

Original Article



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Conflict of Interest

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

Author Contributions

Changes in the Trend of Thyroid Cancer Epidemiology According to South Korean Nationwide Database, 1999–2020

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ABSTRACT

Purpose: The incidence of thyroid cancer has risen acutely over the last two decades around the world. This trend was the most pronounced in South Korea, which has attracted attention from various medical and non-medical experts in the healthcare field. However, a comprehensive statistical analysis of thyroid cancer trends is still lacking. This paper aims to bridge this gap by providing a detailed statistical review of thyroid cancer epidemiology in South Korea from 1999 to 2020.

Methods: Data was collected and analyzed from the Korean Statistical Information Service and Korean Central Cancer Registry system database.

Results: Our analysis reveals a striking increase in thyroid cancer incidence over the past two decades, with a notable rise in both female and male patients. Middle-aged individuals, particularly those aged 40-59, bear the highest burden of thyroid cancer. Correspondingly, the number of thyroid surgeries peaked in 2013, but declined by 2020, mirroring incidence trends. Remarkably, 5-year and 10-year relative survival rates have shown consistent improvement, reaching 100% in recent years. However, medical expenses for thyroid cancer have escalated significantly, reflecting the growing complexity of treatments. Discussions of overdiagnosis, changing incidence trends, and disproportionate shifts in gender distribution underscore the need for continuous assessment of diagnostic and therapeutic approaches.

Conclusion: This study provides valuable insights into thyroid cancer epidemiology and management, emphasizing the importance of ongoing research and healthcare planning to address this evolving public health challenge effectively in South Korea and beyond.

Keywords: Thyroid cancer; South Korea; Public Reporting of Healthcare Data; Trends; Epidemiology

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INTRODUCTION

Thyroid cancer, once a subject of intense debate due to overdiagnosis controversies in 2014, has since witnessed a remarkable shift in its clinical landscape in Korea (1,2). The post-surgical survival rates for thyroid cancer, exceeding 100% when suspected at early stages, have recently sparked discussions around the potential for overtreatment, underscoring the complexity of its management. Despite these high survival rates, a comprehensive statistical analysis examining the trends in thyroid cancer incidence and treatment over the past two decades remains notably absent.

This paper aims to fill this gap by providing a detailed statistical review of thyroid cancer in Korea over the past two decades, utilizing data from the National Cancer Registry and Cancer Registration Statistics. Our study aims to present incidence patterns, demographic variations, survival outcomes, and treatment economics of thyroid cancer throughout this period. With this article, we seek to contribute a settled perspective on the epidemiology of thyroid cancer in South Korea, thereby enriching the discourse on its diagnostic and therapeutic approaches.

MATERIALS AND METHODS

1. Data collection

Data were extracted from annual reports of cancer statistics in Korea (1999–2020) by the Korean Central Cancer Registry (KCCR) system database and Korean Statistical Information Service (<http://kosis.kr>). The Institutional Review Board of the Gil Hospital approved this study (approval no.: GCIRB2024-019).

The KCCR, a nationwide cancer registry based out of hospitals, generates yearly statistics. It has been in operation since 1980 and encompasses various metrics including cancer incidence, death rates, survival percentages, patient age, and geographical distribution. Utilizing KCCR data, we have calculated the incidence rates of thyroid cancer, along with the ages of patients and their respective survival rates.

This study included data of thyroid cancer patients diagnosed with International Classification of Disease (ICD)-10 code C73 which includes all types of thyroid cancers.

2. Statistical analysis

Calculations of thyroid cancer incidence rates were performed using crude rates (CRs) that represented per 100,000 individuals. CRs were determined by dividing the yearly total of newly diagnosed thyroid cancer by the population at mid-year. Survival rates from 1993 to 2020 for thyroid cancer patients were derived from follow-up data up to December 31, 2021. Relative survival rates indicate the proportion of actual patient survival to expected survival in the general population, adjusted for mortality from other causes. We analyzed and contrasted the 5-year relative survival rates, as well as 10-year relative survival rates, considering the year of diagnosis, age, and stage of the disease. A P value less than 0.05 was considered statistically significant. For all statistical analyses, the SPSS software (version 20.0; IBM Corp., Armonk, NY, USA) was used.

