

ORIGINAL ARTICLE

Temporal trends of thyroid cancer between 2010 and 2019 in Asian countries by geographical region and SDI, comparison with global data

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Abstract

Objective: This study aims to describe temporal trends of thyroid cancer (ThC) from 2010 to 2019, in Asian countries by geographical region and sociodemographic index, compared with global data.

Method: Annual case data and age-standardized rates (ASRs) of epidemiological indicators of ThC cancer data were collected from the 2019 Global Burden of Disease (GBD) study from 2010 to 2019 in 49 countries and territories in Asia. The relative difference (%) between years was used to show comparative variations of ASRs for the indicators studied. The female/male ratio was calculated by dividing female ASRs by male ASRs. Also, these rates were compared between the age group ≥ 70 years old and younger age groups.

Results: In 2019, more than 50% of ThC cases and deaths occurred in Asian countries. A total of 53% of ThC patients lived in Asia and more than 60% of the global burden of ThC was imposed on Asian countries. From 2010 to 2019, incidences, deaths, prevalence cases, and DALYs number of ThC cancer increased over 1.28-, 1.26-, 1.3-, and 1.2-fold, in Asia, respectively. During this period, the age-standardized incidence rate (ASIR) and the age-standardized prevalence rate (ASPR) of ThC cancer increased by 5% and 8%, respectively, while the age-standardized death rate (ASDR) and the age-standardized DALYs rate (DALYs ASR) of ThC cancer decreased by 6% and 4%, respectively. These trends are different from what happens in other continents. In 2019, age-specific incidence, death, prevalence, and DALY cases of ThC cancer were peaking at 50–54, 75–79, 50–54, and 55–59 years, respectively. In 2019, the highest ASIR and ASPR of ThC cancer was observed in high-income Asia Pacific countries and the highest ASDR and DALYs ASR in Southeast Asia countries. Only high-income Asia Pacific countries experienced a decreasing trend in ASIR and ASPR from 2010 to 2019. ASDR and DALYs ASR have the highest decreasing trend in high-income Asia Pacific. In 2019, among high SDI Asian countries, the Republic of Korea had the highest ASIR and ASPR, and Brunei Darussalam had the highest ASDR and DALYs ASR.

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The highest ASIR, ASDR, ASPR, and DALY ASR of ThC cancer was found in Lebanon and Malaysia (high-middle SDIs), Vietnam (middle SDIs), and Cambodia and Palestine (low-middle SDIs). Among low SDI Asian countries, Pakistan had the highest ASIR, ASDR, ASPR, and DALY ASR of ThC cancer. All indicators for most countries were higher in women than men.

Conclusion: More than half of the burden of thyroid cancer is imposed on the residents of the Asian continent. Although the incidence and prevalence of this cancer in Asian countries is lower than that of the world, America, and Europe, the highest rate of death from thyroid cancer occurs in Asia and they witness the highest burden of the disease. Therefore, it seems that implementing early detection strategies and increasing access to treatment facilities in Asia is one of the necessities of thyroid cancer control in its residents.

KEYWORDS

Asia, burden, death, incidence, prevalence, thyroid cancer

1 | INTRODUCTION

Thyroid cancer (ThC) is a common form of endocrine cancer worldwide,¹ with adult women being the most affected. It ranks fifth among the most frequently diagnosed cancers in women globally and second in women above the age of 50.¹ Over the past three decades, the incidence of thyroid cancer has been on the rise worldwide.² The global age-standardized incidence rate of thyroid cancer increased by 20% from 1990 to 2013, with low-income countries recording a higher rate than high-income countries (33% vs. 19%).³ In 2020, according to GLOBOCAN estimates, there were 586,000 new cases of thyroid cancer globally, making it the ninth most common cancer.⁴

It's interesting to note that there has been an increasing number of thyroid tumors reported worldwide. While the exact cause is unclear, it is believed to be due to various factors such as general screening, thyroid sonography, and aspiration biopsies that can detect small tumors.⁵ However, many experts believe these higher-quality screening methods alone cannot explain the entire trend, and other risk factors are also being studied.⁶

While certain ThC risk factors like patient age, sex, race or ethnicity, and hereditary predisposition cannot be modified,⁷ other factors can. These include radiation exposure⁵; iodine intake⁵; thyroid stimulating hormone (TSH)⁵; environmental pollutants like several industrialized food additives, such as nitrates from cured meat and some vegetables, which can challenge iodine uptake and potentially alter thyroid function^{8,9}; BMI¹⁰; lifestyle; and diet.¹¹

It is necessary to mention the incidence of ThC varies in different geographical regions. Its incidence is more remarkable in high-income countries compared with low-income and middle-income countries for both sexes.¹² Thus, this study aims to describe temporal trends of ThC from 2010 to 2019, in Asian countries by geographical region and sociodemographic index, compared with global data.

