

# A Study on the Cremation Status by the Jurisdiction Area and Outside of the Jurisdiction Area Using the E-Haneul Funeral Information System of Public Cremation Facilities in Gyeonggi-do : Focusing on Before and After the Opening of Public Cremation Facilities in Hwaseong City

Jae Sil Choi<sup>\*</sup>, Yun Ju Nam<sup>\*\*</sup>

*\*Professor, Department of Mortuary Science, Eulji University, Professor, Korea*

*\*\*phD Student, Department of Policy Science, Hanyang University, Korea*

*20160726@eulji.ac.kr, euljinam@naver.com*

## Abstract

*Based on the results of this study, we presented the following policy recommendations to improve the efficiency of operation and management of public cremation facilities. First, we findings the cremation number of all public cremation facilities in Gyeonggi-do increased from 39,918 people before the opening of public cremation facilities in Hwaseong to 55,642 people after the opening, showing a high rate of increase of 15,724 people(39.4%). Therefore, in order to increase the cremation ratio, the policy of expanding the supply of public cremation facilities should be actively pursued. Second, in this study we compared to before the opening of public cremation facilities in Hwaseong City, the ratio of cremation number the jurisdiction area of all public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System increased by 19.0% from 35.9% to 54.9% after the opening, whereas it was analyzed that the outside of the jurisdiction area decreased by 19.0% from 64.1% to 45.1%. Therefore, in order to improve the convenience of citizens using the jurisdiction area, priority should be given to the promotion of policies for the establishment of public cremation facilities by local governments that do not have public cremation facilities. Third, through we research it is analyzed that the cremation ratio of the jurisdiction area of the public cremation facilities in Hwaseong City, which was jointly installed by six local governments located in Gyeonggi-do, was 92.4%, indicating that the ratio proportion of cremation number in the area is very high. Therefore, in order to improve the efficiency of the operation of public cremation facilities, the promotion of policies for joint installation and operation of public cremation facilities should be encouraged.*

**Keywords:** *E-Haneul Funeral Information System, Cremation, Gyeonggi-do, Jurisdiction, Opening.*

## 1. Introduction

---

Manuscript Received: November. 12, 2022 / Revised: November. 16, 2022 / Accepted: November. 17, 2022

Corresponding Author: [euljinam@naver.com](mailto:euljinam@naver.com)

Tel: +82-31-740-7311, Fax: +82-31-740-7364

phD Student, Department of Policy Science, Hanyang University, Korea

In recent years, due to the steady increase in the elderly population, the national deaths number in 2021 was 317,800 people, the deaths number reached the 300,000 people[1]. In addition, the national cremation ratio increased significantly to 90.5% in 2021. Accordingly, the demand for cremation at public cremation facilities using the E-Haneul Funeral Information System, an online cremation reservation system established by the Ministry of Health and Welfare to operate all cremation facilities nationwide as a unified reservation system[2], is also increasing significantly.

Gyeonggi-do, which has the largest population among Korea's regional local government, is currently operating a total of four public cremation facilities, including public cremation facilities in Suwon City, Seongnam City, Yongin City, and public cremation facilities in Hwaseong City, which opened on July 1, 2021.

This study selected a comparative analysis of the change in the cremation number and the cremators ratio by the jurisdiction area and outside of the jurisdiction area using the E-Haneul Funeral Information System before the opening and after the opening recently opened public cremation facilities in Hwaseong City.

In the case of the Metropolitan area such as Seoul and Gyeonggi-do, and Metropolis such as Busan and Daegu, there is a shortage of public cremation facilities due to the increase in the use of public cremation facilities using the E-Haneul Funeral Information System by outside of the jurisdiction area residents. Therefore, social problems are being predicted[3]. Therefore Based on the operating period of public cremation facilities in Hwaseong City, this study compared between before the opening(July 2020 to June 2021) and after the opening(July 2021 to June 2022). In addition, the effectiveness of operation and management of public cremation facilities through investigation and analysis on the effect of the construction of public cremation facilities in Hwaseong-City on the cremation number and cremation ratios by the jurisdiction area and outside of the jurisdiction area using the E-Haneul Funeral Information System of public cremation facilities located in Gyeonggi-do. The purpose of this study is to make policy recommendations to improve.

## 2. Status of Public Cremation Facilities in Gyeonggi-do

As shown in Table 1, according to the operation status of public cremation facilities in Gyeonggi-do as of September 30, 2022, there are a total of four public cremation facilities and a total of 48 sets of cremation furnaces. The scale numbers of the cremation furnaces by the basic local governments in Gyeonggi-do are 15 sets, the largest ones in Seongnam City, followed by 13 sets in Hwaseong City, and 11 sets in Yongin City, 9 and sets in Suwon City[4-7]. As a result of the comparative analysis of the above public cremation facilities, it was analyzed that Seongnam City had the largest cremation furnaces and the highest demand for cremation.

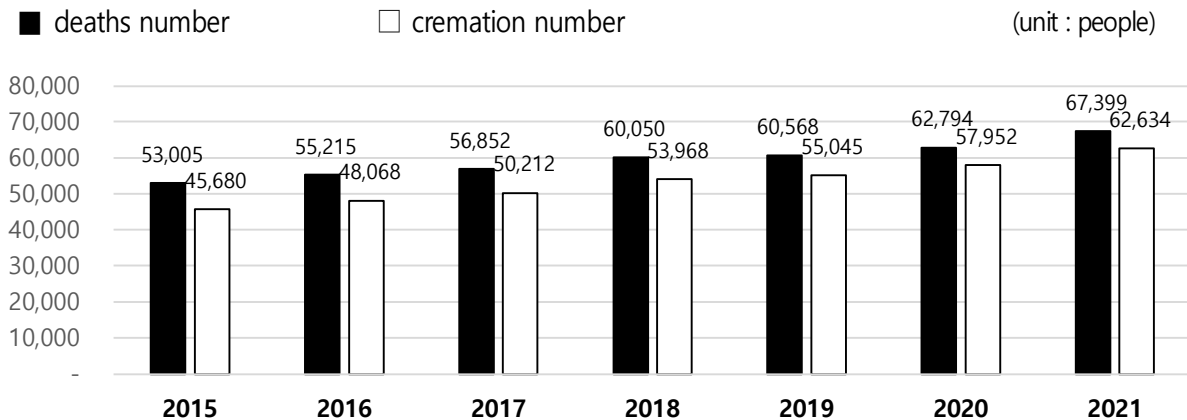
**Table 1. Status of public cremation facilities in Gyeonggi-do(As of June 2022)**