RESULTS

1. Trends in thyroid cancer incidence and surgery

Thyroid cancer incidence trends (1999–2020)

The incidence of thyroid cancer in Korea has strikingly increased over the past two decades. According to KCCR data, there were 3,408 new cases in 1999, which dramatically increased to 29,180 cases in 2020 (**Fig. 1**). In 1999, 2,891 (84.8%) female patients and 517 (15.2%) male patients were newly diagnosed with thyroid cancer, whereas 21,722 (74.4%) female patients and 7,458 (25.6%) male patients were newly diagnosed with thyroid cancer in 2020, showing a 7.5-fold increase in women and 14.4-fold increase in men. The CR of thyroid cancer in Korea increased from 1999 to 2020 as well, which was 7.2 thyroid cancer patients per 100,000 people, and 56.8 per 100,000 people, respectively (**Fig. 2**).

Age distribution of thyroid cancer in 2020

From the KCCR registry, an analysis of 29,180 thyroid cancer patients, newly diagnosed in 2020, revealed that those aged 40–49 years bore the highest burden with 7,784 cases (26.7% of total cases). This was closely followed by those in the 50–59-year-old age group (7,088 cases, 24.3%) (**Table 1**). Interestingly, the incidence of those aged 80 years and above was relatively low, accounting for only 1.0% of total cases. It was observed that the age distribution of thyroid cancer incidence had a similar trend from 1999 to 2020 (**Fig. 3**). This pattern suggests that middle-aged individuals have the highest risk of developing thyroid cancer.

Thyroid surgery trends (2006–2020)

The number of thyroid surgeries mirrors incidence trends, albeit with some fluctuations. A peak was observed in 2013 with 40,889 procedures, aligning with the high incidence rates around this period. However, there was a noticeable decrease to 25,282 surgeries by 2020 (**Fig. 4**). This trend corresponds with the number of newly diagnosed thyroid cancer cases.

