



# Body donation trends in Yonsei University: a statistical analysis of donor records

Hyun Jin Park<sup>1</sup>, Haeryun Ahn<sup>2</sup>, Eunji Ki<sup>3</sup>, Je Seong Lee<sup>4</sup>, Yiseul Choi<sup>5</sup>, Kyung-Seok Hu<sup>1</sup>, Yong-Min Chun<sup>6</sup>, Hee-Jin Kim<sup>1</sup>

<sup>1</sup>Division in Anatomy and Developmental Biology, Department of Oral Biology, Human Identification Research Institute, BK21 FOUR Project, Yonsei University College of Dentistry, Seoul, Korea, <sup>2</sup>BSc Psychology, Department of Health and Science, Coventry University, Coventry, United Kingdom, <sup>3</sup>Department of Psychology, New York University, New York, NY, <sup>4</sup>MD Candidate, Eastern Virginia Medical School, Norfolk, VA, USA, <sup>5</sup>Department of Advanced General Dentistry, Human Identification Research Institute, Yonsei University College of Dentistry, Seoul, <sup>6</sup>Department of Orthopaedic Surgery, Arthroscopy and Joint Research Institute, Yonsei University College of Medicine, Seoul, Korea

**Abstract:** Body donation trends in Korea have changed significantly over the last 3 decades. Establishing a body donation system will promote donations to universities for academic purposes. Yonsei University College of Medicine started its own body donation system in 1992, including documenting donors' records. However, there has been no reported attempt to analyze the trend of these records, which could provide noteworthy information that can be interpreted for medical advances. This study performed a statistical analysis of the donors' records between 1992 and 2019 to analyze the sociological and anthropological changes. Donor personal information such as sex, age, religion, and place and cause of death were extracted from the Yonsei University College of Medicine database. Our statistical analysis revealed significant correlations between donors' records and the changes in the number of geriatric hospitals, religious beliefs, number of donations, and donor age.

**Key words:** Body donation, Trend, Yonsei University, Donors' records, Statistics

Received October 5, 2020; Revised December 8, 2020; Accepted December 8, 2020

## Introduction


Until 1971, it was difficult to satisfy cadaver donation demands in Korea for educational purposes, since each university had its own unorganized system, which hindered a stable supply. The Seoul Conference Faculty established the committee that organizes the body donation system in Korea, and from March 1972 that committee provided accessible means for efficient body donation to universities. However, due to legal issues, universities received barely 1 cadaver for every 30 to 40 students. Prior to 1992, local governments

provided corpses of death-row prisoners and those of people who died without surviving relatives for cadaver laboratorial use and educational purposes [1]. Yonsei University College of Medicine initiated its own advanced body donation system in 1992 in an effort to resolve this deficit. Currently, in order to donate one's body, a donor consent form must be obtained from both the donor and their family members.

A favorable environment for body donation was created through the Revised Act of Corpse Dissection and Preservation law in January 1995 and the organ donation campaign started by a Christian pastor, which later expanded its interest into full-body donations. Most medical universities in Korea had no difficulties receiving body donations from 2006. In the present day, most of the cadavers used in anatomy laboratories are from body donations. Universities take care of the donors with respect and have constructed memorial stones and charnel houses to tribute their deeds [1].

As cadaver supply has been stabilized, there have been

### Corresponding author:

Hee-Jin Kim   
Department of Oral Biology, Yonsei University College of Dentistry,  
Seoul 03722, Korea  
E-mail: [hjk776@yuhs.ac](mailto:hjk776@yuhs.ac)

Copyright © 2021. Anatomy & Cell Biology

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

significant changes in body donation trends, which are influenced by various societal factors. Such changes play even more significant roles in body donation trends in areas where dramatic social change has occurred, such as Korea [2]. Since 1989, the Korean National Health Insurance has extended its coverage nationwide, affecting the organization of the health care system in Korea and creating a new trend in body donation.

Christianity is one of the representative conventional philosophies in Korea, while public understanding and levels of adaptivity with the traditional values of Confucianism still remains. While traditional Korean Confucianism values passed down from parents reject any form of unnatural disturbance of the body, therefore objecting to the idea of body donation, altruistic values of Christianity have encouraged more people to donate their body for academic purposes [3, 4]. Because Yonsei University is one of the leading Christian educational organizations in Korea, it has received many body donations and recorded clinically relevant donor information.