2 | METHODS

2.1 | Data source

The incidence, mortality, prevalence, and burden data for ThC were extracted from the GBD 2019 study for the following regions: 49 Asian countries, 6 global burden of disease (GBD) regions, worldwide, and 4 continents. Data were extracted from the Global Health Data Exchange (GHDx) using the GBD 2019 query tool (<http://ghdx.healthdata.org/gbd-resultstool>) based on the International Classification of Diseases 10 (ICD-10 code 73 for ThC). In GBD, epidemiological indicators included incidence, death, prevalence, years of life lost (YLL), years lived with disability (YLD), and disability-adjusted life years (DALY) by time, location, gender, and age group for 204 countries and territories from 1990 to 2019 is estimated to provide a comparative assessment of health loss due to 364 diseases and injuries.¹³

In this study, the data were extracted for various classifications of Asian countries based on a sociodemographic index (SDI) and six GBD regions of Asia from 2010 to 2019. The data were then compared with worldwide and other continental data, specifically North Africa and the Middle East, where 15 out of 21 GBD countries belong to West Asia. Additionally, two Southeast Asian countries were from Africa.^{14,15}

The GBD has developed a standardized international form of quality-adjusted life year (QALY), known as DALY. DALYs for a given condition within a population are equal to the sum of YLLs and YLDs of known severity and duration. One DALY represents the loss of an equivalent 1 year of full health due to premature death and years lived with a disability of specific severity and duration. "Premature" death is a death that occurs at an age when a person's death is not expected. The expected age of death of a person is calculated based on the expected mortality for a certain age in a population

TABLE 1 The comparing incidence, death, prevalence, and burden rates of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019 (Both genders).

| Location | Incidence | | | | | Death | | | | |
|---------------------------------------|----------------------------------|----------------------|----------------------------------|----------------------|------------------------------|-------------------------------|----------------------|-------------------------------|----------------------|---------------------------|
| | 2010 | | 2019 | | % change 2010–2019 | 2010 | | 2019 | | % change 2010–2019 |
| | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | |
| Global | 191,197 (171,483– 197,888) | 2.80 (2.51–2.9) | 233,847 (211,637– 252,807) | 2.83 (2.56–3.06) | 0.01 (–0.06– 0.09) | 37,268 (33,797– 38,957) | 0.60 (0.54–0.62) | 45,576 (41,290– 48,775) | 0.57 (0.51–0.61) | –0.05 (–0.09–0.01) |
| Continents | | | | | | | | | | |
| Africa | 9483 (7765–10,709) | 1.44 (1.22–1.61) | 14,333 (11,677– 17,056) | 1.64 (1.37–1.92) | 0.14 (0.03–0.28) | 2738 (2362–3084) | 0.56 (0.49–0.63) | 3576 (3005–4128) | 0.56 (0.48–0.64) | 0.00 (–0.07–0.08) |
| America | 37,686 (36,327– 38,642) | 3.78 (3.65–3.87) | 45,225 (40,289– 50,631) | 3.75 (3.33–4.19) | –0.01 (–0.11–0.1) | 5769 (5320–5997) | 0.58 (0.53–0.6) | 7288 (6647–7824) | 0.57 (0.52–0.61) | –0.01 (–0.06–0.04) |
| Asia | 98,632 (83,838– 104,253) | 2.44 (2.07–2.57) | 127,008 (111,149– 139,720) | 2.56 (2.23–2.82) | 0.05 (–0.04– 0.15) | 21,405 (18,846– 22,632) | 0.63 (0.55–0.66) | 26,982 (23,978– 29,391) | 0.59 (0.52–0.64) | –0.06 (–0.13–0.01) |
| Europe | 45,168 (43,086– 46,451) | 3.97 (3.81–4.08) | 47,009 (42,592– 52,230) | 3.84 (3.48–4.26) | –0.03 (–0.12– 0.07) | 7307 (6758–7566) | 0.54 (0.5–0.56) | 7670 (6955–8203) | 0.49 (0.45–0.52) | –0.09 (–0.13 to –0.04) |
| Asian GBD regions | | | | | | | | | | |
| Central Asia | 975 (925–1032) | 1.40 (1.33–1.47) | 1467 (1306–1650) | 1.69 (1.51–1.89) | 0.21 (0.08–0.35) | 243 (233–254) | 0.43 (0.41–0.45) | 309 (278–341) | 0.45 (0.4–0.49) | 0.05 (–0.05–0.14) |
| East Asia | 31,302 (28,108– 35,140) | 1.85 (1.67–2.07) | 41,580 (34,751– 50,204) | 2.11 (1.77–2.54) | 0.14 (–0.05– 0.36) | 6215 (5559–6796) | 0.43 (0.38–0.47) | 7621 (6346–8874) | 0.40 (0.33–0.46) | –0.08 (–0.21–0.07) |
| High-income Asia Pacific | 20,055 (13,617– 21,957) | 7.51 (4.75–8.31) | 15,660 (13,134– 18,056) | 4.98 (4.19–5.79) | –0.34 (–0.44 to –0.05) | 2564 (1981–2795) | 0.68 (0.52–0.73) | 2754 (2128–3071) | 0.53 (0.43–0.58) | –0.22 (–0.26 to –0.1) |
| North Africa and Middle East | 11,873 (9876–13,126) | 2.81 (2.45–3.08) | 19,253 (15,675– 22,281) | 3.46 (2.89–3.96) | 0.23 (0.11–0.36) | 1705 (1548–1994) | 0.54 (0.49–0.67) | 2290 (1981–2669) | 0.54 (0.47–0.66) | 0.00 (–0.09–0.08) |
| South Asia | 21,321 (18,203– 23,510) | 1.62 (1.39–1.78) | 31,534 (26,591– 36,439) | 1.90 (1.61–2.19) | 0.17 (0.02–0.36) | 6885 (6105–7550) | 0.65 (0.57–0.72) | 9196 (7978– 10,477) | 0.65 (0.56–0.74) | 0.00 (–0.12–0.14) |
| Southeast Asia | 18,339 (14,850– 20,486) | 3.32 (2.73–3.67) | 25,581 (20,569– 29,886) | 3.72 (3.01–4.32) | 0.12 (–0.01– 0.28) | 4624 (3928–5034) | 1.06 (0.91–1.15) | 5862 (4999–6646) | 1.02 (0.88–1.15) | –0.04 (–0.13–0.05) |