Sort	Cremation Facilities(Locations)	Cremation Furnaces(Set)	Installation Year
Sum total	4	48	
Suwon City	1	9	August 2000
Seongnam City	1	15	August1982
Yongin City	1	11	January 2013
Hwaseong City	1	13	July 2021

## 3. Status of Deaths and Cremators Number in Gyeonggi-do

As shown in Figure 1, the deaths number in Gyeonggi-do during the period from 2015 to 2021 shows a continuous increasing trend every year from 53,005 peoples in 2015 to 67,399 peoples in 2021[8]. and the

annual average deaths number was analyzed to be 59,412 peoples. In addition, it was analyzed that the average annual growth ratio was 4.5%. The cremation number shows a continuous increasing trend every year from 45,680 peoples in 2015 to 62,634 peoples in 2021, and the annual average cremation number was analyzed to be 53,366 peoples[8]. And it was analyzed that the average annual growth rate increased significantly to 6.2%.

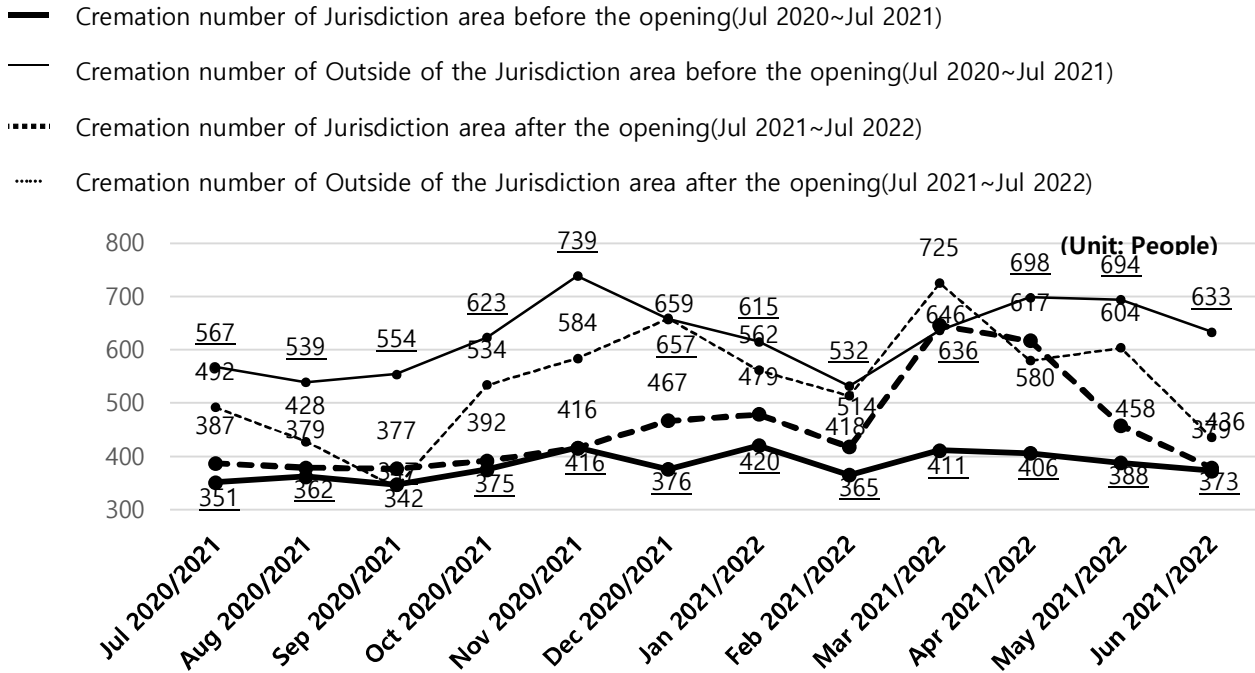


**Figure 1. Progress of deaths and cremation number by year in Gyeonggi-do**

#### **4. Comparative Analysis of the Cremation Number by Jurisdiction Area and Outside of the Jurisdiction Area Using the E-Haneul Funeral Information System Before and After the Opening of the Public Cremation Facilities**

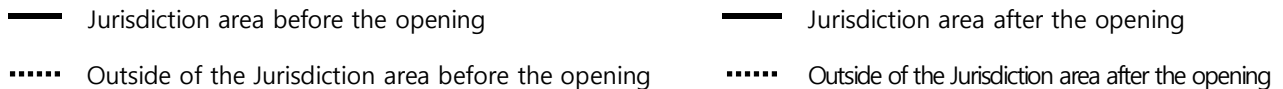
##### **4.1 Public Cremation Facilities in Suwon City**

