



## The trend of prevalence of pain in Korea from 2005 to 2016

Sang-Hyeon Cho<sup>1</sup>, Yong-Min Kim<sup>2</sup>, Jae-Ho Lee<sup>1</sup>, Hyun-Soo Kim<sup>1</sup>, and Jae-Seok Song<sup>3</sup>

<sup>1</sup>Department of Anesthesiology and Pain Medicine, Gangneung Asan Hospital, Gangneung, Korea

<sup>2</sup>Department of Chemical and Biological Engineering, College of Engineering, Seoul National University, Seoul, Korea

<sup>3</sup>Department of Preventive Medicine, Catholic Kwandong University College of Medicine, Gangneung, Korea

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### Correspondence

Jae-Seok Song

Department of Preventive Medicine,  
Catholic Kwandong University College  
of Medicine, 24 Beomil-ro 579beon-gil,  
Gangneung 25601, Korea  
Tel: +82-33-649-7469  
Fax: +82-33-641-1074  
E-mail: songjs@cku.ac.kr

**Background:** Korean society is afflicted with rapid aging. Aging is a risk factor for pain, and pain can reduce patients' quality of life. Thus, adequate management and monitoring of changing trends accompanying the demographic shift are highly valuable. However, this study was conducted because no studies have investigated the recent changes in the prevalence of pain.

**Methods:** The extent of the prevalence of pain was determined by questions related to quality of life based on the data derived from the Korea National Health and Nutrition Survey (KNHNS) from 2005 to 2016. The annual frequencies of the pain group and severe pain group were calculated using the survey questionnaire. Multiple logistic regression analysis was performed to determine possible differences in prevalence by year.

**Results:** The prevalence of pain in all populations was 30.6% in 2005 and 18.9% in 2016. The average prevalence from 2005 to 2016 was 21.9%. A declining trend occurred over time with an odds ratio of 0.929 per year (95% CI: 0.921-0.938). The prevalence of severe pain was 2.35% in 2005 and 1.88% in 2016. Likewise, a decrease was observed over time, with an odds ratio of 0.920 per year at 95% CI 0.901-0.939. The decline in age-/sex-stratified analysis also showed a statistically significant trend in all groups.

**Conclusions:** The prevalence of pain in Korean society, based on the KNHNS, has declined since 2005. Such a trend was observed in all ages and sexes, and was most significant in the elderly.

**Key Words:** Aging; Data Analysis; Health Surveys; Nutrition Surveys; Pain; Population Dynamics; Quality of Life; Risk Factors.

## INTRODUCTION

Korean society has been rapidly aging since 2000, when the proportion of the elderly population passed 7%. Recently in 2017, the elderly population exceeded 14% and Korean society has been classified as an aged society [1]. Various forecasts suggest that the aging of the society will further accelerate, and that Korea will enter the era of the super-aged society. In response to such demographic

changes, it is imperative to predict and respond to various health problems that may occur in the elderly population.

Older adults are more likely to have pain problems. However, it is also true that pain is poorly managed in older adults in general [2], which can lead to a deterioration in their quality of life. Moreover, untreated pain issues can limit daily activities, including economic and recreational activities, which can gradually lead to a vicious cycle [3,4]. In that sense, understanding the incidence and trends in

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the prevalence of pain in Korea will be the starting point in managing the quality of life of the increasing elderly population.

The importance of pain management has recently been widely accepted, and a large amount of medical expenses is being used to manage pain and develop advanced methods of pain management [5,6]. Countries such as the United Kingdom, the United States of America (USA), and Australia have included items related to pain in their national surveys to provide analytical results [7]. In Korea, data necessary for the analysis of pain prevalence are based on the Survey of Living Conditions and Welfare Needs of Korean Older Persons, Korea National Health and Nutrition Survey (KNHNS), and the Korean Longitudinal Study of Aging [3]. However, despite the rapid aging observed in the Korean society, few reports analyzing recent trends in pain prevalence are currently available. This study analyzed the change in prevalence of pain in Korea, based on the KNHNS data generated annually at a national level for all age groups.

