satisfied with OSCE examination		
No	1	1.1
No comments	41	45.1
Yes	49	53.8

highest for training in general surgery anesthesia (80.9 %), and for training in other anesthesia settings as follows: ENT anesthesia (75.7 %), orthopedic anesthesia (75.0 %), obstetrics anesthesia (72.1 %), dental anesthesia (71.3 %), and geriatric anesthesia (71.3 %). Less than 40 % of the respondents were satisfied with their training in critical care, pain management, and transplant surgery anesthesia (Table 4). Overall satisfaction with residency training program was 3.7 ± 0.6 on the five-point Likert scale used. Regression analysis indicated that anesthesia residents who had heavier workloads and higher ratios of work time to learning time had significantly lower satisfaction with residency training programs, and specifically with the program training environments ($R^2 = 0.169$, $p = 0.002$).

Table 5 shows that 86.1 % of the respondents expressed willingness to practice anesthesia after residency training. Reasons given for choosing anesthesia as a career included general interest in anesthesia and related work (66.1 %), the challenging nature of the work (58.5 %), good life quality and more personal time (58.5 %), and less patient contact (53.4 %).

Table 4 Satisfaction with clinical competence training

Variables	Dissatisfied	No comment	Satisfied
General surgery anesthesia	0.0	17.6	80.9
ENT anesthesia	0.0	21.3	75.7
Orthopedic anesthesia	1.5	22.1	75.0
Obstetrics anesthesia	1.5	22.1	72.1
Oral surgery anesthesia	0.7	22.8	71.3
Geriatric anesthesia	0.0	23.5	71.3
Thoracic anesthesia	3.7	21.3	69.9
Neurosurgical anesthesia	2.2	23.5	69.1
Cardiac anesthesia	8.8	25.7	55.9
Pediatric anesthesia	5.9	34.6	53.7
Vascular anesthesia	4.4	30.9	52.9
Pain management	10.3	38.2	39.7
Transplant surgical anesthesia	16.2	37.5	33.8
Critical care	11.0	41.9	33.8

Table 5 Factors associated with selecting anesthesiology as future career

Factors	%
General interest in the specialty and the nature of work	66.1
The challenging nature of the specialty	58.5
Life quality and more personal time	58.5
Less patient contact	53.4
Greater independence of work	43.2
Better salary	19.5
Fewer night duties	4.2
Others	4.2

Discussion

This study found that anesthesia residents in training programs in Taiwan spend more than twice as much time working as in learning during their residency. The heavier the workload residents had, the lower the satisfaction they felt with the training program.

The average number of hours worked each week for anesthesia residents in Taiwan was 64 h; this is similar to work hours reported by Canadian anesthesia residents (60 h) [4]. Anesthesiologists in Taiwan also face long work hours (59.9 h) [1]. According to the guidelines of the US Accrediation Council for Graduate Medical Education (ACGME), duty hours of residents should be limited to 80 h per week for all accredited residency programs [5]. In contrast, the European Working Time Directive (EWTD) limits work hours to a total of 48 h weekly [6]. Extended work shifts were significantly associated with an increase in automobile crashes, serious medical errors, and attention failures among medical trainees [7, 8]. On the contrary, duty hour rules were beneficial to residents' well-being, ability to learn and to safely care for patients, and improved overall satisfaction with resident training experiences [9]. Although the number of work hours per week for anesthesia residents in Taiwan may not appear excessive, when simultaneous management of four operating rooms is included, the workload is significantly higher than in other countries. A previous study has also shown that anesthesiologists in Taiwan face the same working conditions [1]. In addition to anesthesia practice, anesthesiologists must also do teaching and/or conduct research. A previous study showed that each anesthesiologist cared for four or more patients simultaneously. One anesthesia resident usually follows his mentor and therefore is not able to care for only one patient. The workload may therefore be detrimental to learning conditions for anesthesia residents in Taiwan.

In Taiwan, anesthesia teams include anesthesiologists, anesthesia residents, and nurse anesthetists. Most anesthesia induction and extubation is done by anesthesiologists and anesthesia residents. Nurse anesthetists prepare anesthesia supplies and equipment, and monitor the patients during anesthesia. During night shifts and holidays, all team members remain in the hospital and anesthesiologists are responsible for all anesthesia care. When simple emergency anesthesia cases come up, anesthesia residents and nurse anesthetists handle these. Complex cases, however, are handled by anesthesiologists. In addition to resident training (resident seminar, morbidity and mortality conference, morning meeting, journal meeting and bed side

teaching), the amount of various patients should be enough to help anesthesiologists in educating anesthesia residents, especially in the field of pediatric anesthesia, pediatric cardiac anesthesia, critical care, pain management, and transplant anesthesia.

Insufficient training in pediatric anesthesia, pediatric cardiac anesthesia, critical care, pain management, and transplant anesthesia, however, was specifically cited as a reason for dissatisfaction with training programs by survey respondents. Perhaps some training programs did not have enough cases in specific areas for residents to learn. It may also be possible that residents were not allowed to participate in some areas, e.g., pain management and critical care, because of a shortage of manpower in operation rooms.

Training funding is one cause for unsatisfactory training conditions for anesthesia residency in Taiwan. While residency training (including resident salaries and education payments) is funded by Medicare in the USA [10], Taiwan's Ministry of Health and Welfare only provides subsidies for training fee of R1 residents. Otherwise, training hospitals in Taiwan must pay residents' salaries themselves. Inevitably, the anesthesia residents are therefore treated as an integral part of manpower in the hospitals' anesthesia departments, resulting in excessive workloads described above.

In the past decade, the pass rate for the anesthesia board examination in Taiwan has averaged 96.5 % [11], but in our study, only 20 % of the responding residents felt confidence in passing the board examination. This discrepancy might imply that in the view of the anesthesia residents, the board examination (both written and oral portions) does not reflect actual competence. Anesthesia residents reported general interest in anesthesiology and better life quality as the top major factors in choosing anesthesia as a career. A similar attitude was also taken by medical students in the USA [12–15].

In conclusion, anesthesia residents in Taiwan are treated as regular hospital staff. This is one possible source of resident dissatisfaction with their training programs and may reduce the actual effectiveness of the learning environment. To improve this situation, anesthesia residents should perform anesthesia in one operating room at a time. This would improve anesthesia residents' understanding in the clinical changes in an anesthetized patient and the procedures to handle these. Taiwan's Ministry of Health and Welfare should also consider providing more financial support for residents' training fee and salaries. Finally, in order to provide adequate and thorough training for anesthesia residents, the Taiwan Society of Anesthesiologists should consider whether some of anesthesia training hospitals which lack peer competition and anesthesia training cases, such as pediatric cardiac anesthesia and pain management cases, should be suggested for removal.

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