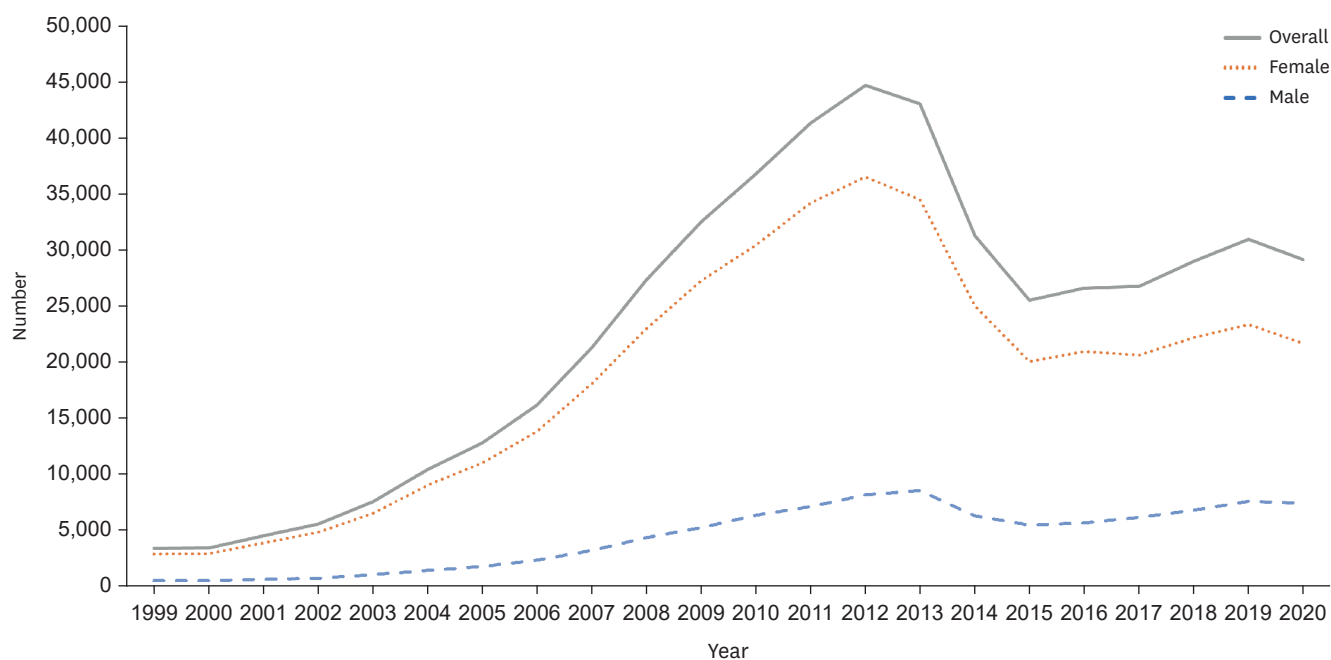


Fig. 1. Number of newly diagnosed patients with thyroid cancer in Korean men and women from 1999 to 2020.

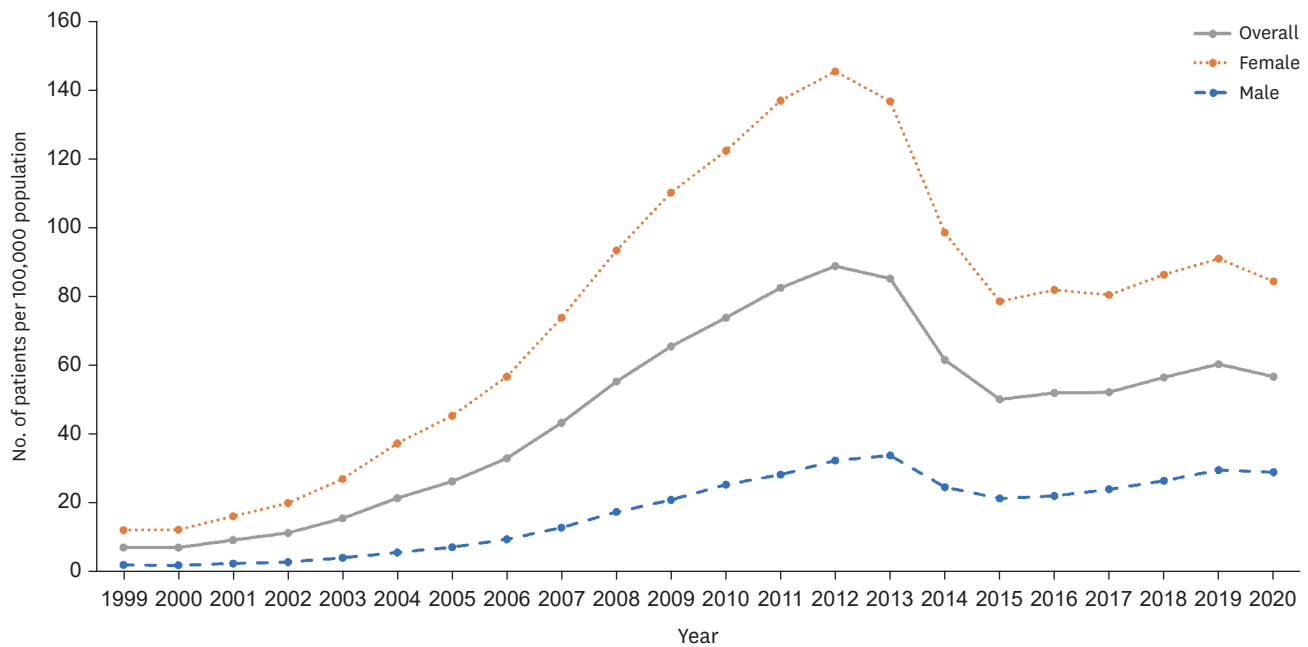


Fig. 2. Trends in the crude rate of thyroid cancer in Korean men and women from 1999 to 2020.

