Economic burden of Eating disorders in South Korea

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Research article

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Abstract

Objective Few studies have investigated the epidemiology of eating disorders using national representative data. In this study, we investigated the prevalence and economic burden of eating disorders in South Korea.

Method The aim of this study was to estimate the disease burden of diagnosed eating disorders (ICD F50.x) over a six-year period between 2010 and 2015, in South Korea. The direct medical cost, direct non-medical costs, and indirect costs resulting from eating disorders were estimated in order to calculate the economic burden of such disorders.

Results The total prevalence was 12.02 people (per 100,000) in 2010, and 13.28 in 2015. The economic cost of eating disorders was estimated to be USD$7,727,843 in 2010 and USD$3,387,752 in 2015. The economic cost and prevalence of eating disorders was the highest in the 20–29 age group.

Conclusion The results showed the eating disorders are insufficiently managed in the medical insurance system. The further research is warranted to better understand the economic burdens of each eating disorders.

Introduction

The prevalence of eating disorders is increasing worldwide, and eating disorders affect approximately 2% of the world's population [1, 2]. Eating disorders may occur at a relatively young age between 10–20 years and is a condition that may run a long course and is associated with various physical and psychiatric conditions. It is one of the most common adolescent chronic disorders [3, 4]. Therefore eating disorders require the long-term care of informal caregivers such as family and friends [5]. Eating disorders have the highest lifetime mortality rate (up to 20%) among mental illnesses and the mortality rate among women with eating disorders is twelve-times higher than for unaffected women [6, 7]. The mortality rate for people with eating disorders is nearly twice as high, compared with the general population [8].

A study of patients with eating disorders, living in communities in the United States, found that majority of patient did not seek treatment for eating disorder itself [9]. Even if treatment is performed, medication has limited efficacy and, in general, more than half the patients with anorexia and bulimia nervosa do not recover fully [1, 3]. One in four people with anorexia nervosa develop long-term impairment in social functioning and employment, to the extent that they cannot be gainfully employed. The quality of life for patients with eating disorders deteriorates more than for patients with symptomatic coronary heart disease or major depression, and the duration of illness tends to be longer [10].

Treatment guidelines recommend the active involvement of family members in the treatment of eating disorders [11], and patients with severe and long-lasting anorexia nervosa are highly dependent on their families, whose caregiving burden is subsequently high [12]. The socio-economic burden and costs of eating disorders (anorexia nervosa and bulimia nervosa) are similar to those of anxiety disorders and depression [3], as quantified by the Global Burden of Disease Study conducted in 2013. Together, anorexia nervosa and bulimia nervosa were responsible for 1.9 million Disability-Adjusted Life years [13].

Studies have been conducted in Europe to estimate the size and cost of eating disorders, but most have included only anorexia nervosa and bulimia nervosa; this led to a gross underestimation of the problem, because binge and unspecified eating disorders are in fact the most commonly occurring disorders. Those studies also did not include key resource items – the cost of lost productivity of the families, and indirect costs due to reduced length of life and health [3, 14].

There have been several studies in which the disease burden of eating disorders have been systematically reviewed. Extant studies of eating disorders face the problem of poor data representation due to the lack of data and its inconsistency [13]. Unlike previous studies, our study also includes data on eating disorders such as binge eating disorder. This study analyzed the healthcare costs of anorexia nervosa, bulimia nervosa, and other eating disorder (binge eating disorder and eating disorder not otherwise specified) using Korean nationwide bigdata and observed trends through a six-year period. Therefore, we attempted to estimate the national burden and economic costs of eating disorders on medical care utilization; and to explore the characteristic of this burden with respect to gender and age groups, using representative health statistics and health insurance data from 2010 to 2015.

Method

Data Sources

This study utilized two data sources from the government system. The prevalence rates of eating disorders were calculated using data from Health Insurance Review & Assessment Service (HIRA). The database provided records of patient numbers, specifying outpatient, inpatient, and hospitalization days by gender. The economic burden of eating disorders was derived from the data of National Health Insurance Services (NHIS), which is the single insurer of South Korea (Seong et al., 2017). The NHIS provides medical costs based on the medical utilization records from the National Health Information Database (NHID). Data from both HIRA and NHIS were taken from January 1, 2010 to December 31, 2015. Population statistics were adopted from the Korean Statistical Information Service (KOSIS). Average currency rates per year were adopted from the Bank of Korea (http://ecos.bok.or.kr) to convert the Korean Won to US dollars (USD). The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Case Definition

Eating disorders (F50) are defined using the International Classification of Diseases, Tenth Revision (ICD-10). For estimation of the economic burden, eating disorders were as: anorexia nervosa (F50.0); bulimia nervosa (F50.2); and other eating disorders (F50.1 – F50.9). Other eating disorders included atypical
anorexia nervosa (F50.1); atypical bulimia nervosa (F50.3); overeating associated with other psychological disturbances (F50.4); vomiting associated with other psychological disturbances (F50.5); other eating disorders (F50.8); and unspecified eating disorder (F50.9).