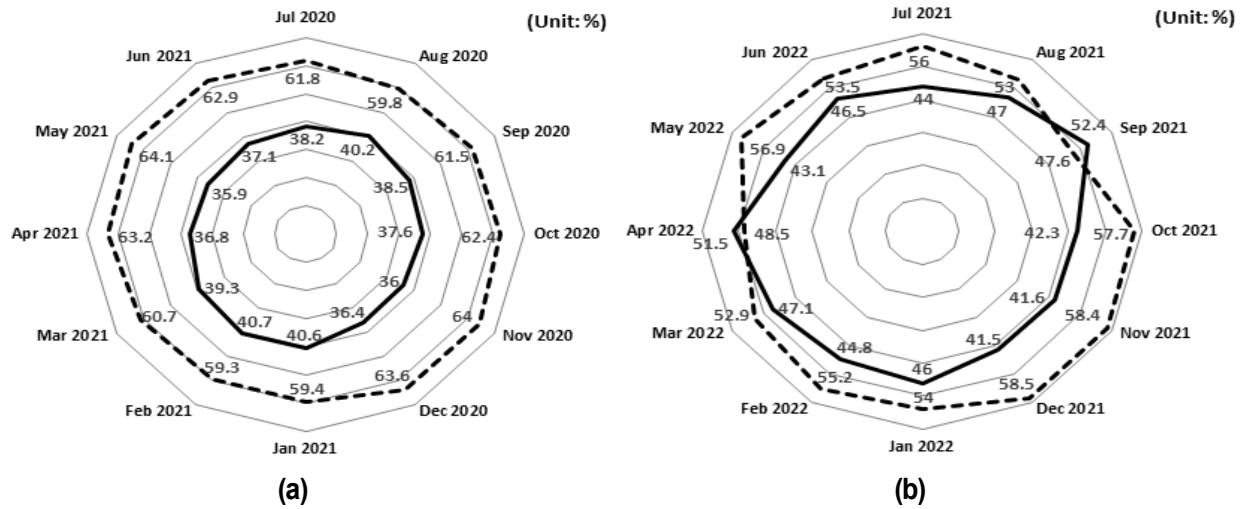
As shown in Figure 2, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Suwon City using the E-Haneul Funeral Information System was 12,077 peoples, with an average Monthly average of 1,006 peoples[8]. Among them, the jurisdiction area was 4,590 peoples(38.0%) and outside of the jurisdiction area was 7,487 peoples(62.0%)[9]. Therefore, it was analyzed that 2,897 peoples(63.1%) were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Suwon City using the E-Haneul Funeral Information System was 11,875 peoples, with an average Monthly average of 990 peoples. Among them, the jurisdiction area was 5,415 peoples and outside of the jurisdiction area was 6,460 peoples[9]. Therefore, it was analyzed that 1,045 peoples were higher in the outside of the jurisdiction area. As a result of the above analysis, the cremation number decreased by 202 peoples(1.7%) after opening compared to before the opening of the public cremation facilities in Hwaseong City. In addition, it was analyzed that 825 peoples(18.0%) in the jurisdiction area increased, whereas the outside of the jurisdiction area decreased by 1,027 peoples(13.7%). It was analyzed that this cause was due to the dispersion of cremation demand due to the opening of public cremation facilities in Hwaseong City.



**Figure 2. Cremation number in public cremation facilities in Suwon City before the Opening and after the opening of public cremation facilities in Hwaseong City**

As shown in Figure 3, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Suwon City using the E-Haneul Funeral Information System was the jurisdiction area was 38.0% and outside of the jurisdiction area was 62.0%[9]. Therefore, it was analyzed that 24.0% were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Suwon City using the E-Haneul Funeral Information System was the jurisdiction area was 45.6% and outside of the jurisdiction area was 54.4%[9]. Therefore, it was analyzed that 8.8% were higher in the outside of the jurisdiction area. As a result of the above analysis, it was analyzed that the cremation ratio in Suwon City after opening compared to before the opening of public cremation facilities in Hwaseong City increased by 7.6% in the jurisdiction area, whereas decreased by 7.6% in outside of the jurisdiction area. .



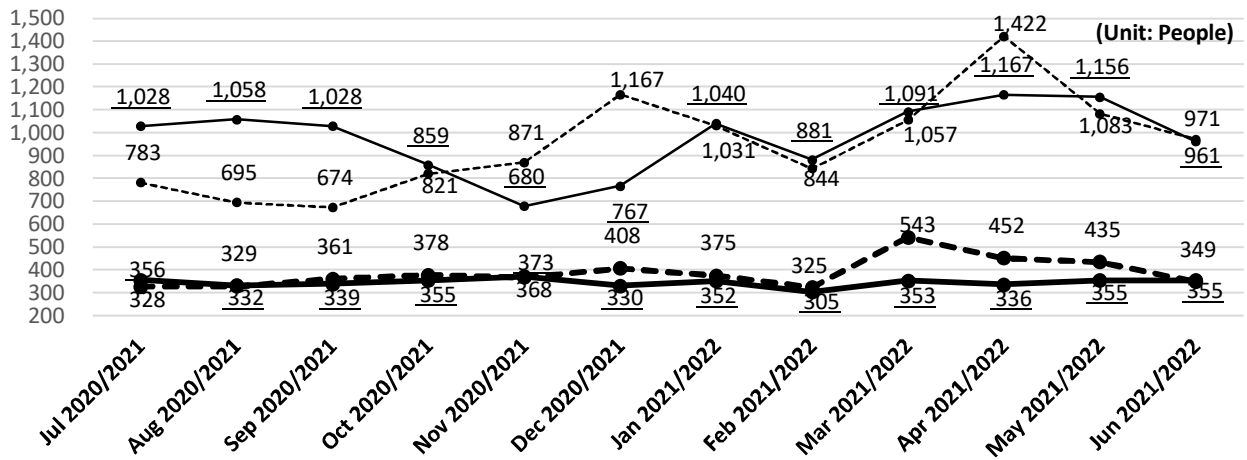


**Figure 3. Cremation ratio (a)before the opening and (b)after the opening of public cremation facilities in Hwaseong City of public cremation facilities in Suwon City**

#### 4.2 Public Cremation Facilities in Seongnam City

As shown in Figure 4, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Seongnam City using the E-Haneul Funeral Information System was 15,857 peoples, with an average Monthly average of 1,321 peoples. Among them, the jurisdiction area was 4,141 peoples(26.1%) and outside of the jurisdiction area was 11,716 peoples(73.9%)[10]. Therefore, it was analyzed that 7,575 peoples(182.9%) were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Seongnam City using the E-Haneul Funeral Information System was 16,070 peoples, with an average Monthly average of 1,339 peoples[10]. Among them, the jurisdiction area was 4,651 peoples(28.9%) and outside of the jurisdiction area was 11,419 peoples(71.1%). Therefore, it was analyzed that 6,768 peoples(145.5%) were higher in the outside of the jurisdiction area. As a result of the above analysis, the cremation number increased by 213 peoples(1.3%) after opening compared to before the opening of the public cremation facilities in Hwaseong City. In addition, it was analyzed that 510 peoples(12.3%) in the jurisdiction area increased, whereas the outside of the jurisdiction area decreased by 297 peoples(2.5%).

