

Brief Research Report

The incidence of thyroid cancer in Danish children, adolescents and young adults

Ulrik Ørsø Andersen, Jakob Myllerup Jensen, Christian Grønhøj & Thomas Hjuler

Department of Otorhinolaryngology, Head & Neck Surgery and Audiology, Copenhagen University Hospital – Rigshospitalet, Denmark

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ABSTRACT

INTRODUCTION. Previous Danish data (1980-2014) showed a significant increase in thyroid cancer incidence among children and adolescents. This study examined whether this trend persisted during the most recent decade.

METHODS. All patients aged 0-24 years diagnosed with thyroid cancer in Denmark between 2015 and 2024 were identified in the Danish Cancer Registry. Crude and age-specific incidence rates (IRs) per 100,000 were calculated for children/adolescents (0-17 years) and young adults (18-24 years), stratified by sex and histological subtype. Trends were analysed using Joinpoint regression.

RESULTS. A total of 159 cases were identified; 81% were female. Median age at diagnosis was 16 years in the 0-17-year group and 22 years in the 18-24-year group. Papillary carcinoma was the most common subtype in both groups (68% and 82%). From 2015 to 2024, overall IRs increased non-significantly from 0.65 to 0.94 per 100,000. Across 1980-2024, the incidence increased significantly in young adults (average annual percentage change (AAPC) = 3.4%) and in the total population (AAPC = 2.8%), but not in children/adolescents. IRs increased with age, reaching 4.89 among 24-year-old females and 1.01 among males.

CONCLUSIONS. The incidence of thyroid carcinoma in Danish children and young adults has remained stable during the 2015-2024 period, with persistent female predominance and papillary carcinoma as the dominant subtype. Long-term trends continue to show an increasing incidence overall, mainly driven by an increasing incidence among young adults.

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Thyroid carcinoma in the paediatric and adolescent population is relatively rare, representing approximately 2% of all malignancies in individuals under 20 years of age [1]. The incidence of thyroid cancer increases with age among children and young adults and exhibits a marked female predominance [1, 2]. The assessment of thyroid nodules in children requires prompt and comprehensive evaluation, as the likelihood of malignancy is substantially higher than in adults. Moreover, compared with adult cases, paediatric thyroid carcinoma more frequently presents with a greater size of tumour, lymph node metastases and distant metastatic disease [2].

A previous study [3] on nationwide Danish register data on children, adolescents and young adults with thyroid cancer during 1980-2024 verified earlier observations that most affected patients were female and that papillary thyroid carcinoma represented the predominant histopathological subtype. The study also demonstrated an increasing incidence of thyroid cancer, especially among females, and reported an overall 99% survival rate. The aim of this study was to investigate whether this trend remained unchanged during the following decade.

Methods

Consistent with the methodology of the previous study [3], data were extracted from the Danish Cancer Registry (DCR) for 2015-2024 [4]. The DCR contains nationwide cancer data from 1943 onwards, including age at diagnosis. All individuals aged 0-24 years with a first primary thyroid cancer diagnosis were included. Data from 1980 to 2014 were also used for descriptive and statistical analyses.

Thyroid cancer cases were identified using the International Classification of Diseases, 10th version (ICD-10), code DC73.9 in the DCR. Histopathological diagnoses were classified according to the International Classification of Diseases for Oncology, Third Edition (ICD-O-3), using MORPHO3 codes recorded in the DCR.

Cases were identified using the ICD-10 code DC73.9. Histopathology was classified according to the ICD-O-3 using MORPHO3 codes in the DCR. Tumours were grouped into four categories, following Jensen et al. [3]: papillary (80503, 82603, 83413, 83433), follicular (82903, 83303, 83313, 83403, 83353, 83393), medullary (85103, 83453) and other types (80003, 80013, 80103, 80203, 81403, 89003, 82303).

Age at diagnosis was stratified into children/adolescents (0-17 years) and young adults (18-24 years).