**Prevalence Rates of Eating Disorder**

The prevalence rates of eating disorders from 2010 to 2015 were estimated using figures of the number of cases from Health Insurance Review & Assessment Service. The number of cases was divided by the total population and then multiplied by 100,000.

**Estimation Of The Economic Burden Of Eating Disorders**

The present study estimated the economic burden of eating disorders (anorexia nervosa, bulimia nervosa, other eating disorders) using a prevalence-based approach from NHIS data.

Direct costs were estimated by taking the sum of medical costs, transportation costs of hospital visits, and caregiver costs. Medical costs included non-covered care costs, insured and non-insured costs, and drug costs. To estimate hospital transportation costs, round-trip transportation costs were taken from the Korean Health Panel. Also, caregiver costs were calculated using data from the Korea Patient Helper Society.

Indirect cost-2 was estimated to explain productivity loss caused by the absence from work for hospital admissions or outpatient visits. Indirect costs-2 was included in the total costs. For sensitivity purpose, indirect cost-1 was estimated. Indirect costs-1 was calculated by taking lost productivity into account. Productivity lost was defined as the loss of one’s time due to medical care. To estimate the productivity lost we used time spent travelling to hospital and waiting for treatment and multiplied the average time spent by the average daily wage. For example, when a patient took the day off due to hospitalization, it was considered as the loss of one day’s income. In case of an outpatient visit, it was considered as the loss of one-third of daily income. Patients aged less than 20 years were excluded. Indirect costs-1 was not included in the total costs. Total economic cost was taken as the sum of direct and indirect costs.

All analyses were performed using SAS (ver. 9.4; SAS institute, Cary, NC, USA).

**Ethics Statement**

Ethical review was obtained by a University review board (IRB No. KHSIRB-19-354 (EA)). Informed consent was exempted due to the public nature of the data sources of NHIS.

**Results**

The current study investigated the prevalence rates of eating disorders and patients’ use of medical care between 2010 and 2015, in addition to evaluating the economic burden of eating disorders in Korea in 2015.

The results of this study showed that the prevalence rates of eating disorders tended to increase from 2010 to 2013 and then decreased slightly from 2014 to 2015 (Table 1 and Fig. 1). There was an increase in the cases of bulimia nervosa from 2010 to 2015. In addition, a gender differential was observed in the economic burden of eating disorders from 2010 to 2015; discrepancy was higher in female patients compared to male patients.
Disorders were the highest contributor to the economic burden among anorexia nervosa, bulimia nervosa, and other eating disorders. Approximately 6 times higher in female patients than male patients. Direct costs were higher than indirect costs in all types of eating disorders. Other eating disorders increased in other eating disorders, anorexia nervosa, and bulimia nervosa, but inconsistently decreased in eating disorders, anorexia nervosa, bulimia nervosa, and other eating disorders, hospitalization days per patient inconsistently decreased in eating disorders, anorexia nervosa, bulimia nervosa, and other eating disorders, but increased in other eating disorders.

### Table 1

Prevalence of eating disorders in Korea from 2010 to 2015 by gender (per 100,000).