## MATERIALS AND METHODS

### 1. Data

This study is a retrospective, longitudinal, population-based, observational survey, based on data obtained from 2005 to 2016. The KNHNS is conducted by the Korea Centers for Disease Control and Prevention (KCDC). The 2006 data were excluded, since the survey was not conducted. The KNHNS is a nationwide health and nutrition survey conducted annually in accordance with Article 16 of the National Health Promotion Act. The sampling frame of the survey is based on the most recent population housing census data available at the time of sampling. In order to use the latest information that reflects the current characteristics of the population, the public housing price data were added to supplement the basic extraction framework and improve the population inclusion rate. It ensured adequate representation of the target population in the sample [8]. The survey was held based on face-to-face interviews in mobile checkup centers.

The sample sizes used in years 2005/2007-2009/2010-2012/2013-2015/2016 were 33,805/24,871/25,534/22,948/8,150, respectively, accounting for 115,308 in total. Participants aged below 19 years were excluded from this study, and 87,908 samples were analyzed. During the process of data collection, the data of 23,118 samples were missed due to non-response or refusal of the subjects. Finally, a total of 64,790 samples were used for statistical analysis. Demographic data of the samples in each year are listed in

**Table 1.** This study was approved by the Institutional Review Board of the Gangneung Asan Hospital, University of Ulsan (GNAH 2020-04-033).

### 2. Definition of variables

The study used Euro quality of life-5 dimension (EQ-5D) of the KNHNS, which reflects the quality of life. EQ-5D quantifies participants' generic health status based on self-completion of survey items related to five dimensions (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). Among the five dimensions, this study referred to the item related to pain/discomfort. The item was designed to categorize the participants' status of pain/discomfort according to three levels: "I have no pain or discomfort", "I have moderate pain or discomfort", and "I have extreme pain or discomfort". Participants who reported moderate pain/discomfort or extreme pain/discomfort were defined as the pain group, and those who complained of extreme pain/discomfort were further classified into a severe pain group. The prevalence was divided into subgroups according to population, sex, and age. The age groups were classified as follows: 1) age between 19 and 44 years, 2) age between 45 and 64, and 3) age more than 65 years.

### 3. Statistical analysis

Weightings offered by the KCDC were applied to the data to enhance the representativeness of the sample to the Korean population. The annual frequencies of the pain group and severe pain group were calculated using the survey questionnaire. The aforementioned weightings were applied to each datum to deduct the weighted frequency using SURVEYFREQ (SAS Institute, Cary, NC, USA), and the

**Table 1.** Demographic Sample Data Used in This Study

Year	Male			Female			Total
	19-44	45-64	Age 65 and over	19-44	45-64	Age 65 and over	
2005	1,088	918	366	1,569	1,082	542	5,565
2007	518	443	307	749	595	434	3,046
2008	1,266	1,006	585	1,747	1,296	940	6,840
2009	1,412	1,152	698	1,816	1,481	979	7,538
2010	1,139	976	630	1,528	1,290	789	6,352
2011	1,009	991	651	1,382	1,299	892	6,224
2012	905	928	673	1,321	1,246	922	5,995
2013	1,037	890	558	1,333	1,203	771	5,792
2014	897	832	656	1,237	1,184	871	5,677
2015	886	926	645	1,084	1,252	839	5,632
2016	1,020	932	695	1,327	1,272	883	6,129

prevalence of each group was calculated and expressed as a percentile. The analysis was conducted separately by age or sex. Errors related to differences in average age by the year were corrected. Multiple logistic regression analysis was performed to determine possible differences in prevalence by year. Odds ratio was calculated for each model including age and sex. All data were analyzed. Data were interpreted as significant at a *P* value less than 0.05 using SAS ver. 9.4 (SAS Institute).