Statistical analysis

All statistical analyses were performed using R (version 4.5.1, Stanford University, Stanford, CA [5]). Consistent with Jensen et al. [3], incidence rates (IRs) were calculated as crude rates based on population data from Statistics Denmark. Age-specific incidences used the average population from 2015 to 2024. Joinpoint software (version 4.9.0.1) was used to estimate the average annual percentage change (AAPC) assuming log-linear growth ($\ln(y) = xb$). To reduce year-to-year variability, incidence curves were based on three-year rolling averages, where each point represents the mean of the index year and the two preceding years. Thus, plotted values may differ slightly from annual estimates. Statistical significance was defined as $p < 0.05$.

Trial registration: not relevant

Results

The study identified 159 patients aged 0-24 years with thyroid cancer in the period from 2015 to 2024. The patients were predominantly female ($n = 129$, 81%), and there was no statistically significant difference in sex distribution between the children/adolescent and young adult groups ($p = 0.9$, **Table 1**). The overall median age at diagnosis was 21 years (IQR: 18-23 years). The median age of children/adolescents was 16 years (IQR: 14-17 years), and that of young adults was 22 years (IQR: 20-23 years).

TABLE 1 Distribution of sex and histological tumour types among children/adolescents (0-17 years) and young adults (18-24 years) with thyroid cancer, Denmark 2015-2024. The values are n (%).

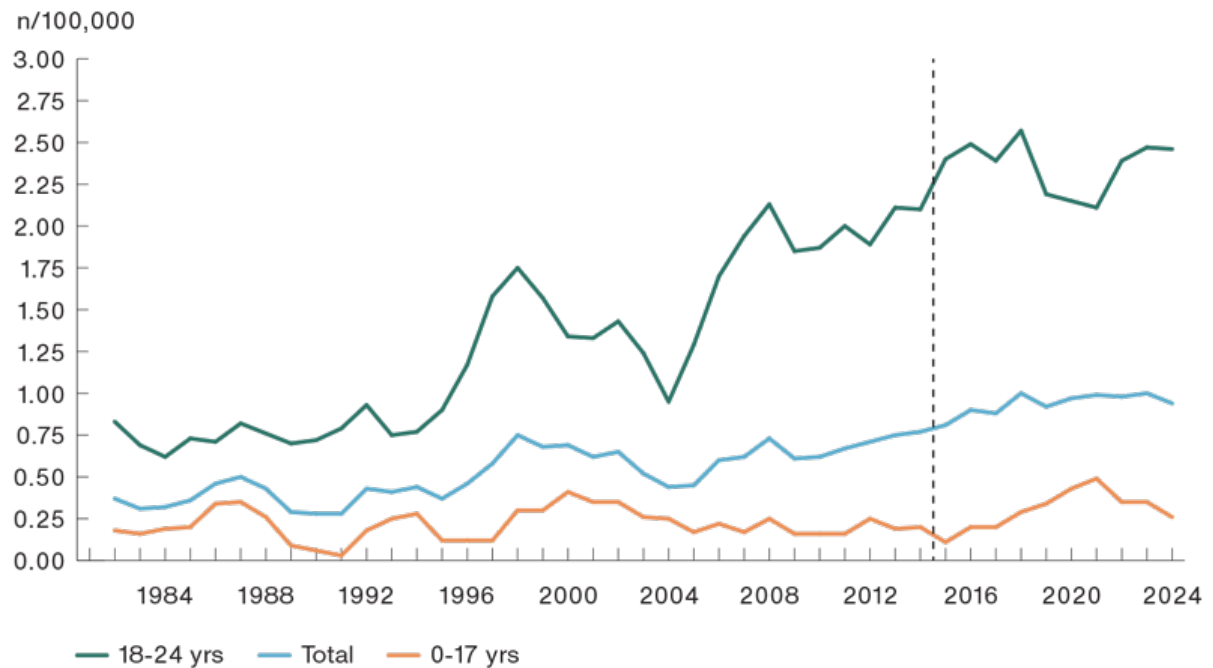
	0-17 yrs (N ₀ = 37)	18-24 yrs (N ₁₈ = 122)	p value ^a
Sex			0.9
Female	29 (78)	92 (75)	
Male	8 (22)	30 (25)	
<i>Histological tumour type</i>			0.2
Follicular carcinoma	9 (24)	17 (14)	
Medullary carcinoma	3 (8.1)	4 (3.3)	
Others	0	1 (0.8)	
Papillary carcinoma	25 (68)	100 (82)	

a) Pearson's χ^2 -test.