Table 1. Age-wise distribution of patients with newly diagnosed thyroid cancer in 2020 in Korea

Age (yr)	Overall	Men	Women
<20	199 (0.7)	41 (0.5)	158 (0.7)
20–29	2,392 (8.2)	533 (7.1)	1,859 (8.6)
30–39	6,069 (20.8)	1,796 (24.1)	4,273 (19.7)
40–49	7,784 (26.7)	2,047 (27.4)	5,737 (26.4)
50–59	7,088 (24.3)	1,691 (22.7)	5,397 (24.8)
60–69	4,027 (13.8)	967 (13.0)	3,060 (14.1)
70–79	1,338 (4.6)	298 (4.0)	1,040 (4.8)
≥80	283 (1.0)	85 (1.1)	198 (0.9)
Total	29,180 (100.0)	7,458 (100.0)	21,722 (100.0)

Values are presented as number (%).

2. Thyroid cancer survival rates

5-year relative survival rates (1993–2020)

The 5-year relative survival rates for thyroid cancer patients have shown remarkable improvement. From 94.5% during the period of 1993–1995, the 5-year relative survival rate rose to 100% during the 2016–2020 period. This improvement is consistent across genders, although females had consistently higher survival rates than males (**Table 2**).

10-year relative survival rates (1993–2015)

The trend in 10-year survival rates mirrors that of the 5-year rates, displaying a steady increase. Starting from 92.6% in 1993–1995, it reached 100.8% in the period 2011–2015 (**Table 3**). The trend again showed a slightly higher survival rate for females compared to males.

3. Medical expenses for thyroid cancer

Trends in medical expenses (2006–2020)

Reflecting the rising incidence and treatment complexities, the medical expenses for thyroid cancer have escalated significantly. From 26,104,753,000 KRW in 2006, expenses soared to

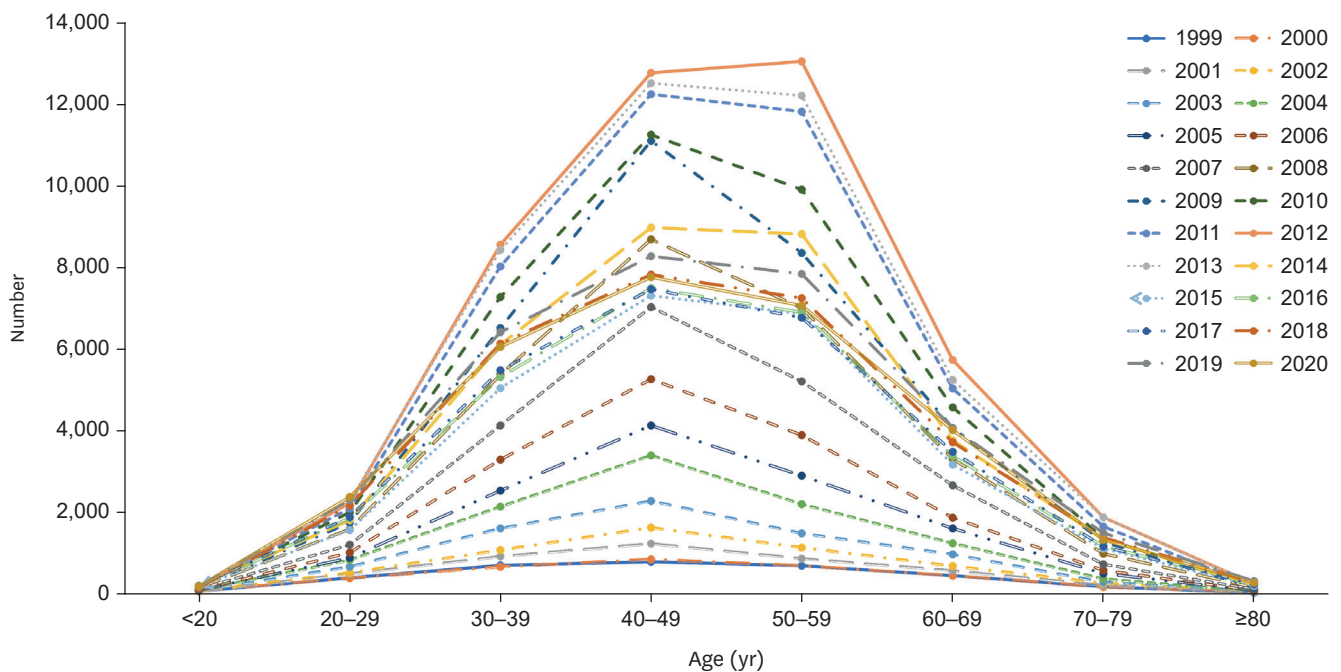


Fig. 3. Trends in age distribution patterns of Korean patients with thyroid cancer from 1999 to 2020.