- Cremation number of Jurisdiction area before the opening(Jul 2020~Jul 2021)
- Cremation number of Outside of the Jurisdiction area before the opening(Jul 2020~Jul 2021)
- ..... Cremation number of Jurisdiction area after the opening(Jul 2021~Jul 2022)
- ..... Cremation number of Outside of the Jurisdiction area after the opening(Jul 2021~Jul 2022)



**Figure 4. Cremation number in public cremation facilities in Seongnam City before the opening and after the opening of public cremation facilities in Hwaseong City**

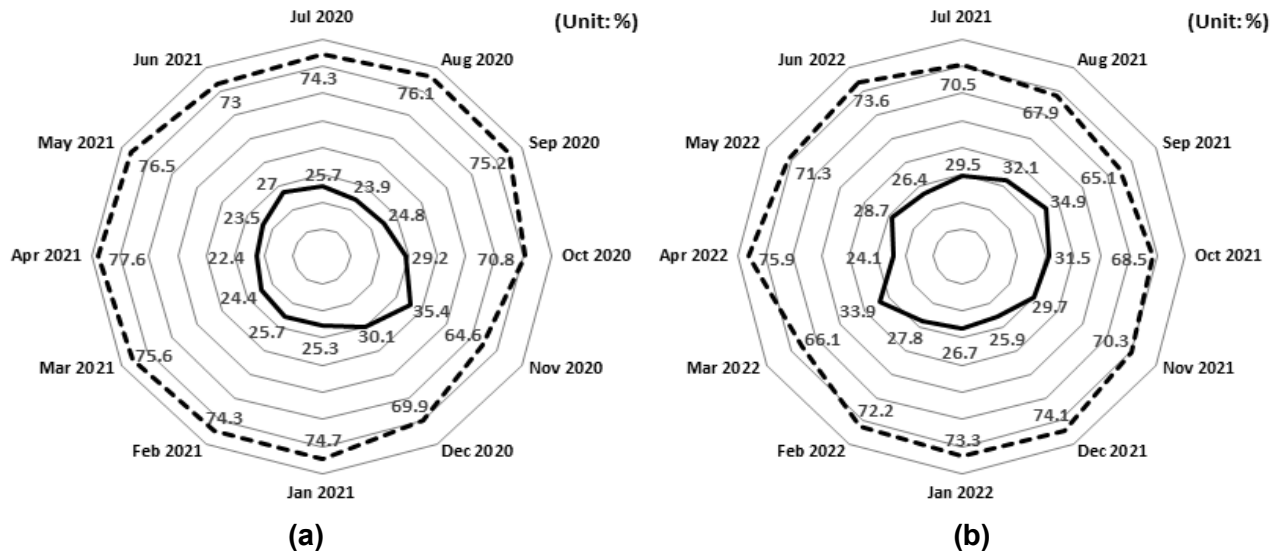
As shown in Figure 5, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Seongnam City using the E-Haneul Funeral Information System was the jurisdiction area was 26.1% and outside of the jurisdiction area was 73.9%[10]. Therefore, it was analyzed that 47.8% were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Seongnam City using the E-Haneul Funeral Information System was the jurisdiction area was 28.9% and outside of the jurisdiction area was 71.1%[10]. Therefore, it was analyzed that 42.2% were higher in the outside of the jurisdiction area. As a result of the above analysis, it was analyzed that the cremation ratio in Seongnam City after opening compared to before the opening of public cremation facilities in Hwaseong City increased by 2.8% in the jurisdiction area, whereas decreased by 2.8% in outside of the jurisdiction area.

— Jurisdiction area before the opening

— Jurisdiction area after the opening

..... Outside of the Jurisdiction area before the opening

..... Outside of the Jurisdiction area after the opening

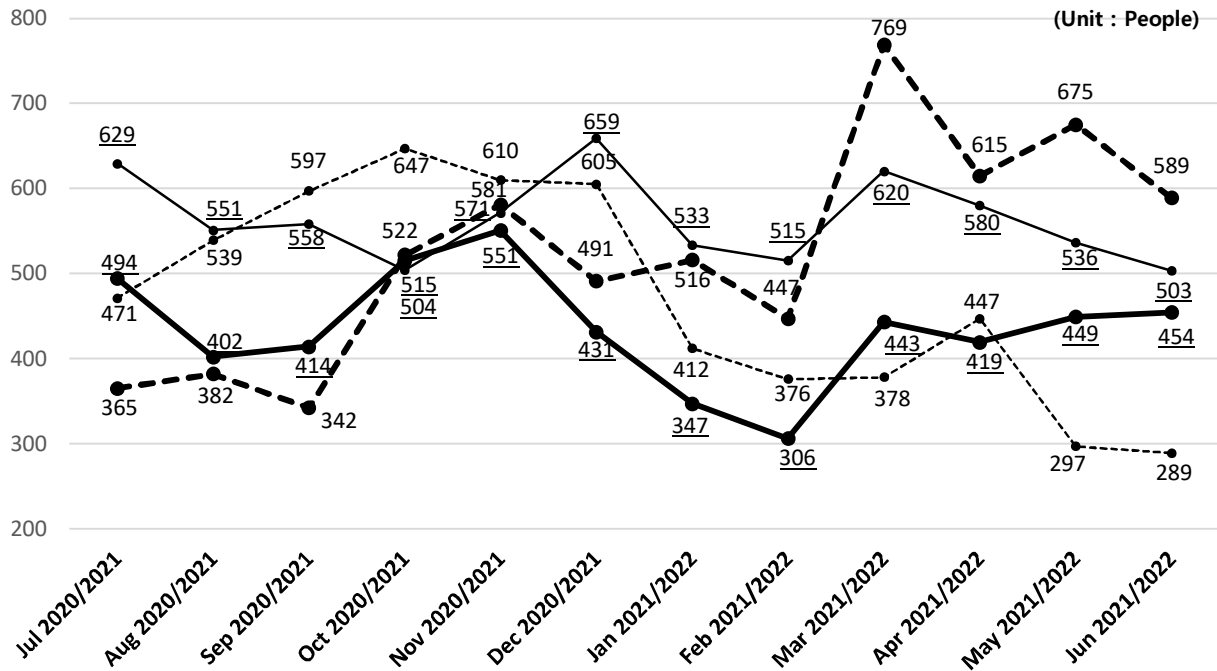


**Figure 5. Cremation ratio (a)before the opening and (b)after the opening of public cremation facilities in Hwaseong City of public cremation facilities in Seongnam City**