In the last 3 decades, Korean philosophical norms have barely changed while healthcare reform affects the target population's lives daily, yet few changes have been made to factors correlating with body donation trends. This article investigates the statistical value of correlating factors that influence these trends.

## Materials and Methods

### Subjects

The research subjects came from 2,418 body donations made to Yonsei University College of Medicine between 1992 and 2019. Consent forms containing detailed information were obtained from the donors themselves and their family members prior to their death.

### Methods

The data set was based on death records collected from Yonsei University College of Medicine. Age, sex, religion, and place and cause of death were analyzed using IBM SPSS Statistics for Windows, Version 23.0 (IBM Co., Armonk, NY,

USA) for one-way ANOVA, chi-square, and frequency-table tests, as appropriate. Time frames, each year, were compared to investigate the effects of each factor on the general trend of body donation in Korea. The statistical  $P$ -values were calculated using parametric tests, and a value of  $P < 0.05$  was considered to be statistically significant.

Cause of death was defined based on the 19-Chapter Classification from the Korean Standard Classification of Diseases and Causes of Death.

## Results

This study indicated that the number of body donations made to the Yonsei University College of Medicine from 1992 to 2019 increased from 7 to 128 annually.

### Sex and mean age

Total of 2,415 (three unknown cases of stillborn and 0 years old body donation). There were more female than male body donations (Table 1). The mean age of the donated bodies was 71.74 years. There was a sharp increase in the mean body donation age between 1992 and 1997, a period that also had small numbers of total body donations, due to a large number of 0- to 1-year-old bodies being donated previously

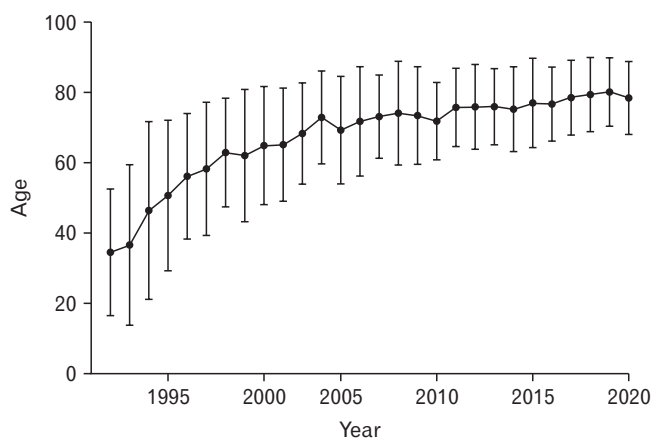


Fig. 1. Age distribution of donors by year, with significant differences each year indicated using a one-way ANOVA test ( $P < 0.001$ ). Data are mean and standard deviation values.

Table 1. Number of body donors by year

S	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	T
M	5	21	25	35	31	31	36	46	49	54	56	36	41	47	44	54	43	44	46	71	63	61	74	97	78	76	76	72	1,412
F	2	3	14	12	10	18	16	37	42	49	38	29	33	39	46	43	36	30	32	38	50	45	50	52	61	68	54	56	1,003
T	7	24	39	47	41	49	52	83	91	103	94	65	74	86	90	97	79	74	78	109	113	106	124	149	139	144	130	128	2,415

S, sex; M, male; F, female; T, total.

(Fig. 1). There was also a gradual increase in the mean age for body donation over time ( $P < 0.001$ ).

### Religion

Of the 2,418 donations, only 1,583 had data on their religion. Of these, 84.5% were Christian, 4.0% were Catholic, 3.9% were Buddhist, 7.5% had no religion, and 0.1% were others (Confucianism) (Fig. 2).

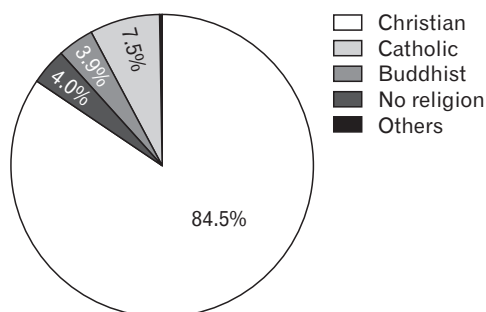


Fig. 2. Donor religions. Of the 1,583 who verified their religion, 84.5% were Christian, 4.0% were Catholic, 3.9% were Buddhist, 7.5% had no religion, and 0.1% were others (Confucianism).