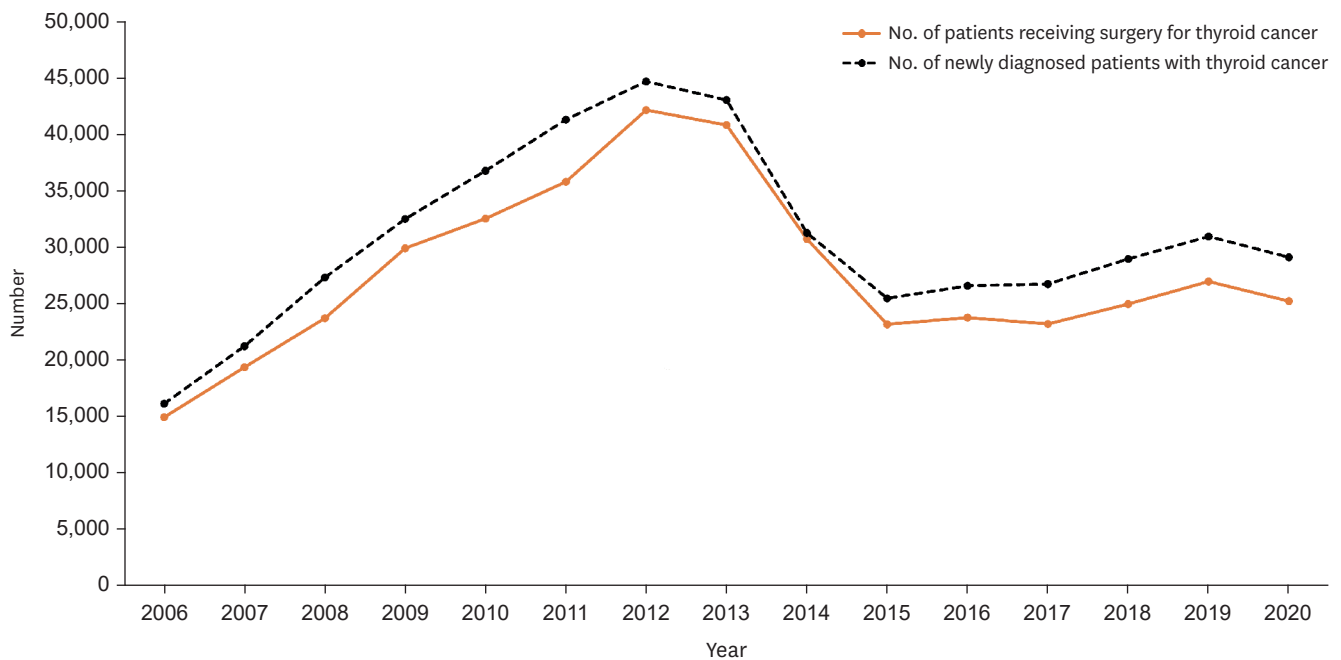


Fig. 4. Number of Korean patients receiving thyroid surgery for thyroid cancer from 2006 to 2020.

89,370,752,000 KRW by 2020 (**Fig. 5**). This increase not only reflects the growing number of cases but also the evolving nature of treatment modalities and their associated costs.