| Year | Eating disorders | Anorexia nervosa | Bulimia nervosa | Other eating disorders | Economic burden of eating disorders |
|------|------------------|------------------|-----------------|------------------------|-------------------------------------|
|      | Number of patients | Number of patients | Number of patients | Number of patients | Number of patients | Prevalence | Number of patients | Number of patients | Prevalence | Number of patients | Number of patients | Prevalence | Number of patients | Number of patients | Prevalence | Number of patients | Number of patients | Prevalence | Number of patients | Number of patients | Prevalence |
| 2010 | 6,074 | 1,010 | 5,064 | 1,511 | 376 | 1,135 | 1,399 | 72 | 1,327 | 3,366 | 572 | 2,794 | 657,482 | 5,070,360 | 5,727,84 |
| 2011 | 6,694 | 1,070 | 5,624 | 1,570 | 405 | 1,165 | 1,440 | 74 | 1,366 | 3,888 | 607 | 3,281 | 603,486 | 5,770,850 | 6,374,33 |
| 2012 | 7,052 | 1,187 | 5,865 | 1,534 | 369 | 1,165 | 1,600 | 92 | 1,508 | 4,151 | 754 | 3,937 | 1,584,390 | 5,895,280 | 7,479,67 |
| 2013 | 7,388 | 1,301 | 6,087 | 1,905 | 478 | 1,427 | 1,597 | 111 | 1,486 | 4,099 | 727 | 3,372 | 4,132,468 | 7,120,671 | 11,253,1 |
| 2014 | 7,364 | 1,204 | 6,160 | 1,793 | 457 | 1,336 | 1,681 | 93 | 1,588 | 4,110 | 680 | 3,430 | 673,257 | 7,302,524 | 7,975,78 |
| 2015 | 6,845 | 1,129 | 5,716 | 1,604 | 397 | 1,207 | 1,832 | 123 | 1,709 | 3,614 | 630 | 2,984 | 791,259 | 4,664,367 | 5,455,62 |
| 2016 | 13,28 | 4,38 | 22,28 | 3,11 | 1,54 | 4,68 | 3,56 | 0,48 | 6,63 | 7,01 | 2,45 | 11,58 |

*Note: Data sources from Healthcare bigdata hub (https://opendata.hira.or.kr/) and Korean Statistical Information Service (KOSIS); size of population = 50,515,666 (female 25,205,281; 2010); 50,734,284 (female; 2011); 50,948,272 (female; 2012); 51,141,463 (female 25,553,127; 2013); 51,327,916 (female 25,658,620; 2014); 51,529,338 (female 25,777,152; 2015); Exchange rate US dollar: 1 Korean won = 1,132 US dollar (2015); 1,083 (2014); 1,095 (2013); 1,127 (2012); 1,108 (2011); 1,156 (2010); from the Bank of Korea (http://ecos.bok.or.kr/).*

Table 2 shows the medical care use of eating disorders including anorexia nervosa, bulimia nervosa, and other eating disorder from 2010 to 2015. There was an inconsistent increase in the number of outpatient visits of patients afflicted with eating disorders, anorexia nervosa, bulimia nervosa, and other eating disorders. The number of inpatient admissions decreased for patients with eating disorders and bulimia nervosa but increased in the cases with anorexia nervosa and other eating disorders. Hospitalization days per patient inconsistently decreased in eating disorders, anorexia nervosa, bulimia nervosa, but increased in other eating disorder.

### Table 2

Patient's medical care use for eating disorders from 2010 to 2015.

| Year | Eating disorders | Anorexia nervosa | Bulimia nervosa | Other |
|------|------------------|------------------|-----------------|-------|
|      | Number of outpatient visit (per patient) | Number of inpatient admissions (per patient) | Hospitalization days (per patient) | Number of outpatient visit (per patient) | Number of inpatient admissions (per patient) | Hospitalization days (per patient) | Number of outpatient visit (per patient) | Number of inpatient admissions (per patient) | Hospitalization days (per patient) | Numb of outpa visit (per patient) |
| 2010 | 3.27 | 1.72 | 31.16 | 2.43 | 1.51 | 28.32 | 4.03 | 1.67 | 37.62 | 3.19 |
| 2011 | 3.07 | 1.80 | 30.40 | 2.30 | 1.93 | 34.26 | 4.20 | 1.77 | 32.95 | 2.92 |
| 2012 | 3.54 | 1.79 | 30.48 | 2.73 | 1.97 | 35.17 | 4.57 | 1.63 | 29.07 | 3.25 |
| 2013 | 3.49 | 1.82 | 29.83 | 2.49 | 1.90 | 35.11 | 4.44 | 1.78 | 22.76 | 3.42 |
| 2014 | 3.51 | 1.71 | 28.69 | 2.71 | 1.65 | 29.42 | 4.16 | 1.66 | 25.78 | 3.15 |
| 2015 | 3.86 | 1.65 | 27.01 | 2.86 | 1.62 | 27.26 | 4.52 | 1.63 | 28.25 | 3.40 |

*Note: Data source from Healthcare bigdata hub (https://opendata.hira.or.kr/).*

Table 3 shows the economic burden of eating disorders including anorexia nervosa, bulimia nervosa, and other eating by gender in 2015. Total costs were approximately 6 times higher in female patients than male patients. Direct costs were higher than indirect costs in all types of eating disorders. Other eating disorders were the highest contributor to the economic burden among anorexia nervosa, bulimia nervosa, and other eating disorders.
Table 3 Economic burden of eating disorders in 2015.