standardized to the population of Japan, which has the longest life-time at birth in the world.¹⁵

The SDI is a composite indicator of a country's lag-distributed income per capita, average educational attainment of people aged 15 years and older, and the total fertility rate (in people aged <25 years). The geometric average of these three indicators is used to calculate the SDI. The SDI reflects the levels of social and economic conditions that can affect health outcomes in a given location. Countries and territories were categorized into five groups based on their SDI values: low SDI (<0.45), low-middle SDI (≥ 0.45 and <0.61), middle SDI (≥ 0.61 and <0.69), high-middle SDI (≥ 0.69 and <0.80), and high SDI (≥ 0.80).¹⁶

The age-standardized rate (ASR) is a calculation that takes into account the differences in age distribution between populations by applying the rates for each population to a standardized population. It is a weighted average of the age-specific rates per 100,000 persons within the corresponding age groups of the WHO standard population.¹⁷

2.2 | Ethical considerations

This study was approved by the Ethics Committee of the Jahrom University of Medical Sciences in Iran (IR.JUMS.REC.1401.094

| Prevalence | | | | | DALY | | | | |
|-----------------------|-------------------|-----------------------|-------------------|--------------------|---------------------|-------------------|-----------------------|-------------------|--------------------|
| 2010 | | 2019 | | | 2010 | | 2019 | | |
| Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 |
| 1,496,364 | 21.47 | 1,831,760 | 22.02 | 0.03 | 1,045,885 | 15.65 | 1,231,841 | 14.98 | -0.04 |
| (1,342,408–1,549,790) | (19.27–22.23) | (1,656,127–1,985,013) | (19.91–23.86) | (-0.05–0.11) | (943,436–1,104,349) | (14.12–16.52) | (1,113,585–1,327,064) | (13.55–16.14) | (-0.1–0.01) |
| 67,759 | 8.95 | 107,585 | 10.99 | 0.23 | 92,094 | 15.09 | 119,320 | 14.92 | -0.01 |
| (54,378–77,060) | (7.39–10.09) | (86,042–128,864) | (9.05–13.02) | (0.08–0.4) | (77,386–104,415) | (12.95–16.99) | (98,903–140,470) | (12.45–17.33) | (-0.1–0.09) |
| 304,159 | 30.52 | 362,056 | 30.27 | -0.01 | 150,721 | 15.20 | 183,206 | 14.90 | -0.02 |
| (294,873–311,885) | (29.6–31.3) | (321,836–405,339) | (26.88–33.93) | (-0.11–0.11) | (141,484–159,249) | (14.27–16.06) | (168,386–199,457) | (13.7–16.22) | (-0.08–0.05) |
| 759,981 | 17.94 | 982,341 | 19.42 | 0.08 | 624,971 | 16.10 | 750,984 | 15.39 | -0.04 |
| (640,546–805,950) | (15.12–18.98) | (857,344–1,082,418) | (16.93–21.38) | (-0.02–0.19) | (545,913–666,046) | (14.08–17.12) | (665,083–819,813) | (13.6–16.79) | (-0.11–0.03) |
