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# Survey on the Education System and National Licensing Examination for Fostering Competent Medical Technologists

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# 우수한 임상병리사 양성을 위한 교육제도 및 국가면허시험제도에 대한 설문조사 분석

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This study aimed at characterizing policy directions to foster competent medical technologists by analyzing the opinions of professors and medical technologists regarding university education and national licensing systems. An online survey questionnaire was distributed to 255 professors and 4,000 medical technologists in August of 2016. Fifty-nine professors (23%) and 1,099 medical technologists (27.7%) responded to the survey. The results were evaluated using descriptive statistics and comparative analysis. Professors and medical technologists agreed that there needs to be an improvement and standardization in both education at universities and practical training at hospitals. Moreover, both groups also thought that it was necessary to reform practical examinations and make improvements in the current licensing system. According to the survey results, professors and medical technologists thought that, the improvement of the quality of university education and hospital practical training should be essential, and the reform of existing national licensing examination should be necessary.

**Key words:** Education system, National licensing examination, Survey

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## INTRODUCTION

The current Korean medical technologist education and training process consists of university education, practical training at hospitals, a national license examination, retraining after obtaining the license, and management. There are many studies about university education [1,2] and practical training at hospital [3,4]. However, the parts of the process as a whole do not interconnected or managed in a systematic manner. Each institution including university, hospital, Korea Health Personnel Licensing Examination Institute (KHPLEI) manage the individual parts of the process independently. As a result, the components of the entire process are not fully communicating or cooperating with one another, and it is hard to say that an integrated system for fostering expert medical technologists is managed successfully. In this study, therefore, a survey has conducted by professors responsible for university education and medical technologists currently working in medical institutions with the objective of contributing to strengthening of the capacity of medical technologists to follow the changes in the public health and medical environments. This study examined respondents' opinions of the university education system, qualification requirements for university professors, criteria for the educational environment, development of a standardized curriculum, a framework for university experiments and training courses, hospital practical training, the foundation of Korean Accreditation of Board of Medical Technology, and the current national licensing examination system. It examined options for developing a new direction and suggested policy directions required for an integrated system for establishing the most effective measures for producing competent medical technologists.

## MATERIALS AND METHODS

### 1. Study design

This study is descriptive analysis of survey data. Survey questionnaire formulated based on literature analysis and validity test.

### 2. Subjects and methods

The content of question was obtained using data from an analysis of the literature as well as the focus group interview that comprised 7 professors and 5 medical technologists. We prepared the questionnaires according to the results, and received consultation from the Korea Association of Medical Technologists (KAMT) and the Korean Association of Biomedical Laboratory Science Professors (KABLSP) for confirming content validity. To identify opinions of professors and medical technologists, a questionnaire-based survey was conducted online by respondent's consent. The questionnaire was distributed to professors at departments of medical technology and medical technologists at hospitals across the country on August 17, 2016, and was retrieved on August 22, 2016. Fifty-nine professors (23%) responded to the survey out of a total 255, and 1,099 medical technologists (27.7%) out of 4000. In keeping with the study's objective, the questionnaire consisted of a general section, an education system section, and a national licensing examination system section. The questions consisted of questions with 5-point Likert scales from "strongly disagree" (1 point) to "strongly agree" (5 points), and selection questions.

### 3. Statistical analysis

The data analyzed using SPSS. Their validity tested by percentages, averages, and standard deviations. The significance of the results between the two groups measured through a Student's t-test.

## RESULTS

### 1. The general characteristics of subjects

The general information of professors and medical technologists has shown in Table 1.

