INTRODUCTION

Since the 2000s, the number of newly emerging and re-emerging infectious diseases has increased rapidly along with climate change. At the same time, the risk of new infections has increased because of greater probability of overseas infections being introduced to Korea as the number of foreign travelers increases owing to diversification of overseas travel opportunities and international trade [1].

Moreover, it is difficult to understand the domestic outbreak characteristics of emerging infectious diseases or those introduced from overseas, such as Middle East Respiratory Syndrome (MERS) and Ebola, and, although there is a dire need for specialists with accumulation of experience in dealing with various infectious diseases, current selection methods for Epidemic Intelligence Service (EIS) officers show little ability to discriminate and select highly competent resources for the job at hand. Moreover, because it is impossible to function as an EIS officer after being appointed and trained as an EIS officer, there are problems with no accumulation of human resources and expansion of organizational capacity.

In particular, Korea experienced a national health crisis in 2015 due to a MERS epidemic after introduction of MERS patients infected from the Middle East into Korea, and this national health crisis became a starting point in recognizing the great importance of establishing an epidemic defense system for preventing infec-


KEY WORDS: Epidemiologists, Communicable diseases, Education, Surveys and questionnaires
tious diseases. Subsequent to the MERS epidemic, amendments to the regulations regarding prevention and management of infectious diseases established the legal basis for assigning 30 government EIS officers in the Ministry of Health and Welfare and 36 officers in local municipal, including city and provincial, government agencies, and, as such, a fundamental transformation is needed from the perspective of selecting and nurturing human resources to strengthen the epidemiological investigation competency of the Korea Centers for Disease Control and Prevention (KCDC).

EIS officers play a central role in the Korean epidemic defense system against various infectious diseases, and, from its initial pilot program in 1999 to 2015, most EIS officers have comprised public health physicians who have completed the basic training for becoming an EIS officer to serve their military duty as a medical officer. However, because of the nature of public health physicians, it was difficult to select physicians who specialized in infectious diseases, and EIS officers could function in that capacity for a limited time of only 2 years or so after training and assignment. After working in that capacity, most public health physicians who served as EIS officers went to work in their own field of specialty and the private sector, unrelated to public health, as soon as they were relieved of their duties as EIS officers. These physicians were assigned to EIS officer position for their 3 years mandatory military service.

Therefore, the existing EIS officer system showed organizational issues such as failure in both accumulation of human resources with experience and strengthening of the competency to respond against infectious diseases based on such experience.

A lack of EIS officers with specialized expertise was pointed out as one of the causes of the 2015 MERS epidemic, and, as a result, a decision was made to add a significant number of EIS officers as an important part of improving the national epidemic defense system. Consequently, the legal basis was established for assigning 30 government EIS officers in the KCDC and 36 local health department officials [2]. With the change of the existing system of EIS officers from being based on public health physicians to comprising professional government employees, the need for fundamental transformation of EIS officer training to strengthen the epidemiological investigation competency has been heightened from the perspective of selecting and nurturing human resources. In keeping with the change in those who will participate as EIS officers, a revision of the direction of education training courses for EIS officers is urgently required [3].

Accordingly, there is a need to establish base data on systematic improvement in nurturing epidemiological investigation specialists among infectious disease response staff at central (KCDC) and local municipal government levels. At the same time, there is also a need for curriculum reform and content development to strengthen the epidemiological investigation competency in KCDC staff and to address the change in those who will participate as EIS officers. Accordingly, the present study aimed to conduct a questionnaire survey on these topics, analyze the results, and introduce a summary of such findings. Moreover, the study also aimed to examine detailed requirements for improvement and strengthening of comprehensive education on epidemiological investigation, including the curriculum, methods, and contents.