### 4.3 Public Cremation Facilities in Yongin City

As shown in Figure 6, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Yongin City using the E-Haneul Funeral Information System was 11,984 peoples, with an average Monthly average of 999 peoples. Among them, the jurisdiction area was 5,225 peoples(43.6%) and outside of the jurisdiction area was 6,759 peoples(56.4%)[11]. Therefore, it was analyzed that 1,534 peoples(29.4%) were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Yongin City using the E-Haneul Funeral Information System was 11,962 peoples, with an average Monthly average of 997 peoples[8]. Among them, the jurisdiction area was 6,294 peoples(52.6%) and outside of the jurisdiction area was 5,668 peoples(47.4%)[11]. Therefore, it was analyzed that 626 peoples(5.2%) were higher in the jurisdiction area. As a result of the above analysis, the cremators number decreased by 22 peoples(0.2%) after opening compared to before the opening of the public cremation facilities in Hwaseong City. In addition, it was analyzed that 1,069 peoples(24.5%) in the jurisdiction area increased, whereas the outside of the jurisdiction area decreased by 1,091 peoples(16.1%).

- Cremation number of Jurisdiction area before the opening(Jul 2020~Jul 2021)
- Cremation number of Outside of the Jurisdiction area before the opening(Jul 2020~Jul 2021)
- ..... Cremation number of Jurisdiction area after the opening(Jul 2021~Jul 2022)
- ..... Cremation number of Outside of the Jurisdiction area after the opening(Jul 2021~Jul 2022)

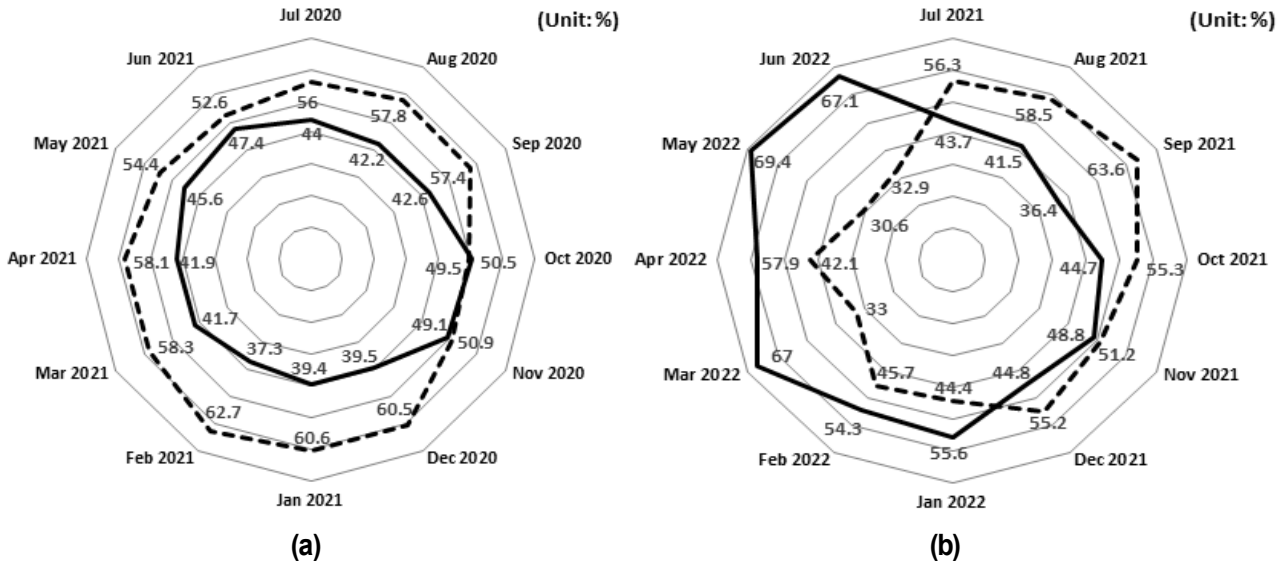


**Figure 6. Cremation number in public cremation facilities in Seongnam City before the opening and after the opening of public cremation facilities in Yongin City**

As shown in Figure 7, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Yongin City using the E-Haneul Funeral Information System was the jurisdiction area was 43.6% and outside of the jurisdiction area was 56.4%[11]. Therefore, it was analyzed that 12.8% were higher in the outside of the jurisdiction area. During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation ratio of public cremation facilities in Yongin City using the E-Haneul Funeral Information System was the jurisdiction area was 52.6% and outside of the jurisdiction area was 47.4%[11]. Therefore, it was analyzed that 5.2% were higher in the jurisdiction area. As a result of the above analysis, it was analyzed that the cremation ratio in Yongin City after opening compared to before the opening of public cremation facilities in Hwaseong City increased by 5.2% in the jurisdiction area, whereas decreased by 5.2% in outside of the jurisdiction area.