### 2. Education system

#### 1) Qualification requirements for professors

Sixty-seven percent and 68% of the professors agreed

**Table 1.** The general information of professors and medical technologists

| Classification | | Percent (%) | Note |
|---|---|---|---|
| Professors (N=59) | | | |
| Sex | Male | 64.41 | male > female |
| | Female | 33.90 | |
| | Other | 1.69 | |
| Age | Twenties | 0.00 | forties > fifties > sixties > thirties |
| | Thirties | 8.47 | |
| | Forties | 45.76 | |
| | Fifties | 33.90 | |
| | Sixties | 10.17 | |
| | Other | 1.69 | |
| Academic degree | Master | 3.39 | doctor > master |
| | Doctor | 91.53 | |
| | Other | 5.08 | |
| Career | 1~5 year | 23.73 | below 10 year: 60 %, |
| | 6~10 year | 37.29 | above 11 year: 36 % |
| | 11~15 year | 3.39 | |
| | 16~20 year | 6.78 | |
| | Above 20 year | 27.12 | |
| | Other | 1.69 | |
| Job grade | Lecture-charged | 1.69 | assistant professor > |
| | Assistant professor | 45.76 | associated professor > professor |
| | Associated professor | 27.12 | |
| | Professor | 23.73 | |
| | Other | 1.69 | |
| Work region | Seoul | 0.00 | Chungcheong > Gyeongsang > |
| | Gyeonggi | 15.25 | Gyeonggi = Jeolla > Gangwon, Jeju |
| | Chungcheong | 37.29 | |
| | Gyeongsang | 23.73 | |
| | Jeolla | 15.25 | |
| | Gangwon, Jeju | 6.78 | |
| | Other | 1.69 | |
| Medical technologists (N=1,099) | | | |
| Sex | Male | 33.76 | female > male |
| | Female | 64.60 | |
| | Other | 1.64 | |
| Age | Twenties | 29.57 | thirties > twenties > forties > fifties |
| | Thirties | 31.76 | |
| | Forties | 24.75 | |
| | Fifties | 11.28 | |
| | Sixties | 1.09 | |
| | Other | 1.55 | |
| Academic degree | Associate | 39.22 | bachelor > associate> master > doctor |
| | Bachelor | 41.95 | |
| | Master | 10.19 | |
| | Doctor | 6.28 | |
| | Other | 2.37 | |
| Job title | Laboratory technologists | 49.77 | laboratory technologist > |
| | Laboratory supervisor | 24.84 | laboratory supervisor > |
| | Laboratorymanagers | 21.93 | laboratory managers |
| | Other | 3.46 | |
| Career | 1~5 year | 40.13 | below 10 year: 61 %, |
| | 6~10 year | 21.38 | above 11 year: 34 % |
| | 11~15 year | 11.46 | |
| | 16~20 year | 8.83 | |
| | Above 20 year | 15.56 | |
| | Other | 2.64 | |
| Hospital size | Above 500 persons | 33.94 | above 500 persons > below 100 persons > |
| | 300~500 persons | 12.74 | 100-300 persons > 300-500 persons |
| | 100~300 persons | 22.57 | |
| | Below 100 persons | 27.48 | |
| | Other | 3.28 | |
| Work region | Seoul | 23.20 | Seoul = Gyeonggi > Gyeongsang > |
| | Gyeonggi | 23.02 | Jeolla > Chungcheong > Gangwon, Jeju |
| | Chungcheong | 10.37 | |
| | Gyeongsang | 22.02 | |
| | Jeolla | 14.38 | |
| | Gangwon, Jeju | 4.82 | |
| | Other | 2.18 | |

with the need for licensing and industrial field experience, respectively. The medical technologists also demonstrated high distributions of 78% and 70%, respectively (Table 2).

2) Curriculum reform

Seventy-two percent of the professors and 76%, of the medical technologists thought the curriculum should be integrated into a four-year program (Figure 1A). Thirty-seven percent of the professors and 23% of the medical technologists responded that an education accreditation institute should precede the integration. Thirty-five percent and 47% thought that quality management of education should precede the integration, followed by 22% and 23% who thought integration should be implemented through administrative and financial support from the government (Figure 1B). Concerning reforming the department of medical technology to accord with changes in the external environment, 28% of the professors selected strengthening the specialty through integration into a four-year system, and 25% opted for enhancing educational quality through the establishment of an education accreditation institute. Thirty-five percent of the medical technologists chose curriculum reform to promote job seeking at non-medical institutions, and 27% chose a reduction of the admission quota for medical technology studies across the country (Figure 1C). Both the professor and medical technologist groups yielded a high rate of comments on this issue, accounting respectively for 49% and 58% (Table 3).

3) Practical training courses of college

Seventy-seven percent of both professors and medical technologists responded that standardizing practical items for each subject was necessary, and 50% and 82%, respectively, positively supported practical courses with experts from university hospitals as professors (Table 2).