Table 2. Trends in 5-year relative survival of thyroid cancer patients by sex and incidence period, 1993–2020 in Korea

Sex	Period of diagnosis											
	1993–1995		1996–2000		2001–2005		2006–2010		2011–2015		2016–2020	
	Cases	5-year survival (%)	Cases	5-year survival (%)	Cases	5-year survival (%)	Cases	5-year survival (%)	Cases	5-year survival (%)	Cases	5-year survival (%)
Total	5,214	94.5	13,946	95.0	39,493	98.4	128,109	100.0	177,483	100.2	135,625	100.0
Male	781	87.9	2,103	89.7	5,363	96.0	20,339	100.2	33,605	100.6	31,921	100.3
Female	4,433	95.7	11,843	96.0	34,130	98.7	107,770	99.9	143,878	100.1	103,704	100.0

Table 3. Trends in 10-year relative survival of thyroid cancer patients by sex and incidence period, 1993–2015 in Korea

Sex	Period of diagnosis									
	1993–1995		1996–2000		2001–2005		2006–2010		2011–2015	
	Cases	10-year survival (%)	Cases	10-year survival (%)	Cases	10-year survival (%)	Cases	10-year survival (%)	Cases	10-year survival (%)
Total	5,214	92.6	13,946	93.6	39,493	98.2	128,109	100.5	177,483	100.8
Male	781	86.3	2,103	86.6	5,363	95.8	20,339	101.5	33,605	101.9
Female	4,433	93.7	11,843	94.8	34,130	98.6	107,770	100.3	143,878	100.6

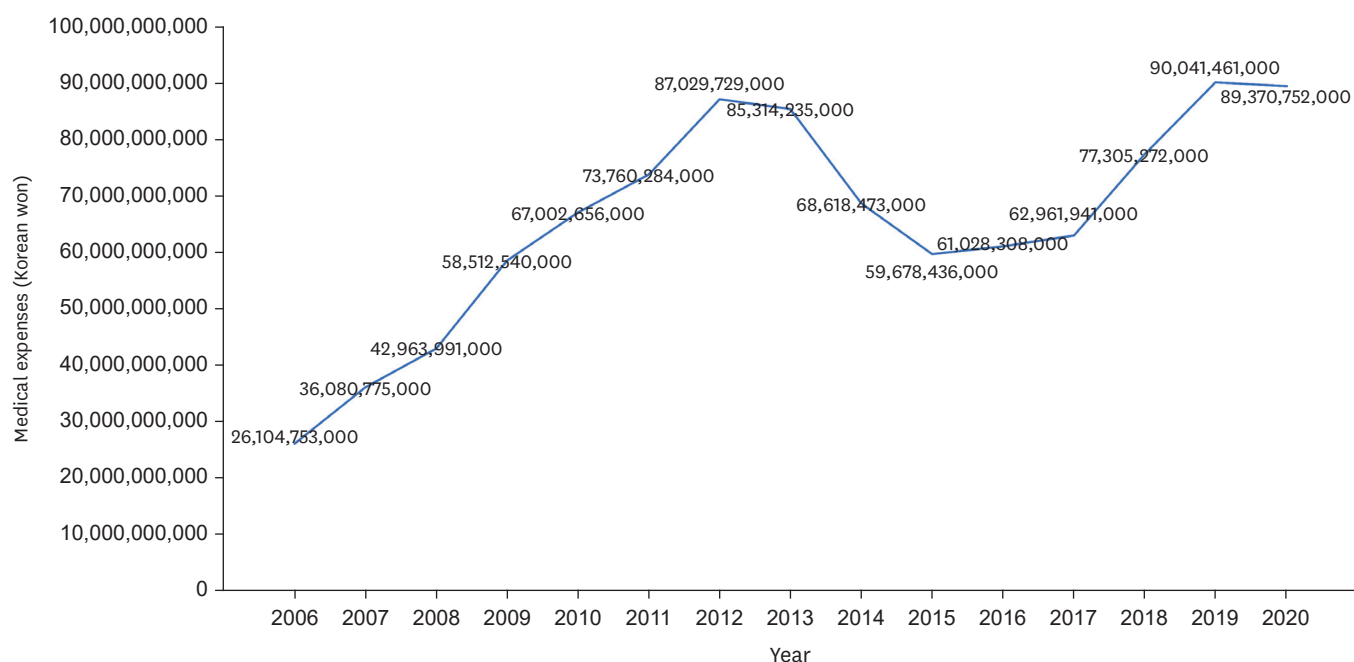


Fig. 5. Trends in medical expenses for thyroid cancer in the overall Korean population from 2006 to 2020.