In both age groups, the most common histopathological tumour was papillary carcinoma, with 68% (n = 25) in the children/adolescents' group and 82% (n = 100) in the young adults group. The distribution of histopathological tumour types was not significantly different between the two age groups (p = 0.2) (Table 1).

IR per 100,000 per year is presented in **Figure 1**, which includes the IR for thyroid cancer for the periods 1980-2014 and 2015-2024. For the total population, the IR increased from 0.65 in 2014 to 0.94 in 2024; for children/adolescents, the IR increased from 0.09 in 2014 to 0.26 in 2024; and for the young adults, the IR increased from 1.91 in 2014 to 2.46 in 2024. For all three groups, the results were insignificant. The AAPC for the combined 1980-2024 period demonstrated a significant upward trend in the IR among both the young adult population (AAPC = 3.4%; 95% CI: 2.6-4.2%) and the total population (AAPC = 2.8%; 95% CI: 2.0-3.5%). However, no significant change was observed in children/adolescents (AAPC = 1.1%; 95% CI: -6.9-9.7%).

FIGURE 1 Three-year rolling average of incidence rates per 100,000 for children/adolescents (orange), young adults (green) and the total population (blue), Denmark 1980-2024. The dotted line indicates the change of data from Jensen et al. [3] and the present study population, respectively.



Among females, the age-specific IR increased from 0.00 at birth to 4.89 at age 24 years (AAPC = 121.9%; 95% CI: 78.4-176.0%), whereas in males, it increased from 0.00 at birth to 1.01 at age 24 years (AAPC = 85.4%; 95% CI: 36.7-151.5%). For the total population, age-specific IR increased from 0.00 at birth to 2.91 at the age of 24 years (AAPC = 91.1%; 95% CI: 51.0-141.9%). For all groups, the IR trajectory remained relatively stable until approximately 13 years of age, after which it increased.

Discussion

This nationwide registry-based study provides an updated ten-year assessment of thyroid cancer in individuals aged 0-24 years in Denmark. Although the incidence increased slightly during the 2015-2024 period, the change was not statistically significant. In contrast, long-term analyses (1980-2024) show a sustained increase among young adults, while rates in children and adolescents remain stable.

Clinically, a stable incidence in children and adolescents is reassuring. Even without statistical significance, the findings suggest that earlier increases have not continued, which may reflect a balance between true disease occurrence and diagnostic activity, reducing concern about a growing disease burden in this group.

Papillary carcinoma remained the predominant subtype across all age groups, with no significant differences between children/adolescents and young adults. The incidence increased with age and showed a marked female predominance, especially after early adolescence.

Limitations include reliance on DCR registry data, which may be subject to misclassification or incomplete reporting, although cancer registration is mandatory [4]. The study lacks data on factors such as mortality or clinical management and diagnostic pathways, which limits the clinical depth and novelty of the findings.

Furthermore, the IR trends may be influenced by changes in diagnostic practices or awareness. Despite this, the study updates national incidence data and shows that while rates are stable in younger individuals, the continued increase among young adults warrants attention and ongoing surveillance.

Conclusions

This nationwide registry-based study provides an updated ten-year overview of thyroid cancer in individuals aged 0-24 years in Denmark. The incidence increased slightly from 2015 to 2024, but the change was not statistically significant. Long-term trends (1980-2024) show a continued rise among young adults, while rates in children and adolescents remain stable, suggesting a plateau. Papillary carcinoma was the predominant subtype across all age groups, with no significant differences between them. The incidence showed a clear female predominance and increased after early adolescence. Overall, these findings confirm previous patterns and highlight the need to investigate risk factors behind the rising incidence in young adults.

Correspondence *Ulrik Ørsø Andersen*. E-mail: Ulrik.oersoe.andersen@regionh.dk

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