4) Practical training of hospitals

The professors and the medical technologists responded negatively concerning the general propriety of clinical practice, by 49% and 76%, respectively. However, 41% of

**Table 2.** The analysis of education system between professors and medical technologists by Likert scale

| Classification | | Professors (N=59) | | | | | | Hospital medical technologists (N=1,099) | | | | | | *p*-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percent (%) | | | | | Mean (SD) | Percent (%) | | | | | Mean (SD) | |
| | | 5 | 4 | 3 | 2 | 1 | | 5 | 4 | 3 | 2 | 1 | | |
| Qualification of professor | Necessity of license | 45.76 | 22.03 | 10.17 | 11.86 | 8.47 | 3.86 (1.35) | 50.86 | 28.75 | 7.46 | 8.10 | 3.64 | 4.16 (1.1) | 0.098 |
| | Necessity of hospital experience | 33.90 | 30.51 | 15.25 | 11.86 | 6.78 | 3.74 (1.25) | 35.30 | 35.58 | 15.92 | 9.10 | 3.00 | 3.92 (1.07) | 0.29 |
| Practical training of college | Standardization of practical training | 35.59 | 42.37 | 11.86 | 6.78 | 1.69 | 4.05 (0.96) | 33.76 | 44.22 | 15.83 | 3.73 | 0.73 | 4.08 (0.84) | 0.801 |
| | Practical training-specialized professor | 23.73 | 27.12 | 27.12 | 10.17 | 10.17 | 3.44 (1.25) | 44.31 | 38.31 | 12.01 | 1.82 | 1.91 | 4.23 (0.87) | 1.63879E-05 |
| Clinical practical training | Propriety of clinical practical training | 1.69 | 15.25 | 30.51 | 38.98 | 11.86 | 2.55 (0.95) | 1.27 | 3.73 | 15.92 | 45.31 | 31.85 | 1.95 (0.86) | 1.72587E-05 |
| | Propriety of clinical practical training period | 13.56 | 28.81 | 33.90 | 16.95 | 5.08 | 3.29 (1.07) | 3.64 | 12.10 | 32.21 | 31.85 | 18.47 | 2.49 (1.04) | 7.5496E-07 |
| Accreditation board of medical technologist education | Necessity | 35.59 | 30.51 | 18.64 | 8.47 | 5.08 | 3.84 (1.16) | 34.76 | 36.76 | 19.29 | 4.55 | 3.37 | 3.96 (1.01) | 0.455 |