## RESULTS

The prevalence of pain ranged from 30.6% in 2005 to 18.9% in 2016. The average prevalence from 2005 to 2016 turned out to be 21.9% (Fig. 1). The prevalence of pain showed a decreasing trend with an odds ratio of 0.929, and a 95% confidence interval (CI) of 0.921-0.938, indicating statistical significance (Table 2). The prevalence of severe pain was 2.35% in 2005 and 1.88% in 2016 (Fig. 2). The prevalence of severe pain also decreased with an odds ratio of 0.920, and was statistically significant with a 95% CI of 0.901-0.939 (Table 2).

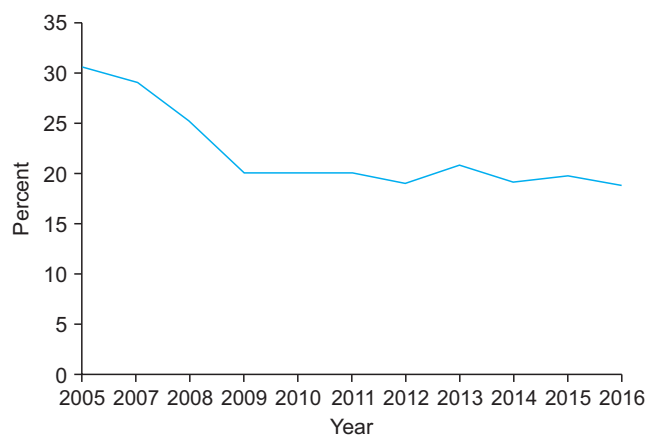


Fig. 1. The trend in prevalence of pain.

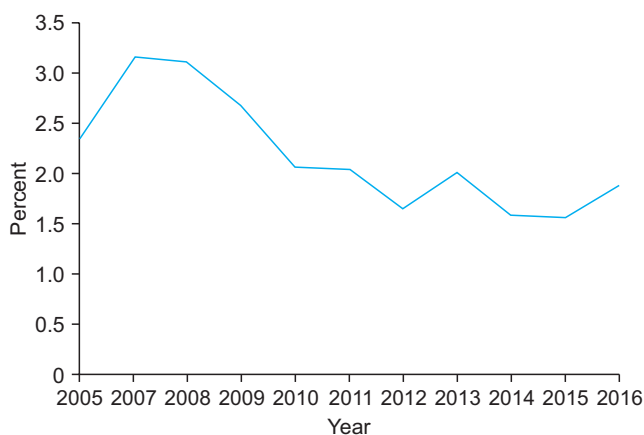


Fig. 2. The trend in prevalence of severe pain.

Table 2. The Odds Ratio for Pain and Severe Pain according to Variables

Variable	Odds ratio in pain (95% CI)	Odds ratio in severe pain (95% CI)
Sex	1.837 (1.750-1.930)	2.164 (1.905-2.459)
Age	1.035 (1.033-1.037)	1.075 (1.071-1.080)
Year	0.929 (0.921-0.938)	0.920 (0.901-0.939)

CI: confidence interval.

Table 3. The Average Prevalence of Pain according to Sex and Age Groups from 2005 to 2016

Severity	Male			Female		
	19-44	45-64	Age 65 and over	19-44	45-64	Age 65 and over
Pain (%)	11.7	18.5	30.5	17.4	30.2	50.1
Severe pain (%)	0.38	1.42	4.25	0.56	2.36	12.08