**MATERIALS AND METHODS**

To establish measures for nurturing the epidemiological investigation specialists, the present study selected 175 participants from 4 sectors consisting of 27 academic and clinical specialists, 22 EIS officers, 84 KCDC employees, and 42 local municipal health department officials. A questionnaire survey was conducted on the participants regarding the need for educational training on epidemiological investigation, opinions on educational operation when planning specialist nurturing, and the need for curriculum and competency for performing epidemiological investigation in the epidemiological investigation education program. A total of 173 participants responded to the questionnaire survey for a response rate of 98.9%. The questionnaire survey was conducted between January 25 and March 18, 2016. Analysis was performed using simple frequency and comparison of mean values.

**RESULTS**

The total number of respondents was 173, consisting of 27 specialists (16%), 22 EIS officers (13%), 82 KCDC employees (47%), and 42 local municipal health department officials. There were more females (n = 96, 56%) than males (n = 77, 44%) among the respondents, while < 39 years old was the most common age group (n = 99, 57%) followed by 40–49 years (n = 46, 27%) and ≥50 years (n = 28, 16%). With respect to education level, bachelor’s degree was the most common response (n = 59, 34%) followed by mas-
Table 2. The opinions about the operational of educational training program

| Category                              | A target of educational training |
|---------------------------------------|----------------------------------|
|                                       | KCDC staffs                      | Local officials                 |
| Time per educational training (hr)    |                                  |                                 |
| Mean±SD                               | 53.4±51.6                        | 44.1±45.5                       |
| Min–Max                               | 1–240                            | 2–240                           |
| Median                                | 40                               | 30                              |
| No. of annual educational training (times) |                                  |                                 |
| Mean±SD                               | 6.4±21.3                         | 6.8±21.3                        |
| Min–Max                               | 1–240                            | 1–200                           |
| Median                                | 4                                | 4                               |
| Interval among educational training   |                                  |                                 |
| 1 mo                                  | 12 (10)                          | 6 (7)                           |
| 3 mo                                  | 52 (41)                          | 46 (53)                         |
| 6 mo                                  | 44 (35)                          | 23 (26)                         |
| 1 yr                                  | 18 (14)                          | 12 (14)                         |
| The most appropriate educational training methods |                                  |                                 |
| Lectures and exercises in parallel    | 121 (95)                         | 75 (86)                         |
| Virtual training                      | 7 (5)                            | 11 (13)                         |
| Lectures or online training           | 0 (0)                            | 1 (1)                           |
| No. of people who participate per educational training |                                  |                                 |
| ≤9                                    | 21 (16)                          | 14 (16)                         |
| 10–19                                 | 83 (65)                          | 41 (47)                         |
| 20–29                                 | 22 (17)                          | 28 (32)                         |
| ≥30                                   | 2 (2)                            | 4 (4)                           |
| Others                                | -                                | 1 (1)                           |
| Managing department                   |                                  |                                 |
| Self-operation of KCDC               | 57 (44)                          | 48 (55)                         |
| Contracting out of educational training |                                  |                                 |
| Korea Human Resource development institute for Health & Welfare | 35 (28)                         | 28 (32)                         |
| Need of educational training before arranging task in new employee | 35 (28)                         | 11 (13)                         |
| Yes                                   | 124 (97)                         | 82 (93)                         |
| No                                    | 4 (3)                            | 6 (7)                           |
| Total time of educational training before arranging task in new employee (wk) |                                  |                                 |
| ≤1                                    | 34 (28)                          | 32 (39)                         |
| 2                                     | 49 (40)                          | 26 (32)                         |
| 3                                     | 14 (11)                          | 13 (16)                         |
| 4                                     | 26 (21)                          | 11 (13)                         |

Values are presented as number (%).

Min, minimum; Max, maximum; SD, standard deviation; KCDC, Korea Centers for Disease Control and Prevention.
ter’s (n = 57, 33%) and doctorate (n = 57, 33%) degrees. With respect to affiliation, the responses appeared in the order of KCDC (n = 89, 51%), metropolitan city/provincial government (n = 55, 32%), university (n = 23, 13%), hospital (n = 4, 2%), and Incheon International Airport Quarantine Station (n = 2, 1%). Work period of less than 9 years (n = 105, 61%) was the most common response followed by 10-29 years (n = 30, 17%), 10-19 years (n = 30, 17%), and ≥ 30 years (n = 8, 5%), while type of work appeared in the order of healthcare (n = 60, 66%), nursing (n = 13, 14%), and administrative (n = 12, 13%) (Table 1).