| Eating disorders | Male | Female | Sub total | Male | Female | Sub total | Male | Female | Sub total | Male | Female | Sub total |
|------------------|------|--------|-----------|------|--------|-----------|------|--------|-----------|------|--------|-----------|
| Direct costs     |      |        |           |      |        |           |      |        |           |      |        |           |
| Direct medical costs | 246,792 | 2572,075 | 2,818,867 | 91,585 | 1,037,569 | 1,129,154 | 31,420 | 737,817 | 769,237 | 123,786 | 796,690 |
| Direct nonmedical costs |      |        |           |      |        |           |      |        |           |      |        |           |
| Transportation cost for hospital visits | 11,492 | 84,283 | 95,776 | 4,402 | 20,806 | 25,208 | 1,275 | 27,047 | 28,322 | 5,815 | 36,430 |
| Caregiver cost | 79,798 | 405,167 | 484,965 | 44,865 | 213,194 | 258,059 | 5,964 | 67,603 | 73,568 | 28,969 | 124,370 |
| Total direct costs | 338,082 | 3,061,526 | 3,399,608 | 140,852 | 1,271,569 | 1,412,421 | 38,660 | 832,467 | 871,127 | 158,570 | 957,490 |
| Indirect costs | 453,177 | 1,602,841 | 2,056,018 | 353,510 | 485,694 | 18,772 | 328,218 | 346,991 | 302,220 | 921,113 |
| Total costs | 791,259 | 4,664,367 | 5,455,626 | 273,037 | 1,625,078 | 1,898,115 | 57,432 | 1,160,686 | 1,218,118 | 460,790 | 1,878,602 |

Note. Exchange rate US dollar: 1 Korean won = 1,132 US dollar from the Bank of Korea (http://ecos.bok.or.kr/); For indirect costs 2, productivity loss from the from work due to hospital admission and outpatient visits were included.

Table 4 Sensitivity analysis of indirect costs for economic burden of eating disorders in 2015.

| Eating disorders | Male | Female | Sub total | Male | Female | Sub total | Male | Female | Sub total | Male | Female | Sub total |
|------------------|------|--------|-----------|------|--------|-----------|------|--------|-----------|------|--------|-----------|
| Indirect costs 1 | 920,012 | 3,064,617 | 3,984,629 | 157,353 | 638,689 | 796,043 | 24,599 | 552,534 | 577,132 | 738,060 | 1,873,394 | 2,611,45- |

Note. Indirect costs 1 is different from indirect costs 2. Indirect costs 1 was estimated for the purpose of sensitivity analysis without the employment-to-population ratio (i.e., proportion of the population employed). Indirect costs 1 was not included in the total costs.

Table 5 and Figs. 2 and 3 show the economic burden of eating disorders in Korea in 2015 by age and gender. Eating disorders were higher in patients aged between 20 years and 29 years than other age ranges. Anorexia nervosa was higher in patients aged between 10 years and 19 years than other age ranges. Bulimia nervosa was higher in patients aged between 20 years and 29 years than other age ranges. Other eating disorders were higher in patients aged 50 years and 59 years than other age ranges. In general, female patients showed higher economic burden than male patients. In addition, younger generations showed a higher economic burden than older generations except for in the case of other eating disorders.
Economic burden of disease due to eating disorders

| Age range | Male | Female | Sub total | Direct cost | Indirect cost | Male | Female | Sub total | Direct cost | Indirect cost |
|-----------|------|--------|-----------|-------------|---------------|------|--------|-----------|-------------|---------------|
| 0–9       | 29,659 | 41,561 | 71,220 | -           | -             | 16,507 | 20,429 | 36,936 | -           | -             |
| 10–19     | 58,076 | 766,065 | 824,141 | -           | -             | 29,904 | 507,441 | 537,345 | -           | -             |
| 20–29     | 59,903 | 913,172 | 973,075 | 22,652 | 390,672 | 413,324 | 12,388 | 274,955 | 287,343 | 5,134 | 126,763 | 131,897 |
| 30–39     | 42,248 | 688,260 | 730,507 | 126,348 | 427,966 | 554,314 | 26,783 | 237,700 | 264,483 | 105,300 | 166,309 | 271,609 |
| 40–49     | 16,621 | 293,279 | 309,900 | 30,714 | 200,841 | 231,555 | 4,100 | 118,678 | 122,778 | 7,081 | 42,819 | 49,901 |
| 50–59     | 16,330 | 89,894 | 106,224 | 23,474 | 574,452 | 597,925 | 7,170 | 25,813 | 32,984 | 10,143 | 13,574 | 23,717 |
| 60–69     | 27,404 | 34,994 | 62,398 | 240,666 | 4,301 | 244,967 | 5,041 | 10,934 | 15,975 | 1,894 | 1,321 | 3,215 |
| 70–79     | 47,007 | 98,324 | 145,331 | 4,483 | 3,213 | 7,697 | 24,946 | 45,507 | 70,453 | 2,544 | 1,555 | 4,099 |
| 80–89     | 40,834 | 135,978 | 176,812 | 4,840 | 1,395 | 6,236 | 14,013 | 30,113 | 44,125 | 88 | 1,167 | 1,255 |
| Total     | 338,082 | 3,061,526 | 3,399,608 | 145,317 | 1,602,841 | 2,056,018 | 140,852 | 1,271,569 | 1,412,421 | 132,185 | 353,510 | 485,694 |