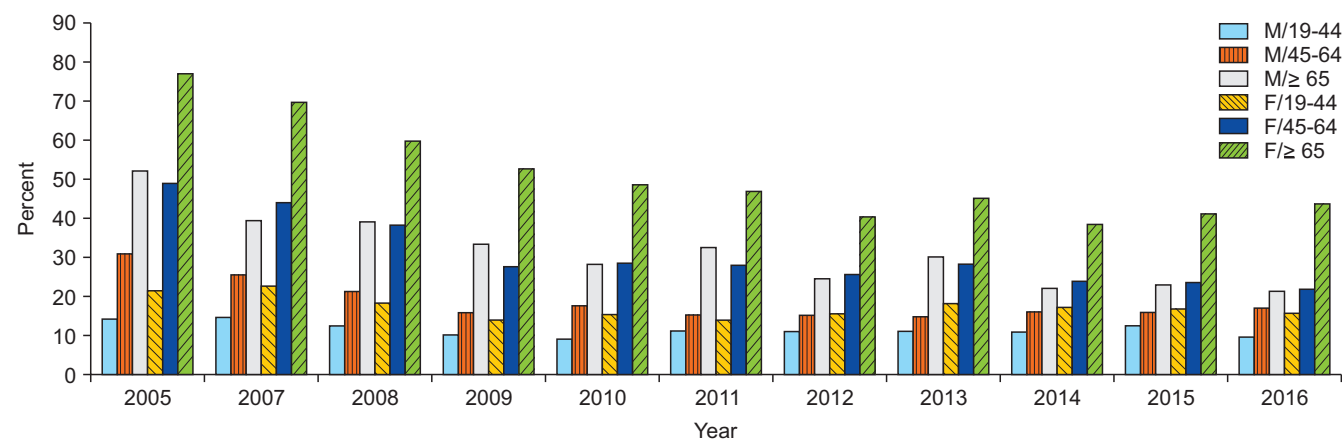


Fig. 3. The trend in prevalence of pain by sex and age groups: 19-44 years old, 45-64 years old, and 65 years old or older.

The average prevalence of pain in the subgroups according to age and sex is shown in **Table 3**. The annual change in the prevalence of pain in each group is shown in **Fig. 3**. The number of subjects suffering from pain in the female group was 1.837-fold higher than in the male group (95% CI, 1.750-1.930). The prevalence increased by 1.035-fold per year as age increased, which was statistically significant (95% CI, 1.033-1.037) (**Table 2**). Furthermore, the odds ratio per year in all groups was less than 1, which suggested that the prevalence of pain decreased over time, with a statistical significance. The results also indicate that the decreased prevalence was more significant in the groups at higher ages (**Table 4**).

For severe pain, the prevalence changed in each group as shown in **Fig. 4**. The female group complained of 2.164-fold higher pain compared with the male group (95% CI, 1.905-2.459). The prevalence increased by 1.075-fold each year older, which was statistically significant (95% CI, 1.071-1.080) (**Table 2**). Furthermore, there was a decreasing trend in the prevalence of severe pain among all groups except in the male group under 45 years of age (**Table 4**).

## DISCUSSION

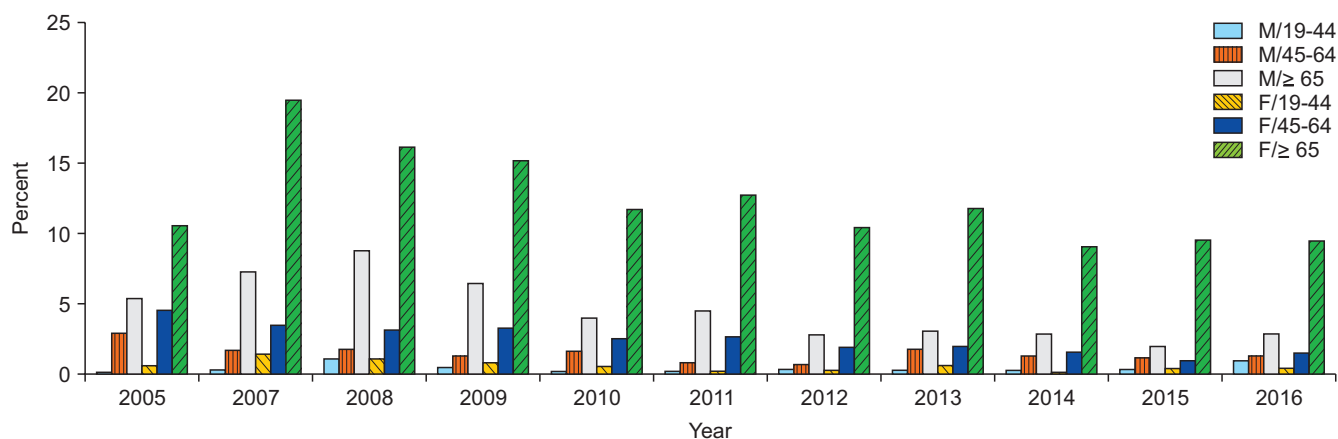
Pain is a crucial factor determining quality of life. Pain is generally divided into acute and chronic types, based on a 3-month period [9]. This classification is based on whether or not pain alleviation occurs within the normal time of healing, and the mechanism and direction of treatment also differ between the two types of pain [9,10]. Many studies focus only on the prevalence of chronic pain. However, regardless of the duration of pain, poorly relieved pain is an essential cause of functional impairment and deterioration of quality of life in any age group [2]. Especially in the elderly, management of not only chronic pain, but also acute pain, is seriously difficult [2]. Therefore, this study focused on analyzing a broader incidence and trend of pain including both acute and chronic pain in diverse groups according to age or sex.