In the survey on the need for specialized education training on epidemiological investigation for KCDC employees and local municipal health department officials, 83% of all respondents (93% of specialists, 83% of KCDC employees, and 67% of EIS officers) responded “yes,” indicating a need for such training for KCDC employees, while 91% of all respondents (95% of local municipal health department officials, 89% of EIS officers, and 85% of specialists) responded “yes” in case of local municipal health department officials (Figure 1).

In the survey on educational operation when planning epidemiological investigation specialist nurturing, different responses were given depending on the target of educational training, as shown in Table 2. For educational training targeting KCDC employees, the mean number of hours per training session was 53.4 while the mean number of annual training sessions was 6.4. For interval between training sessions, 3 months was the most common response (n = 52, 41%) while the combination of lectures and practical exercises (n = 121, 95%) was the most frequent response given as the most appropriate training method. The most common responses to the number of participants per training session and the department in charge of training were 10-19 participants (n = 83, 65%) and self-operation by KCDC (n = 57, 45%), respectively. With respect to the need for training before assigning tasks to new employees, 97% (n = 124) responded “yes” with 2 weeks being the most common response for the length of training prior to assigning tasks to new employees (n = 49, 40%).

For educational training targeting local municipal health department officials, the mean number of hours per training session was 44.1 while the mean number of annual training sessions was 6.8. For interval between training sessions, 3 months was the most common response (n = 46, 53%) while the combination of lectures and practical exercises (n = 75, 86%) was the most frequent response given as the most appropriate training method. The most common responses to the number of participants per training session and the department in charge of training were 10-19 participants (n = 83, 65%) and self-operation by KCDC (n = 57, 45%), respectively. With respect to the need for training before assigning tasks to new employees, 97% (n = 124) responded “yes” with 2 weeks being the most common response for the length of training prior to assigning tasks to new employees (n = 49, 40%).

Table 3. Impact of educational training on epidemiological investigation and the need of programs in educational training

| Category                                      | Impact of education on epidemiological investigation | Need of programs |
|-----------------------------------------------|-----------------------------------------------------|------------------|
|                                               | KCDC staffs | Local officials | KCDC staffs | Local officials |
| Understanding of infectious diseases          |             |                 |             |                 |
| Water-borne infectious disease                | 3.0±0.9     | 2.7±0.9         | 4.2±0.7     | 4.2±0.7         |
| Infectious disease targeted for the vaccination| 3.0±1.0     | 2.8±1.0         | 4.2±0.8     | 4.1±0.7         |
| Chronic infectious disease (HIV, tuberculosis, etc.) | 3.0±0.9     | 2.7±0.9         | 4.0±0.8     | 4.0±0.8         |
| Zoonosis (brucellosis etc.)                   | 2.7±1.0     | 2.4±1.0         | 4.0±0.8     | 3.9±0.8         |
| Vector-borne infection disease (malaria, tsutsugamushi, etc.) | 2.9±1.0     | 2.6±0.9         | 4.2±0.7     | 4.0±0.7         |
| Emerging infectious disease (AI, SARS, Ebola, etc.) | 2.7±1.0     | 2.6±1.1         | 4.4±0.7     | 4.2±0.8         |
| Infectious disease epidemiology               |             |                 |             |                 |
| The concept of epidemiological studies and process understanding | 3.0±1.0     | 2.6±1.0         | 4.5±0.7     | 4.2±0.8         |
| Use of personal protective equipment          | 3.0±1.2     | 2.8±1.1         | 4.4±0.9     | 4.1±0.7         |
| Interview participants                        | 2.7±1.0     | 2.6±0.9         | 4.3±0.9     | 4.1±0.8         |
| Data collection and analysis                  |             |                 |             |                 |
| To understand scale of data and to input data | 3.1±1.1     | 2.6±1.1         | 3.9±1.0     | 3.9±0.9         |
| A descriptive analysis of epidemiological studies | 3.0±1.0     | 2.5±1.0         | 4.1±0.9     | 4.0±0.9         |
| Statistical analysis                          | 2.8±1.0     | 2.3±1.1         | 3.9±1.1     | 3.8±1.0         |
| Sample collection and laboratory testing       |             |                 |             |                 |
| Collecting of the samples, packaging, transportation | 2.9±1.0     | 2.5±0.9         | 3.8±1.0     | 3.8±1.0         |
| To understand the results of the scan of a specimen and analysis | 2.9±1.1     | 2.5±1.0         | 3.8±1.0     | 3.8±1.0         |
| Other capabilities                             |             |                 |             |                 |
| Creating documents (table, chart, etc.)       | 3.5±1.0     | 3.2±1.0         | 3.5±1.1     | 3.7±1.0         |
| Presentation of the result of survey          | 3.0±0.9     | 2.7±1.0         | 4.0±1.0     | 4.0±0.8         |
| Writing the massage on issues of public interest | 2.7±0.9     | 2.7±0.9         | 3.8±1.1     | 3.9±0.9         |
| Writing press releases and media response      | 2.8±0.9     | 2.8±0.9         | 3.9±1.1     | 3.9±0.9         |