### Place of death

Place of death was only documented from 2005 (Table 2), and was categorized into the home, hospital, geriatric hospital, nursing home, and others. This table indicates how the trend for place of death changed over time. The numbers of nursing facilities (geriatric hospitals and nursing homes) increased from early 2000, as did the numbers of deaths in these facilities, while home deaths decreased. Analysis was performed using a chi-square test, and the place of death result was statistically significant ( $P < 0.001$ ) (Table 2).

### Cause of death

Cause of death has been documented since 1994 for 2,259 bodies (death by unknown factors and undocumented causes of death were not included) (Table 3). There were 19 official factors causing death, as listed in Table 3. The most common cause of death was neoplasm (37.2%). Death by old age was included in symptoms, signs, and abnormal clinical and laboratory findings not elsewhere classified, accounting for 302 of the 336 cases. The following four cause-of-death factors were not included due to no confirmed cases being present: (1) diseases of the eye and adnexa, (2) diseases of the ear and mastoid process, (3) diseases of the skin and subcutaneous

Table 2. Place of death by year

Place of death	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19
Home	29	40	31	24	18	22	24	17	11	15	21	26	25	24	18
Hospital	46	45	53	40	44	38	51	69	56	62	75	70	65	71	71
Geriatric hospital	4	0	6	7	7	9	14	15	18	25	31	16	32	29	36
Nursing home	3	2	5	3	0	3	11	8	8	4	8	11	14	4	2
Etc.	4	3	2	5	5	6	9	4	13	18	14	16	8	2	1
Total	86	90	97	79	74	78	109	113	106	124	149	139	144	130	128

Table 3. Cause of death

Cause of death	Frequency	Percent (%)
1. Certain infectious and parasitic diseases	149	6.6
2. Neoplasms	840	37.2
3. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	6	0.3
4. Endocrine, nutritional and metabolic diseases	34	1.5
5. Mental and behavioural disorders	7	0.3
6. Diseases of the nervous system	61	2.7
9. Diseases of the circulatory system	400	17.7
10. Diseases of the respiratory system	209	9.3
11. Diseases of the digestive system	75	3.3
13. Diseases of the musculoskeletal system and connective tissue	3	0.1
14. Diseases of the genitourinary system	76	3.4
16. Certain conditions originating in the perinatal period	2	0.1
17. Congenital malformations, deformations and chromosomal abnormalities	2	0.1
18. Symptoms, signs and abnormal clinical and laboratory findings	336	14.9
19. Injury, poisoning and certain other consequences of external causes	59	2.6
Total	2,259	100.0

tissue, and (4) pregnancy, childbirth, and the puerperium.

Table 3 lists the causes of death from 1994 to 2019. Death by neoplasm was the most common each year. The Yonsei University College of Medicine stopped receiving body donation from suicide cases due to ethical issues after 2004, which is included in injury, poisoning, and certain other consequences of external causes. Analysis was performed using a chi-square test, and the cause of death result was statistically significant ( $P < 0.001$ ) (Table 3, Supplement Table 1).

## Discussion

The Yonsei University College of Medicine started receiving body donations from 1992. The reason for the dramatic increase in mean age immediately following 1993/1994 is due to prior donations including a large proportion of deaths at 0 to 1 years old, including stillborn cases.

The increase in the mean age of donated bodies could be due to the increased mean age of death in Korea. In 1983, the age range of 70 to 79 years had the largest number of deaths (51,700, 20.3%) from the total of 254,600, with the age range of 60 to 69 years having the second largest (48,400, 19.0%) according to a population investigation by the National Statistical Office of Korea. In 2019, the age range of over 80 years had the most deaths (138,600, 70.0%) followed by the age range of 70 to 79 years (68,300, 23.1%) from the total of 295,100 [5]. This increase in the mean age of body donation reflects the trend found in our research (Fig. 1).