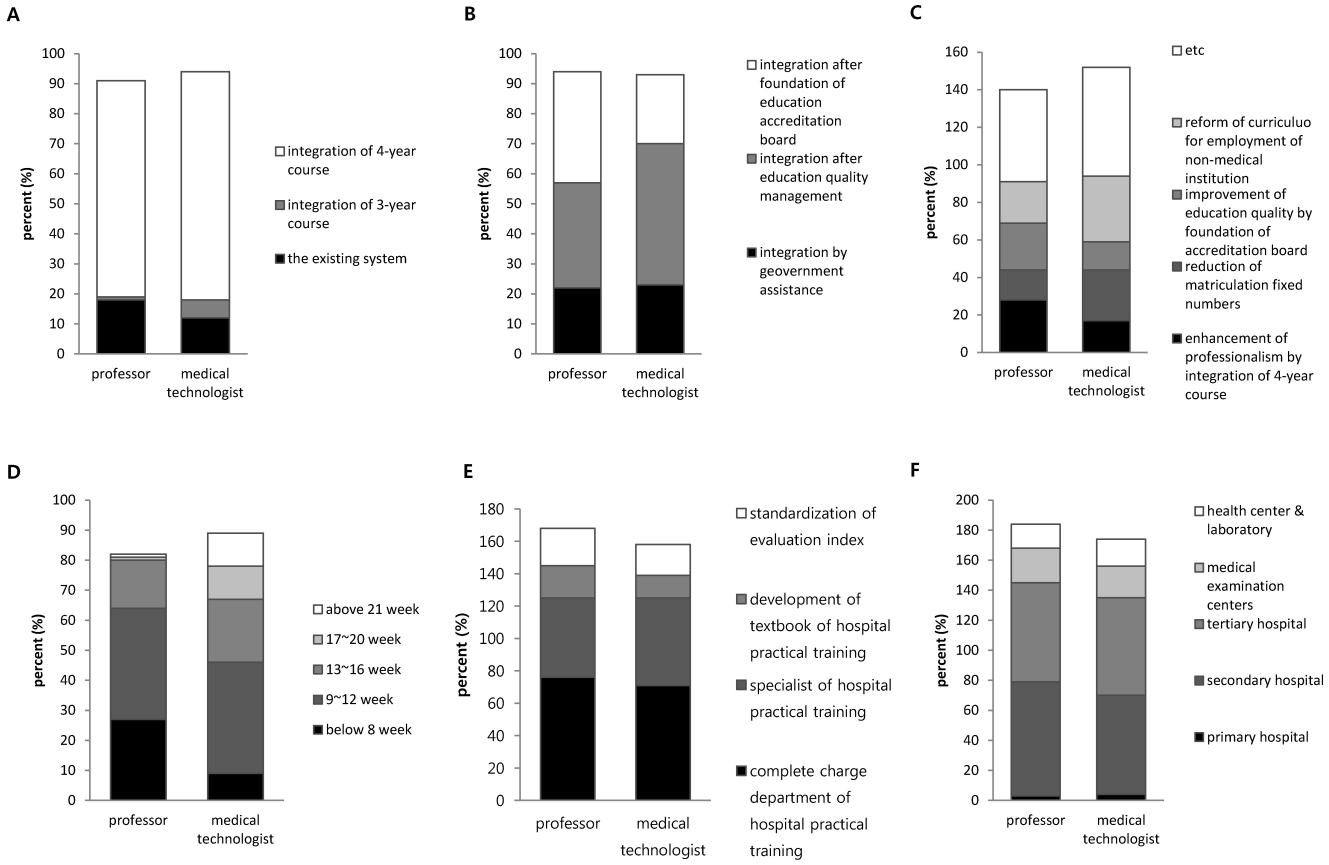


**Figure 1.** Analysis of the survey responses on the education system between professors and medical technologists. (A) Integration of a dual educational system, (B) Prerequisites for the integration into a four-year system, (C) Direction for medical technology education following changes in the external environment (multiple choice), (D) Desirable duration of a hospital practical training period, (E) Items required to standardize hospital practical training (multiple choice), (F) Suitable size of institutions for hospital practical training (multiple choice).

**Table 3.** Other comments on Figure 1C

| Order | Other comments |
|---|---|
| 1 | Education should train students for working at hospitals as professionals (including more practical subjects in curriculum) |
| 2 | Specialties and the level of national examination should be reinforced after the integration into the 4-year system. |
| 3 | The system should be improved to allow students to apply for health educator positions as well as nurse. |
| 4 | Students should be provided with opportunities for job exploration and education in accordance with the changing external environment (jobs should be ramified into diverse job fields). |
| 5 | Education for fostering researchers |
| 6 | It is necessary to make more efforts to strengthen adaptation skills for real tasks. |
| 7 | The quotas of university departments of medical technology should be reduced. The pass rate of the national examination should be downsized. |
| 8 | The number of employed medical technologists according to number of beds should be legally defined. |
| 9 | the curriculum should be reformed and the association should make more efforts to help graduates successfully get a job. |
| 10 | Full-time medical technologists should be available at medical institutions even though testings are outsourced through CROs. |
| 11 | The quality of education and the level of national examination should be increased. |
| 12 | Disqualification per subject should be revived in the national examination. |
| 13 | The value of medical technologist should be elevated. |
| 14 | More lectures should be given by professors with rich experience in major courses and clinical practice. |
| 15 | The gap should be bridged between real medical fields and educational institutions. |
| 16 | It is necessary to reform the curriculum to be based on practical tasks. |

the professors gave a positive response to the duration of clinical practice, compared to a negative response by 50% of the medical technologists (Table 2). The professor and medical technologist groups chose 8 to 12 weeks as the most appropriate period for clinical practice by 37% rates each, the highest responses (Figure 1D). Concerning requirements for standardizing clinical practice, 76% of the professors and 71% of the medical technologists chose the establishment of a department responsible for clinical practice. The two groups chose the employment of clinical practice experts by 49%, and 54%, respectively (Figure 1E). As for the appropriate size of hospitals for clinical practice, the scale of secondary hospitals garnered the highest responses from both the professors and the medical technologists, 76% and 66%. Tertiary-level size received responses of 66% and 65% respectively (Figure 1F).