DISCUSSION

The epidemiologic trend of thyroid cancer in South Korea has been of great interest to practitioners, researchers, and government policy makers alike (1,2). Our study summarizes and provides a comprehensive overview of the evolving landscape of thyroid cancer epidemiology in South Korea from 1999 to 2020, based on official statistics published by the South Korean government. Not only does our article facilitate access to this data for domestic readers, but also provides a translated version of the official government raw data that would have otherwise been incomprehensible for foreign researchers. In summary, the data highlights a significant increase in incidence, particularly among men, and improvements in survival rates concerning thyroid cancer. Although data presented in this article are

summaries of the analyzed, official raw data, they provide valuable insights into some key issues relevant to diagnostic and therapeutic approaches to thyroid cancer, not only in South Korea, but also worldwide.

First, in and around 2013, the issue concerning thyroid cancer overdiagnosis was greatly publicized through South Korean mainstream media outlets (1,2). It led to a massive reaction from professionals in both the medical and non-medical fields, followed by a nadir in diagnosis and treatment of thyroid cancer from 2015 to 2017. Medical professionals practicing in thyroid cancers were receptive to medical and non-medical critics and responded by actively and systematically implementing measures such as active surveillance protocols. This demonstrates the concerted efforts and self-regulatory capacity of the various South Korean medical associations related to thyroid cancer, including the Korean Association of Thyroid and Endocrine Surgeons, responding to and adjusting to new evidence.

Furthermore, this data illustrates an interesting point in the changing trends of thyroid cancer. If the increase in incidence was solely due to overdiagnosis, the epidemiologic pattern, apart from incidence, should remain constant. While the incidence of newly diagnosed thyroid cancer rose significantly throughout the study period and the age distribution remained constant, the distribution between both sexes, however, changed disproportionately. Although this trend may be a result of mere habitual changes concerning access to healthcare between both sexes, a comprehensive insight into this phenomenon is imperative to exclude changes in thyroid cancer risk factors that may have caused it.

Finally, in contrast to the incidence and treatment of thyroid cancer that has not reached previous records after the nadir of 2015–2017, medical expenses have already eclipsed their previous peak costs. Although it could be suspected that robotic surgery plays a role in the increase in medical expenses for thyroid cancer, an analysis of the actual data shows that while the costs of surgery reached a peak in 2020, the actual number of surgeries performed showed a decreasing trend around 2020. Therefore, it is difficult to attribute the increase in medical expenses for thyroid cancer solely to the introduction of robotic surgery. Instead, according to previous Korean cost effectiveness analyses on thyroid cancer active surveillance, the cumulative direct and indirect costs of active surveillance and surgery in low-risk papillary thyroid cancer patients plateaued over the course of 10 years. These analyses also concluded that surgery could be more economical for patients with a long-term life expectancy upon follow-up (3,4). Since these studies were review articles, they demonstrated a need for South Korean cost analyses on active surveillance at a national level, which would comprehensively assess the efficacy of various approaches to thyroid cancer.

Due to the analysis of nationally standardized data, there are limitations in understanding the details and the relationships between individual data items. Thyroid cancer has a good prognosis with a 10-year survival rate exceeding 90%. However, it is impossible to confirm from the national data whether the cause of death for patients diagnosed with thyroid cancer is due to the thyroid cancer itself or other diseases, making it difficult to ascertain detailed relationships. For the same reasons, despite the noticeable gender differences in incidence rates for this disease, the current data does not allow for the examination of differences in surgical methods or treatment costs by gender. Likewise, this study relies heavily on KCCR and the Korean Statistical Information Service. While these sources are robust, the accuracy and comprehensiveness of registry-based studies can be limited by factors like changes in data collection methods over time, reporting biases, and the completeness of follow-up data.

Additionally, the study period ends in 2020, and more recent trends may not be reflected in the current analysis. Nevertheless, the significance of this study is considerable as it represents the first extensive analysis of thyroid cancer data using national records.

CONCLUSION

In conclusion, we have demonstrated a significant increase in incidence, particularly among men, and improvements to survival rates for thyroid cancer patients. However, these advances come with increased medical expenses, underlining the need for ongoing research and healthcare planning to manage this public health challenge effectively.

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