Modern-day Korean society has established its national identity in its conventional belief of Confucianism [6]. Confucianism emphasizes the importance of preserving the body received from your parents, resulting in a prevalence of burial after death. Funeral culture was generally focused on burial amongst Koreans until the mid-1990s. The Korean government promoted cremation as part of funeral culture in the early 1990s to solve the nationwide problem of the lack of space caused by centuries of burial funerals [7, 8].

Another factor fueling the dramatic change from burial culture to cremation is the societal change in religious beliefs from Confucianism to Christianity, since Christian values play a significant role in altering mindsets toward body donation. A social movement encouraging cremation was initiated by Protestant ministers in December 1998, who opened the 'Christian Center for Promoting Cremation.' They urged to Christians that cremation is not against their doctrine of resurrection, and also emphasized to other religious groups

that cremation is simply another method of corpse disposal. Protestant churches actively led this innovation by working on opening up conservative mindsets by teaching the positive aspects of cremation and building Protestant columbaria with specialized memorialization [9]. In the late 1990s, cremation became popular and emerged as the major disposal method in funerals as a result of such endeavors.

Cremation rates increased from 7% to 84.6% in the last 20 years [10, 11]. From this trend it could be inferred that the changes in attitudes toward treatment of the body has led people to understand different aspects of body donation, as opposed to the negative approach used previously. The value shift from the importance of preservation of the body to making a social contribution by donating the body for medical purposes is therefore the fundamental factor that might have caused the increase in body donations in Korea [12] (Table 1).

Comparatively large numbers of Christians amongst body donors to Yonsei University could be explained by the university being the oldest and biggest missionary university in Korea (Fig. 2). In addition, Yonsei University Severance Hospital was the first Western medical hospital in Korea [13].

Over the last fifty years, Korea has experienced a dramatic socioeconomic shift. Rapid industrialization and economic growth brought even more attention to the public wealth department and led to national health reform. As of 2004, 96.5% of Koreans were covered by insurance [14]. Being one of the most rapidly aging populations, Korean medical communities have warranted more attention being paid to geriatric care. Since 2004, National Health Insurance has supported a wide range of medical expenses from geriatric care, alleviating the burden of expensive medical costs from the patient. Due to lower expenses, overuse of geriatric hospitals by people who do not need urgent medical care has become a common trend [15]. The number of geriatric hospitals has increased by approximately 30 times from early 2000 to 2018 [16, 17], contributing to the rapid growth in death numbers in geriatric hospitals (Table 2).

Since a randomized controlled trial was not conducted to validate this statistical relationship, clear causality for the trend cannot be determined. However, a correlation was found between the increase in body donations and the number of geriatric hospitals.

Donor records categorize large portions of cases into natural death in cases where autopsies are not mandated. This causes a statistical bias as those diagnosed with a natural

death can be classified differently when correctly examined at the time of death. We included such cases in the factor of symptoms, signs, and abnormal clinical and laboratory findings not elsewhere classified (Table 3, Supplement Table 1).

In conclusion, analyses of body donation trends indicate that males have had a higher donation percentage than females and a greater increase in the mean age of donation. As the number of geriatric hospitals increased from the beginning of 2000, the number of people who died in geriatric hospitals increased. Also, most of the people who donated body to Yonsei University College of Medicine were Christians. Our analysis indicates neoplasm is the most common cause of death among body donors.

There are some limitations in this study that should be acknowledged. There may be a selection bias since Seoul-based Yonsei University is unable to receive donations from outside of the city area due to systemic and bureaucratic limitations. As it is the largest and oldest missionary school in Korea, most body donors are Christian, adding statistical bias to the results. For these reasons, the findings of this study may not truly represent the overall body donation trends in Korea. Future research should include comparative studies that minimize statistical biases and further validate research findings. This can be accomplished through cooperation among medical centers with different backgrounds.

## ORCID

Hyun Jin Park: <https://orcid.org/0000-0001-5639-6540>

Haeryun Ahn: <https://orcid.org/0000-0002-6946-5696>

Eunji Ki: <https://orcid.org/0000-0002-3914-4824>

Je Seong Lee: <https://orcid.org/0000-0003-4854-5854>

Yiseul Choi: <https://orcid.org/0000-0001-6283-9686>

Kyung-Seok Hu: <https://orcid.org/0000-0002-9048-3805>

Yong-Min Chun: <https://orcid.org/0000-0002-8147-6136>

Hee-Jin Kim: <https://orcid.org/0000-0002-7292-3491>

## Author Contributions

Conceptualization: HJP, YC. Data acquisition: YMC. Data analysis or interpretation: HJP, HA, EK, YC. Drafting of the manuscript: HA, EK, JSL. Critical revision of the manuscript: KSH, HJ K. Approval of the final version of the manuscript: all authors.

## Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

## Acknowledgements

We deeply appreciate all the generous donations made to Yonsei University College of Medicine. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No. 2018R1A5A7023490). Also, this work was supported by the Institute of Convergence Science (ICONS) grant funded by the Yonsei University.

## References

1. Korean Association of Anatomists. History of Korea anatomy. Seoul: Korean Association of Anatomists; 2017.
2. Saha A, Sarkar A, Mandal S. Body donation after death: the mental setup of educated people. *J Clin Diagn Res* 2015;9:AC05-9.
3. Park JT, Jang Y, Park MS, Pae C, Park J, Hu KS, Park JS, Han SH, Koh KS, Kim HJ. The trend of body donation for education based on Korean social and religious culture. *Anat Sci Educ* 2011;4:33-8.
4. Ralph AF, Alyami A, Allen RD, Howard K, Craig JC, Chadban SJ, Irving M, Tong A. Attitudes and beliefs about deceased organ donation in the Arabic-speaking community in Australia: a focus group study. *BMJ Open* 2016;6:e010138.
5. Statistics Korea. Preliminary results of birth and death statistics in 2019 [Internet]. Daejeon: Statistics Korea; c2020 [cited 2020 Jul 20]. Available from: <https://stats.oecd.org/Index.aspx?QueryId=30142>.
6. The Academy of Korean Studies. Encyclopedia of Korean Culture [Internet]. Seongnam: The Academy of Korean Studies; 2017 [cited 2017 Jun 22]. Available from: <https://encykorea.aks.ac.kr/Contents/Item/E0041280>.
7. Aveline-Dubach N. Invisible population: the place of the dead in East Asian megacities. Lanham: Lexington Books; 2012.
8. Bautista J, Lim FKG. Christianity and the state in Asia: complexity and conflict. London: Routledge; 2009.
9. Korea Evangelical Fellowship. Korea church and funeral culture [Internet]. Seoul: Korea Evangelical Fellowship; 1998 [cited 2020 Nov 15]. Available from: <https://www.cjob.co.kr/christianity/1351>.
10. Ministry of Health and Welfare (MOHW). The cremation rate in 2017 [Internet]. Sejong: Ministry of Health and Welfare; 2019 [cited 2020 Aug 1]. Available from: <http://www.mohw.go.kr/react/index.jsp>.
11. Health Insurance Review and Assessment Service (HIRA).

- Health insurance nursing facility statistical status (2007-2011) [Internet]. Wonju: Health Insurance Review and Assessment Service; c2020 [cited 2020 Jul 30]. Available from: <https://www.hira.or.kr/bbsDummy.do?pgmid=HIRAA020045010000>.
12. Park CW. Cultural blending in Korean death rites: new interpretive approaches. London: Continuum; 2010.
  13. Yeo IS, Shin KH. The debate over Jejungwon succession. Seoul: Yeogsagonggan; 2015.
  14. Cho KH, Chung Y, Roh YK, Cho B, Kim CH, Lee HS. Health care for older persons: a country profile-Korea. *J Am Geriatr Soc* 2004;52:1199-204.
  15. Organisation for Economic Co-operation and Development (OECD). Health statistics. Long term care hospital beds in OECD countries 2014 [Internet]. Paris: Organisation for Economic Co-operation and Development; 2020 [cited 2020 Jul 20]. Available from: <https://www.oecd.org/els/health-systems/>.
  16. Song HJ. Current status and policy issues of geriatric hospitals. *Health Insur Rev Assess Serv* 2011;5:5-13.
  17. Healthcare Bigdata Hub. Number of nursing facilities in Korea [Internet]. Wonju: Health Insurance Review and Assessment Service; c2020 [cited 2020 Aug 6]. Available from: <https://open-data.hira.or.kr/home.do>.