- Jurisdiction area before the opening
- ..... Outside of the Jurisdiction area before the opening
- Jurisdiction area after the opening
- ..... Outside of the Jurisdiction area after the opening

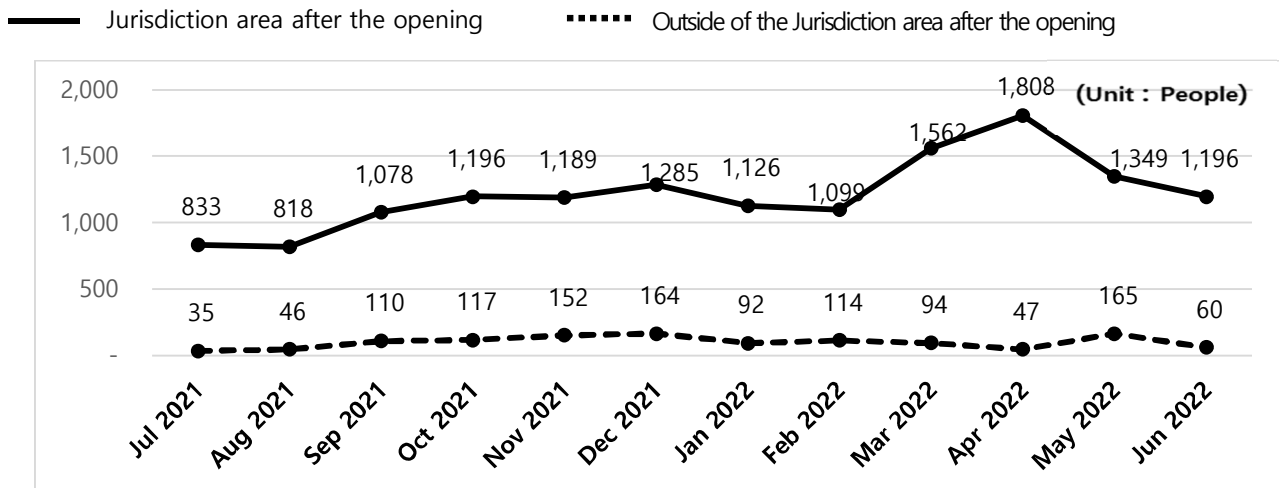




**Figure 7. Cremation ratio (a)before the opening and (b)after the opening of public cremation facilities in Hwaseong City of public cremation facilities in Yongin City**

#### 4.4 Public Cremation Facilities in Hwaseong City

As shown in Figure 8, during the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation number of public cremation facilities in Hwaseong City using the E-Haneul Funeral Information System was 15,735 peoples, with an average Monthly average of 1,311 peoples. Among them, the jurisdiction area was 14,539 peoples(92.4%) and outside of the jurisdiction area was 1,196 peoples(7.6%)[12]. Therefore, it was analyzed that 13,343 peoples(1,115.6%) were higher in the jurisdiction area.

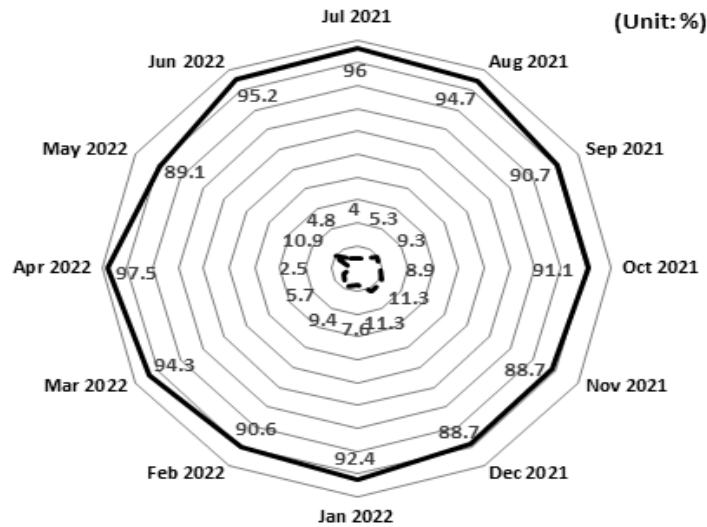


**Figure 8. Cremation number in public cremation facilities in Hwaseong City After the opening of public cremation facilities in Hwaseong City**

As shown in Figure 9, during the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the ratio of cremation number of public cremation facilities in Hwaseong City using the E-Haneul Funeral Information System was the jurisdiction area was 92.4% and

outside of the jurisdiction area was 7.6%[12]. Therefore, it was analyzed that the cremation ratio in the jurisdiction area was 84.8% higher. It was analyzed that the cremation ratio the jurisdiction area to be the highest among public cremation facilities in Gyeonggi-do.

—— Jurisdiction area after the opening      ····· Outside of the Jurisdiction area after the opening



**Figure 9. Cremation ratio the after the opening of public cremation facilities In Hwaseong City of public cremation facilities in Hwaseong City**

## 5. Comprehensive Analysis Results

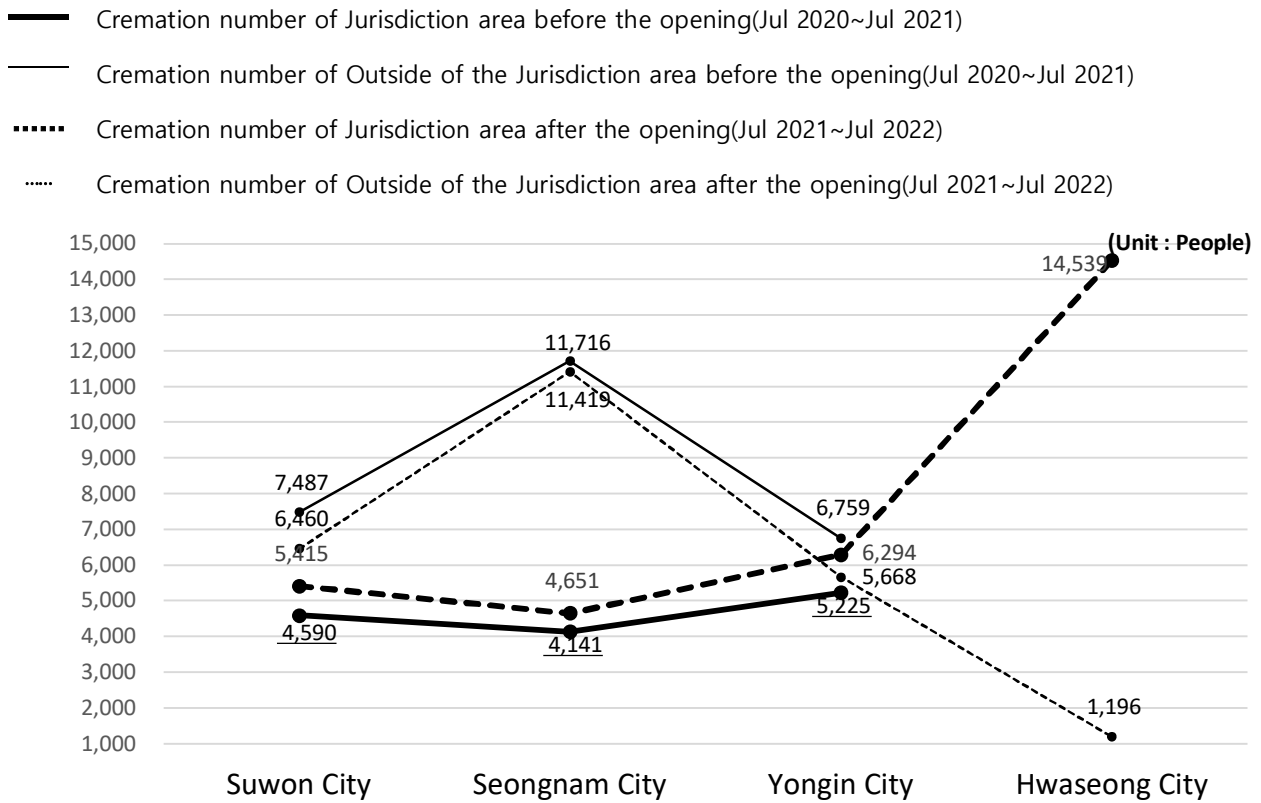
### 5.1 Status of Cremation Number by Public Cremation Facilities in Gyeonggi-do

