



## Re-Increasing Trends in Thyroid Cancer Incidence after a Short Period of Decrease in Korea: Reigniting the Debate on Ultrasound Screening

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In Korea, the incidence of thyroid cancer has increased steeply over the past three decades. However, it started to decrease rapidly in 2012 after a societal debate regarding the overtreatment of small, low-risk thyroid cancer. Nonetheless, in recent years, as the incidence of thyroid cancer has increased again, the issue of ultrasound screening for thyroid cancer has been reignited. Therefore, we aimed to investigate whether there might be other causes of this recent increase by comparing nationwide data on cancer registration and thyroid fine needle aspiration (FNA).

According to the Korea Central Cancer Registry annual report published by the National Cancer Control Institute ([www.ncc.re.kr](http://www.ncc.re.kr)) in December 2021, the incidence of thyroid cancer in Korea sharply increased from 3,407 new cases in 1999 to 44,748 new cases in 2012. The incidence then significantly decreased to 25,523 new cases in 2015 (Fig. 1). However, the number of incident thyroid cancer cases rose again to 30,676 in 2019.

The Korean Society for Cytopathology (KSC) has been annually collecting nationwide data about the number of FNA procedures through the Continuous Quality Improvement (CQI) program for cytopathology laboratories since 2007 [1,2]. Since all pathology laboratories must submit their data about cytology

statistics to KSC, the CQI data represent all FNA procedures performed in Korea. The number of thyroid FNA procedures per institution is available from 2015 [3]. From 2015 to 2021, thyroid FNA accounted for an average of 67.2% of all FNA procedures. We estimated the number of thyroid FNA procedures conducted from 2007 to 2014 by multiplying the number of all FNA procedures per year by that average percentage (Fig. 1). The changing trend in the total number of FNA procedures by year was consistent with the change in the number of new thyroid cancer cases (Fig. 1).

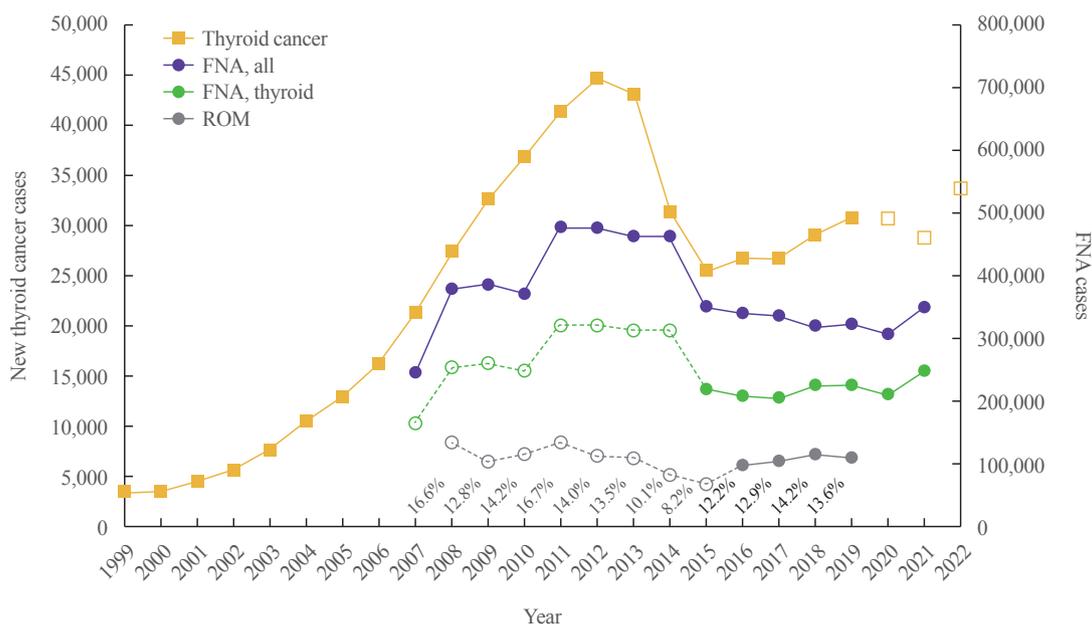
It usually takes months to years for patients to undergo surgery after being diagnosed with thyroid cancer by FNA [4]. Therefore, we calculated the risk of malignancy (ROM) for FNA procedures each year by dividing the number of cancer cases by the total number of FNA procedures performed in the previous year [4,5]. Using this formula, we estimated the ROM at 12.8% to 16.6% during 2007 to 2012, when thyroid cancer incidence rapidly increased. However, the estimated ROM steadily decreased from 13.5% to 8.2% during 2013 to 2015, when thyroid cancer incidence decreased. These results indicate that the number of patients diagnosed with thyroid cancer by

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**Fig. 1.** Trends in new thyroid cancer cases and the number of thyroid fine needle aspiration (FNA) procedures from 1999 to 2022 in Korea. All FNA procedures include tests performed on whole organs, including the thyroid. We estimated the number of thyroid FNA procedures in 2007 to 2014 based on procedures performed from 2015 through 2021. The risk of malignancy (ROM) represents the percentage of thyroid cancer cases divided by the number of thyroid FNA procedures in the previous year. Closed squares and circles denote observed values. Open squares and circles, and dotted lines refer to estimated values.

FNA but not registered as cancer patients increased because they did not undergo surgery.

Since the outbreak of thyroid cancer peaked, the revised clinical guidelines in Korea have increased the size of nodules subject to FNA and thus reduced the number of unnecessary FNA procedures [6-8]. However, the number of new thyroid cancer cases continued to increase during 2015 to 2019, although there was no significant change in the total number of thyroid FNA procedures (Fig. 1). These results caused an increase in ROM during this period. Therefore, the renewed increase in the incidence of thyroid cancer may not be explained only by an increase in thyroid ultrasound screening in the general population.

There is a lag time of 2 years for the registration of patients newly diagnosed with cancer in the Korea Central Cancer Registry. The KSC annually collects nationwide data on all FNA procedures performed in the previous year. Using the CQI data from the KSC, we can predict thyroid cancer incidence in the current year. By applying the ROM of 13.6% observed in 2019, we predict that the number of new thyroid cancer cases in Korea in 2020, 2021, and 2022 might be 30,630, 28,728, and 33,751, respectively (Fig. 1). The decrease in the predicted thyroid cancer incidence in 2021 may be related to the decrease in thyroid FNA procedures in 2020 due to coronavirus disease 2019 (CO-

VID-19). Our prediction for 2022 is very similar to that predicted by Jung et al. [9] using linear regression models.

In conclusion, the cause of the recent re-increase in thyroid cancer is difficult to explain only by an increase in the number of patients who underwent surgery for small, low-risk thyroid cancer. Other reasons other than ultrasound screening may also be involved in this increase. Further studies are necessary to investigate whether the incidence of large or advanced thyroid cancers is also increasing. Nationwide data on thyroid FNA may help estimate thyroid cancer incidence in the latest year.

## CONFLICTS OF INTEREST

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

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