Values are presented as mean±standard deviation.

KCDC, Korea Centers for Disease Control and Prevention; HIV, human immunodeficiency virus; SARS, severe acute respiratory syndrome.
DISCUSSION

KCDC began operating Korea Field Epidemiology Program (K-FETP) as a pilot program in 1999. Since that time, it has trained public health physicians and government workers to produce 15-20 EIS officers per year. Public health physicians who completed the 4-week basic EIS officer training, within the curriculum, have been appointed as EIS officers and assigned to central and local health department posts as EIS officers [4,5].

Meanwhile, the Field Management Training Program, supervised and operated by Korea Human Resource Development Institute for Health and Welfare, is also conducting epidemiological investigation training for infectious disease response staff in various levels of local government, but specific time has not been allocated exclusively for strengthening epidemiological investigation competency [6,7].

This is counterevidence to the point that K-FETP operated by KCDC, as the only program in Korea for developing EIS officers, is a very important training program for enhancing the ability to respond to infectious diseases on a national level [8]. Moreover, the fact that the significantly increased number of EIS officers after the MERS epidemic included professional government workers and not existing public health physicians also heightened the need for EIS officer educational training reform. Survey results on need for educational training to strengthen epidemiological investigation competency with 83% of KCDC employees and 95% of local health department officials demonstrate a high demand for reform by those who participate in such educational training. It is determined that these results reflect the fact that KCDC and health department workers who were assigned to the 2015 MERS epidemic recognized on their own a need to grow the ability to perform epidemiological investigation, which was a vital process in responding to infectious diseases. Educational training for strengthening epidemiological investigation competency, targeting KCDC and local health department workers, has the goal of cultivating practical epidemiological investigation competency in local health department officials and healthcare professionals in charge of epidemiological investigation, except EIS officers. Be-
cause educational training for strengthening epidemiological investigation competency still lacks the details for its purpose, participants in such training, core competencies, educational goals, educational topics, methods, and materials, it would be necessary to reference K-FETP when considering expected problems and operational issues that may arise when such training program is implemented. It is also anticipated that the survey results from the present study on various categories about educational training on epidemiological investigation will serve as important data in selecting the areas of focus in the process of future educational training program reform.

CONCLUSION

In conclusion, the need for epidemiological investigation educational training reform and levels of satisfaction in various subcategories of the curriculum found in the present study can be helpful in developing a new educational training program for epidemiological investigation to be implemented in the future, and it is believed that such findings will also make a significant contribution in strengthening the competency of EIS officers who will form the basis of a national epidemic-defense system.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare for this study.

SUPPLEMENTARY MATERIAL

Supplementary material (Korean version) is available at http://www.e-epih.org/.

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