As shown in Figure 10, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation number of by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System was 39,918 peoples. Among them, the jurisdiction area was 13,956 peoples(35.0%) and outside of the jurisdiction area was 25,962 peoples(65.0%). Therefore, it was analyzed that 12,006 peoples(86.0%) were significantly higher in the outside of the jurisdiction area.

During the period from From July 2021 to June 2022, after the opening of the public cremation facilities in Hwaseong City, the cremation number of by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System was 12,077 peoples. Among them, the jurisdiction area was 30,899 peoples and outside of the jurisdiction area was 24,743 peoples. Therefore, it was analyzed that 6,156 peoples were higher in the jurisdiction area. During the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the cremation number of by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System, it is the highest in Seongnam City followed by Suwon City and, Yongin City. On the other hand, after the opening of the public cremation facilities in Hwaseong City, Seongnam City was the highest, followed by Hwaseong City, Yongin City, Suwon City.

Based on the results of our survey and analysis, it was derived that the total cremators number by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System increased significantly by 15,724 peoples(39.4%) from 39,918 people to 55,642 people after opening compared to before the opening of public cremation facilities in Hwaseong City. It was analyzed that this significantly exceeded the recent(2015-2021) annual average increase rate of the cremation number by 6.2%. The reason for this is that

the construction of public cremation facilities leads to an increase in the demand for public cremation facilities using the E-Haneul Funeral Information System, which has a significant impact on the increase in the cremation number[13].



**Figure 10. Cremation number before the opening and after the opening of public cremation facilities in Hwaseong City**

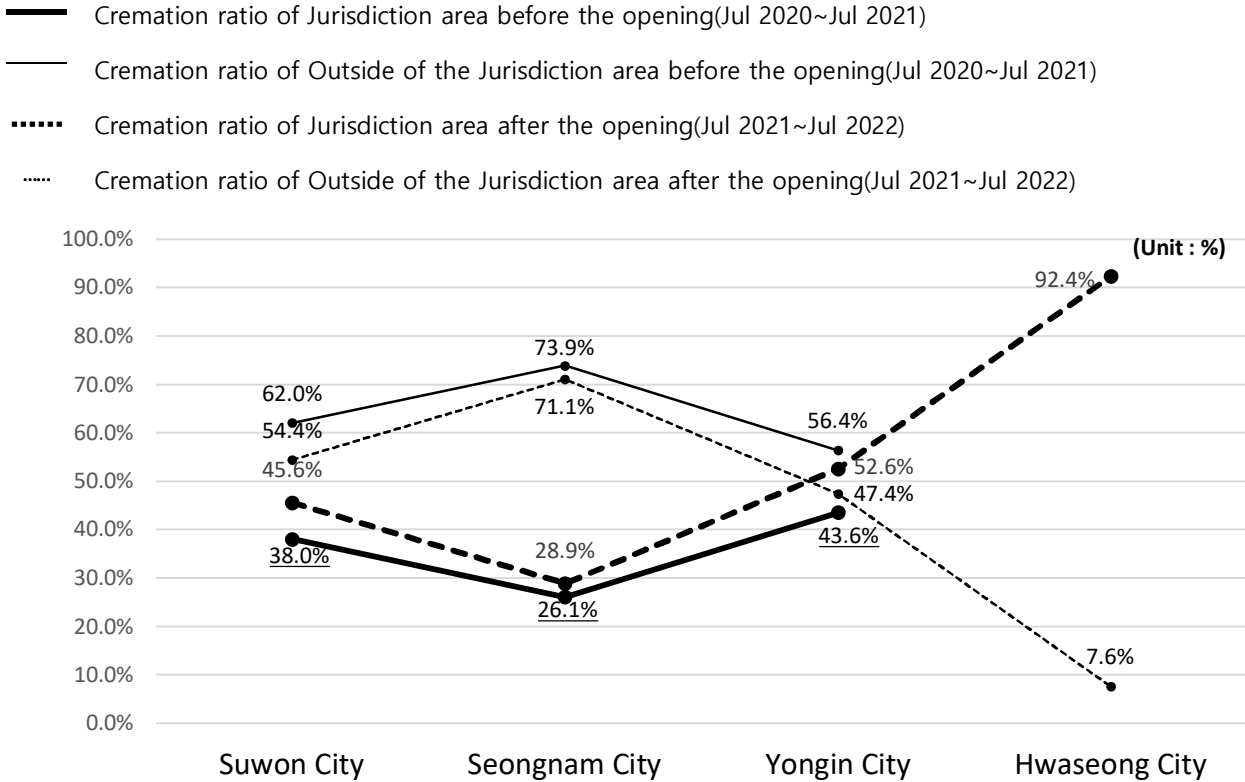
## 5.2 The Cremation Ratio by the Jurisdiction Area and Outside the Jurisdiction Area of Public Cremation Facilities in Gyeonggi-do

As shown in Figure 11, during the period from From July 2020 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the ratio of cremation number by public cremation facilities in Gyeonggi-do.1% in the outside of the jurisdiction area. Therefore, it was analyzed that the outside of the jurisdiction area was 28.2% higher. using the E-Haneul Funeral Information System was 35.9% in the jurisdiction area and 64

During the period from From July 2021 to June 2021, before the opening of the public cremation facilities in Hwaseong City, the ratio of cremation number by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System was 54.9% in the jurisdiction area and 45.1% in the outside of the jurisdiction area. Therefore, it was analyzed that the jurisdiction area was 9.8% higher.