Note. Exchange rate US dollar: 1 Korean won = 1,132 US dollar from the Bank of Korea (http://ecos.bok.or.kr/).

Discussion

Population-representative epidemiological research studies on eating disorders are rare. Eating disorders are known to have a relatively low prevalence of 15.2%. In particular, population coverage of prevalence data in East Asia is reported to be 7.9% [15]. Despite knowledge of the onset of this disorder at young ages, few studies have been conducted on eating disorders among children and young people under the age of 18 [16]. The current study is meaningful, in that it represents the whole country by investigating prevalence and disease burden in patients with eating disorders of all ages, using a nationwide database. It included eating disorder with ICD F50.x in its entirety and was not limited to anorexia nervosa and bulimia nervosa alone.

This study found that the prevalence of eating disorders steadily increased by about 20% between 12.02 in 2010 (per 100,000) and 13.28 in 2015 (per 100,000). The estimated economic burden of eating disorders in the current study was 5,455,626 USD, which is equivalent to 0.0039% of Korean GDP in 2015. The other eating disorder group, including binge eating disorder accounted for 42% of the economic burden; anorexia nervosa 34.7%; and bulimia nervosa 22.3%. Our result on the burden of eating disorders was underestimated because the study did not take the negative impact of eating disorders on individual health, nor socioeconomic well-being into account. Given this, the actual economic costs can be expected to be much higher.

As shown by previous studies as well, the current study found that the disease burden of eating disorders was high in adolescent and early adult ages. This implies that disease burden is likely underestimated, because it is a condition that progresses and has the potential to take on a chronic course [17].

A few limitations in the present study must be noted. First, the data was collected from a secondary database, the NHIS claims database and not from medical records. It considers only the burden of disease based on patients who sought treatment. Also, we did not consider either psychiatric or physical comorbid disorders. Therefore, questions about the validity of the diagnosis and comorbidity information across hospitals may be raised. In addition, we used the number of hospitalizations and frequency of outpatient visits to ensure accuracy. Another limitation is that binge eating disorder has been recently added in DSM 5 and was not reflected in the existing ICD diagnostic system; so in our study, it is included under unspecified eating disorders.

Despite these limitations, this study is meaningful in that it has calculated the prevalence and economic burden of eating disorders using national representative bigdata; eating disorders create severe and disabling conditions for the afflicted individual and their families and society, but are prone to be overlooked. In particular, this study is unique in its inclusion of other eating disorder groups, which includes the binge eating disorder; most previous studies studied only bulimia nervosa and anorexia nervosa. The findings from the current study contribute to the evidence base from which suggestions for improvements in health service can be made, and to make policy- and service-planning more effective.

Declarations

Ethics approval and consent to participate
Ethical review was obtained by a University review board (IRB No. KHSIRB-19-354 (EA)). Informed consent was exempted due to the public nature of the data sources of NHIS.

**Consent for publication**

Not applicable

**Availability of data and materials**

No additional data available

**Competing interests**

The authors declare that they have no competing interests.

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**Authors' contributions**

S.M.L and I.H.O conceptualized the study and were major contributors to writing the manuscript. S.P and M.H analyzed the data and contributed to organizing data collection. W.S.K assisted in manuscript revision and interpretation. All authors read and approved of the final manuscript.

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Figures

Figure 1
Prevalence of eating disorders in Korea from 2010 to 2015 (per 100,000)

Figure 2
Economic burden of eating disorders in Korea in 2015 by age
Figure 3

Economic burden of eating disorders in Korea in 2015 by gender and age