The main objective of this study was to analyze the recent trends in the prevalence of pain in Korea, which is considered an increasingly aging society. A reflection of changes in population structure was a crucial element in the analysis. The focus was on sample representativeness in each subgroup. The KNHNS uses well-sampled big data, by incorporating the most recent population housing census data as the basic extraction framework, and a stratified cluster sample method, to define each sample size in accordance with the proportion of each subgroup [11]. Thus, the sample representativeness is significantly improved compared to random sampling. The KNHNS provided a

**Table 4.** The Annual Odds Ratio for Pain and Severe Pain by Group

Odd ratio	Male			Female		
	19-44	45-64	65 years old or older	19-44	45-64	65 years old or older
Odd ratio in pain (95% CI)	0.973 (0.952-0.995)	0.927 (0.908-0.946)	0.89 (0.870-0.910)	0.97 (0.954-0.986)	0.894 (0.880-0.909)	0.881 (0.866-0.896)
Odd ratio in severe pain (95% CI)	1.022 (0.911-1.147)	0.925 (0.870-0.984)	0.882 (0.844-0.921)	0.871 (0.809-0.937)	0.881 (0.846-0.918)	0.942 (0.918-0.966)

CI: confidence interval.



**Fig. 4.** The trend in prevalence of severe pain by sex and age groups: 19-44 years old, 45-64 years old, and 65 years old or older.

large database, which was entirely necessary for our analysis.

Pain is highly subjective, and the same degree of pain is perceived as higher or lower depending on the individual. Moreover, the degree of pain is assessed differently, depending on the methods and questionnaires adopted by different survey organizations [12]. Thus, many investigations of the prevalence of pain show differences depending on the survey methods used. In this regard, this study was based on a single survey over a long period. Although the results of assessment may have limitations in objectively reflecting the degree of pain experienced by the population, the survey retained the assessment criteria for the 10-year period, which generated adequate data for exploration of the national trends in the prevalence of pain. The decreasing trends of pain prevalence in Korea over the past ten years are thus considered clinically significant.

According to the results of this study, the prevalence of pain in the entire Korean population over age 19 was 21.9% on average, from 2005 to 2016. According to the study investigated by the Korea Health Panel, the prevalence of pain among 58,151 adults over the age of 18 years from 2009 to 2013 was 29.8% [5]. In the case of studies investigating chronic pain in other countries, the prevalence of chronic pain among 6,000 individuals in the total population was 39.3% in Japan in 2011 [13]. In Hong Kong, the prevalence of chronic pain in 2007 was 35.2% in a sample size of 5,001 in the general population [14]. The prevalence of "pain" in the Canadian population ranged from 15.1% to 18.9% during the years 1994-2008, according to big data research using stratified samples [15]. In the USA, according to a random sampling survey, 20.4% of the total population reported experiencing chronic pain [6]. However, the differences in the definition of pain in each study should be considered when interpreting the results.