#### 5) Establishment of Korean Accreditation of Board of Medical Technology Education

The professors and medical technologists supported the establishment of an institute by 66% and 71%, respectively (Table 2).

### 3. National licensing examination system

Forty percent of the professors responded positively to the question of whether national examinations (theoretical examination) are suitable for requiring competent medical technologists from clinical fields, while 32% of the medical technologists responded negatively. Concerning the propriety of the current national examination (practical examination), both the professor and medical technologist groups gave negative responses of 44% and 64% respectively. As to whether the computer-based "Smart Device Based Test (SBT)" is better at evaluating the quality of students' capacity in comparison with the current paper-based test, the professors gave a 35% positive response, 37% negative responses, and the medical technologists gave a 44% positive response. Concerning changes in the current method of practical examination, in which pictures are offered, the professors and medical

**Table 4.** The analysis of national examination system and licensing system between professors and medical technologists by Likert scale

| Classification | | Professors (N=59) | | | | | | Hospital medical technologists (N=1,099) | | | | | | *p*-value |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Percent (%) | | | | | Mean (SD) | Percent (%) | | | | | Mean (SD) | |
| | | 5 | 4 | 3 | 2 | 1 | | 5 | 4 | 3 | 2 | 1 | | |
| National licensing examination | Propriety of theoretical examination | 8.47 | 32.20 | 35.59 | 20.34 | 1.69 | 3.25 (0.94) | 3.73 | 16.47 | 44.13 | 23.75 | 9.55 | 2.8 (0.95) | 0.0007 |
| | Propriety of practical examination | 1.69 | 11.86 | 38.98 | 25.42 | 18.64 | 2.5 (1.0) | 1.27 | 5.10 | 27.48 | 40.31 | 23.75 | 2.18 (0.9) | 0.018 |
| | Efficiency of SBT | 11.86 | 23.73 | 25.42 | 18.64 | 18.64 | 2.91 (1.3) | 8.92 | 35.21 | 38.40 | 9.37 | 6.46 | 3.31 (0.99) | 0.025 |
| | Change of practical examination method | 16.95 | 27.12 | 32.20 | 15.25 | 5.08 | 3.36 (1.11) | 15.65 | 40.40 | 32.67 | 7.64 | 1.82 | 3.61 (0.9) | 0.1046 |
| | Propriety of practical examination subjects | 10.17 | 32.20 | 32.20 | 20.34 | 3.39 | 3.25 (1.01) | 7.19 | 30.48 | 42.58 | 14.74 | 3.18 | 3.24 (0.9) | 0.902 |