Based on the results of our survey and analysis, it was derived that after the opening compared to before the opening of public cremation facilities in Hwaseong City, the ratio of cremation number by public cremation facilities in Gyeonggi-do using the E-Haneul Funeral Information System increased 19.0% from 35.9% to 54.9% in the jurisdiction area. Whereas decreased 19.0% from 64.1% to 45.1% in the outside of the jurisdiction area. It was

analyzed that the reason for this is that the construction of public cremation facilities leads to an increase in the cremation number in the jurisdiction area using the E-Haneul Funeral Information System, which has a positive effect on the increase in the cremation ratio.



**Figure 11. Cremation ratio by the jurisdiction area and outside of the jurisdiction area before the opening and after the opening of the public cremation facilities in Hwaseong City**

## 6. Conclusion

Based on the survey analysis results of this study, we presented a summary of the research results and policy recommendations as follows. First, we findings the cremation number in all public cremation facilities in Gyeonggi-do increased from 39,918 people before the opening of public cremation facilities in Hwaseong City to 55,642 people after the opening 15,724 people(39.4%) of it shows a high ratio of increase. Therefore, as it is analyzed that the establishment of public cremation facilities has a significant impact on cremation growth, policies to expand the supply of public cremation facilities should be actively pursued to increase cremation ratio by local governments. Second, As a result of we study, after the opening of public cremation facilities in Hwaseong City, the cremation ratio of the jurisdiction area in the all public cremation facilities in Gyeonggi-do using the E-Haneul funeral information system increased by 19.0% from 35.9% to 54.9% after opening, whereas that the outside of the jurisdiction a increased from 64.1% to 45.1%, A decrease of 19.0% was analyzed. Therefore, it was analyzed that the establishment of a public cremation facilities had a significant impact on the increase in the cremation number of the the jurisdiction area. Accordingly, in order to enhance the convenience of citizens using public cremation facilities, the local government's policy to build public

cremation facilities should be prioritized. Third, through we research after the opening of public cremation facilities in Hwaseong City, the cremation ratio of the jurisdiction area in Yongin City 52.6%, Suwon City 45.6%, and Seongnam City 28.9%, whereas Hwaseong City was jointly established by six local governments, accounted for 92.4%. Therefore, as in the case of Hwaseong City, it is analyzed that public cremation facilities jointly installed and operated between local governments have a positive effect on the increase of the cremation ratio in the jurisdiction area. Accordingly, in order to resolve the NIMBY phenomenon conflict in the process of building public cremation facilities and to improve the efficiency of public cremation facilities operation, the promotion of policies for joint installation and operation of public cremation facilities between local governments should be encouraged.

## References

- [1] Statistics Korea, “2021 Population Trend Survey Birth and death statistics (provisional)”, 2022.2.22.
- [2] J. S. Choi and J. L. Kim, “Statistical Analysis of the Usage Type of Online Cremation Reservation Service in Funeral Information System: Focused on the Public Cremation Facilities of Incheon Metropolitan City,” *International Journal of Internet, Broadcasting and Communication(IJIBC)*, Vol. 10, No. 4, pp. 12-18, November 2018.  
DOI: <http://dx.doi.org/10.7236/IJIBC.2018.10.4.12>.
- [3] J. S. Choi and J. L. Kim, “Comparison on Regional Current Status of usage of the Public Cremation Facilities through the Online Cremation Reservation Service of Funeral Information System: Focused on the Incheon Metropolitan City,” *International Journal of Internet, Broadcasting and Communication(IJIBC)*, Vol. 10, No. 4, pp. 37-42, November 2018.  
DOI: <http://dx.doi.org/10.7236/IJIBC.2018.10.4.37>.
- [4] Suwon Urban Development Corporation, <https://www.suwonudc.co.kr/suwonyhj/PageLink.do>, 2022.10.7.
- [5] Seongnam City, <https://www.seongnam.go.kr/city/1001267/10852/contents.do>, 2022.10.7.
- [6] Yongin urban Corporation, [https://www.tranquil-forest.or.kr/main\\_new/m01/3/](https://www.tranquil-forest.or.kr/main_new/m01/3/), 2022.10.7.
- [7] Hwaseong urban Corporation, <https://hbm.hsuco.or.kr/hambaeksan/www/20/200100.jsp>, 2022.10.7.
- [8] Korea Funeral Culture & Policy Institute, December 2021 Cremation Statistics, 2022.3.7.
- [9] SuwonCity, Data of Request to Information Disclosure, 2022.9.28.
- [10] Seongnam City, Data of Request to Information Disclosure, 2022.9.28.
- [11] Yongin City, Data of Request to Information Disclosure, 2022.9.28.
- [12] Hwaseong City, Data of Request to Information Disclosure, 2022.9.28.
- [13] J. S. Choi and J. L. Kim, “Analysis of the Effect of Construction of Public Cremation Facilities in Jeongeup City on Cremators Number Using E-Haneul Funeral Information System in Jeollabukdo and on Cremation Rate,” *The Journal of the Institute of Internet Broadcasting and Communication (IJASC)*, Vol. 10, No. 1, pp. 117-124, March 2021.  
DOI:<http://dx.doi.org/10.7236/IJASC.2021.10.1.117>.