According to the analysis in this study, the prevalence of pain was 30.6% in 2005 and 18.9% in 2016, showing a de-

creasing trend with an odds ratio of 0.929. The prevalence of severe pain averaged 2.17% from 2005 to 2016, decreasing from 2.35% in 2005 to 1.88% in 2016, with an odds ratio of 0.920. The prevalence of pain in all age-/sex-subgroups showed a significant decreasing trend over the period. Especially in the female group 65 years old or older, the decreasing trend in the prevalence of pain was the greatest (odds ratio, 0.881) and the prevalence decreased significantly between age groups as the age increased (Table 4). According to the Korea National Statistical Office, the population 65 years old or above was 4.32 million in 2005 (8.9% of total population), and 6.76 million in 2016 (13.2% of total population) [16]. Although the proportion of the aged population increased, the prevalence of pain actually showed a decreasing trend. In the case of Canada, the prevalence of pain did not show any statistically significant trend during 1994-2008 [15].

It is widely known that the elderly and female population are exposed to a higher degree of pain [7]. The results of this study are parallel with such observations: the prevalence increased by 1.035 times per year as the age increased and the female group experienced 1.837 times more pain than the male group as shown in Table 2. Therefore, the conclusion of this study is, aging was a factor increasing the prevalence of pain and although the elderly population increased, the prevalence of pain decreased through all age subgroups, especially in the elderly population (Figs. 1, 3).

Although it is difficult to define the causes of such a decreasing trend in this study, diverse factors may have affected the results. Some of the causes might be the increase in medical service availability and medical expenses. In fact, the frequency of medical use in patients with pain was 5.858-fold higher [17], and the medical expenses of patients with pain showed a relatively high increase [5].

Against the background of such phenomena, the changes in pain perception by patients and the development of



diverse and state-of-the-art interventions, are available. Recent advances in access to health information, including those associated with control of pain, are broadcast via diverse media compared to the past [18]. Besides, according to researchers, patients report that they are ready to adopt such information spontaneously, and implement it into actual practice [19]. Moreover, there have been remarkable developments in the diagnosis and treatment of pain, which have been applied to different types of pain, resulting in favorable outcomes for many pain patients [20]. These factors appear to have played a role in such phenomena.

This study was based on the KNHNS. This annual, well-standardized and controlled national survey has the advantage of high reliability. Another advantage is the high representativeness of the sample since it was extracted from the latest population housing census data, which reflects recent demographic changes. Moreover, the statistically significant decrease shown in such large-scale data surveys strongly suggests the persistence of such phenomena.

As mentioned above, the present study adopted “stratified cluster sampling” rather than “random sampling” to improve the representativeness of the subgroups of subjects distinguished by sex and age. However, the approach required knowledge of population, higher costs, and time for the sampling [11]. In addition, the data from a long-term period were necessary to identify the trends in the prevalence of pain. Therefore, big data was employed for the analysis. However, the present study had a few limitations, attributable to the inability of researchers to design the questions contained in the questionnaire.

Our study has several limitations. First, a more specific analysis according to the lasting period of pain was not conducted. The focus was thus directed towards general pain, and not chronic pain, which has recently attracted substantial attention. If it was considered important to determine whether or not the pain lasted more than three months, our results would have overestimated than the prevalence of chronic pain. Second, the analyses on the origins of the pain and subgroups according to the type of underlying disease were impossible. Further research based on data with more subgroup information will enable us to specifically detect the causes of the decreasing trend of prevalence of pain. Besides, the researches could also provide us with the information on whether pain of different types are under control and being treated appropriately, or require further attention due to inadequate care.

In conclusion, according to our study, the prevalence of pain was 30.6% in 2005 and 18.9% in 2016, showing a statistically significant decreasing trend. The decreasing

trend appeared in all age and sex subgroups, and was most significant in the elderly population.

## CONFLICT OF INTEREST

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

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## ORCID

Sang-Hyeon Cho, <https://orcid.org/0000-0001-9363-2573>  
Yong-Min Kim, <https://orcid.org/0000-0001-6866-4135>  
Jae-Ho Lee, <https://orcid.org/0000-0002-2965-5794>  
Hyun-Soo Kim, <https://orcid.org/0000-0001-6817-7214>  
Jae-Seok Song, <https://orcid.org/0000-0001-5583-182X>

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