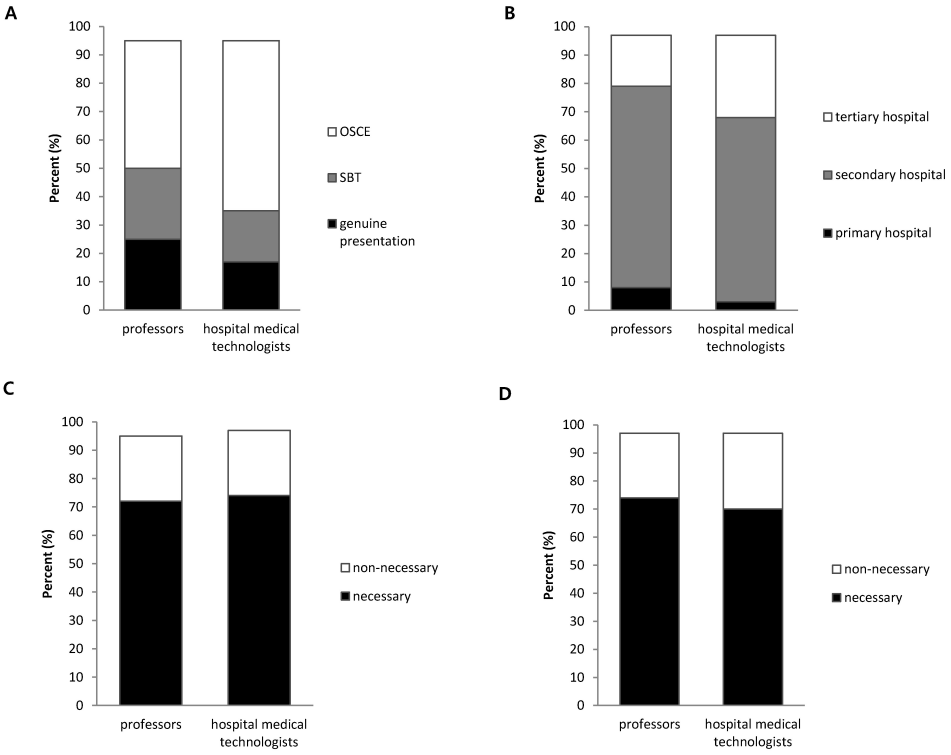


**Figure 2.** Analysis of the survey responses on a national licensing examination system between professors and medical technologists. (A) Method of practical examination, (B) Suitable size of hospitals for practical examination, (C) Necessity for improving the current licensing system, (D) Necessity for a separate certification system for each of the sub majors other than the current licensing system.

technologists gave positive responses of 45% and 56%, respectively (Table 4). For the method to which the practical examination should be changed, the professors and medical technologists chose the OSCE method by 45% and 60%, respectively (Figure 2A); the two groups gave positive responses of 42% and 37%, respectively, concerning the suitability of the subjects currently comprising the practical examination (Table 4). As for the hospital scale, one of the criteria for questions on the current practical examination, both the professors and the medical technologists rated secondary hospitals highly, by 71% and 65%, respectively (Figure 2B).

### 4. National licensing system

Majorities of professors and medical technologists responded that reforming the licensing system currently in effect was necessary, by rates of 71% and 74%, respectively (Figure 2C). The professors and medical technologists responded that a separate certification system for each of sub majors other than the licensing system was necessary, by 74% and 70%, respectively (Figure 2D).

## DISCUSSION

In terms of general characteristics of survey respondents, the region, age, and occupational title of respondents showed an even distribution, which proved the reliability of survey results. In medical technologists, bachelor's degree holders outnumbered college diploma holders. This is probably thought to be the results of increase in 4-year university programs and diversification of education system.

As for the qualification required of professors to produce competent medical technologists, both professors and medical technologists considered that medical technologist license and clinical experience were important to educate medical technologists required at real clinical sites. As for the current dual education system, both professors and medical technologists thought that it was necessary to integrate into 4-year system. The responses showed that education quality management came first as a prerequisite for the integration into 4-year system. Precedent studies also showed that unification of education system by establishing a single 4-year system, and ensuing education

quality reinforcement would help foster medical technologists capable of performing various tasks of the fast-paced medical technology field [5-7].

The professor and medical technologist groups offered varying opinions about the direction of medical technology education depending on the changes in the external environment. The professors mainly prioritized the integration into the four-year system, whereas the medical technologists favored curriculum reform to promote and support job seeking at non-clinical institutions. The professors were positive about the four-year integration as it would strengthen quality education and, in turn, lead to a downsizing of university admission quotas, producing competent medical technologists. However, the medical technologists working at hospital forefronts reflected pessimism due to the saturation of their workplaces, which would probably have led them to suggest job seeking in other fields after graduating with a medical technology degree.

Quite a big gap appeared in the practical education among universities. Regarding this issue, both the professors and medical technologists perceived a necessity for standardizing practical training at educational institutions. Therefore, the Korea Association of Medical Technologists (KAMT) and the Korean Association of Biomedical Laboratory Science Professors (KABLSP) should cooperate to devise a system that will help implement more standardized practical education in a more systematic manner concerning obligatory practical training of university [8].

Concerning current hospital practical training, professors and medical technologists alike responded in large numbers that it was not suitable; particularly the latter gave negative responses. This result implies that there are many problems with the management of clinical practice from the perspective of hospital workers. Standardized clinical practice is suggested to improve current clinical practice. As to the question of what items are required to achieve this improvement, the professors and medical technologists both responded that it was necessary to establish a department responsible for clinical practice at hospitals and to foster clinical practice experts. The KHPLEI reported that the study of improvement of practical examination of medical technologist [9,10]. The results of our study suggest that the KAMT and KABLSP should reach an agreement concerning the practical management quality of clinical practice. It is recommended that hospitals and universities should conduct further in-depth discussion of more effective clinical practical education.

Considering establishing a system for fostering competent medical technologists, many respondents agreed that it was necessary to found Korean Accreditation of Board of Medical Technology Education [11]. The foundation of this institution should be moved forward with more vigor to accelerate the fostering of talented medical technologists with practical skills. In the clinical field, the process of standardization has continuously developing through CAP and ISO certification [12]. In this context, the KABLSP is currently conducting advanced research.

The national examination is in transition from examining the simple memorization capacity to evaluating problem-solving skills through interpreting problems based on knowledge required in real clinical fields. In terms of theoretical examination, questions are allotted more for interpretation or problem solving rather than memorization. Therefore, a continued increase in the proportion of interpretation-based or problem-solving types of questions is recommended. In terms of practical examinations, both the professors and the medical practitioners responded that it was not suitable, and particularly the latter group gave negative responses. Therefore, breaking away from the current indirect practical examination, and introducing OSCE or SBT (multimedia) questions for a more comprehensive examination is recommended. A more complex examination system is required to assess skills and attitude as well as knowledge of applicants. Both the professors and the medical technologists responded that practical examination subjects are suitable. An additional recommendation is further expansion of the area of clinical

physiology, which has recently come to be more diversified and specialized [13,14]. Moreover, it is necessary to establish a pool of test questions for the theoretical and practical examination of the subject of molecular biology.

Regarding the current domestic medical technologist licensing system, the professors and medical technologists agreed that it needs to be improved. In consideration of the job scope of the medical technologist, which requires more specialization and sophistication, the quality of university education, a system of national examination, and a national licensing system should be considered, together with consistency in association with one another to advance this specialization [15-17]. Thus, a review of the licensing system will have to take issues concerning these factors into consideration, including posterior examination through license renewal, regular evaluation of disqualification and job aptitude, and obligatory retraining to maintain competence. Both groups regarded a separate certification system for each sub major other than the existing licensing system as necessary; therefore, institutional efforts should be made to address this issue. As a measure to secure specialization in sub majors, existing education for specialists can be promoted. The education of sub majors will have to be converted into regular courses at formally accredited education institutions to produce specialists. Lastly, the future organization of certification and evaluation of medical technology education will perform more vigorously with the management of a higher-level certification exam and the accreditation of education for medical technology specialists approved in the medical community. On conclusion, these result show that the improvement of the quality of university education and hospital practical training should be essential, and the reform of existing national licensing examination should be necessary for fostering competent medical technologist.

## 요 약

본 연구는 대학 교육제도와 국가면허시험 제도에 대한 교수와 병원실무자들의 의견을 조사하여 분석함으로써 우수한 임상병리사 양성을 위한 정책방향을 결정하는데 목표로 하고 있다. 2016년 8월에 온라인 설문지가 255명의 대학교수들과 4,000명의 병원실무자들에게 배포되었다. 회수율은 교수들은 59명(23%), 병원실무자들은 1,099명(27.7%)이 응답하였다. 결과는 기술통계분석과 비교분석을 통해 처리하였다. 대학 교육제도에서는 교수들과 병원실무자들 모두 대학 및 임상실습 교육의 질적 향상과 교육의 표준화가 필요하다고 조사되었다. 국가면허시험제도에서는 교수들과 병원실무자들 모두 특히 실기시험의 개편이 필요하다고 조사되었고, 면허시험제도도 개선이 필요하다고 조사되었다. 위의 결과들은 교수들과 병원실무자들은 우수한 임상병리사 양성을 위해서는 대학 및 임상교육의 질적 향상과 국가면허시험제도의 개선이 필요하다고 생각하고 있음을 보여준다.

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