| 362,713 | 32.79 | 377,694 | 31.99 | -0.02 | 176,830 | 14.40 | 176,829 | 12.99 | -0.10 |
| (347,378–373,148) | (31.47–33.73) | (341,009–419,952) | (28.88–35.47) | (-0.11–0.08) | (165,890–187,139) | (13.55–15.32) | (162,099–191,586) | (11.88–14.14) | (-0.15 to -0.04) |
| 7288 | 9.77 | 11,454 | 12.37 | 0.27 | 7261 | 11.16 | 9231 | 11.46 | 0.03 |
| (6860–7770) | (9.19–10.39) | (10,131–12,975) | (10.95–13.97) | (0.12–0.43) | (6900–7650) | (10.65–11.73) | (8203–10,321) | (10.27–12.79) | (-0.08–0.13) |
| 246,288 | 14.05 | 330,694 | 16.65 | 0.18 | 169,689 | 10.54 | 197,337 | 9.86 | -0.07 |
| (220,561–279,945) | (12.62–15.94) | (274,743–403,528) | (13.89–20.23) | (-0.02–0.43) | (151,959–186,977) | (9.47–11.6) | (165,224–228,530) | (8.3–11.35) | (-0.2–0.09) |
| 166,514 | 64.62 | 123,548 | 42.29 | -0.35 | 56,207 | 17.94 | 49,019 | 12.46 | -0.31 |
| (110,557–182,829) | (40.15–71.7) | (105,012–142,979) | (35.62–49.33) | (-0.46 to -0.05) | (41,048–62,003) | (12.37–20.06) | (41,648–54,668) | (10.69–13.99) | (-0.36 to -0.11) |
| 98,458 | 22.11 | 163,048 | 28.17 | 0.27 | 54,929 | 14.62 | 74,180 | 14.88 | 0.02 |
| (79,166–109,564) | (18.36–24.41) | (130,172–189,792) | (22.9–32.54) | (0.15–0.42) | (48,453–61,216) | (13.2–16.54) | (62,526–86,119) | (12.81–17.09) | (-0.07–0.11) |
| 147,955 | 10.15 | 226,467 | 12.80 | 0.26 | 231,768 | 18.49 | 291,575 | 18.33 | -0.01 |
| (123,964–164,187) | (8.54–11.23) | (189,126–263,769) | (10.66–14.9) | (0.08–0.48) | (203,824–253,204) | (16.42–20.24) | (254,403–330,796) | (15.98–20.88) | (-0.13–0.12) |
| 136,412 | 22.74 | 194,899 | 26.85 | 0.18 | 132,702 | 26.41 | 164,304 | 25.34 | -0.04 |
| (108,547–154,350) | (18.3–25.63) | (153,975–230,803) | (21.32–31.59) | (0.03–0.37) | (109,066–146,918) | (22.05–29.03) | (136,534–187,956) | (21.37–28.88) | (-0.14–0.06) |

code). In this study, informed consent was not required due to the use of the anonymous online dataset.

2.3 | Statistical analysis

In this study, the incidence, prevalence, deaths, DALY, and age-standardized rates were expressed per 100,000 population to eliminate the influence of the composition of different age groups within populations. The data are reported as values with 95% confidence intervals (CI). Selected epidemiological indicators are presented separately for each classification system.

The relative difference (%) between years was used to demonstrate the comparative changes in age-standardized rates. The relative differences were calculated by dividing the value of the absolute

difference by the value of the source year, which is multiplied by 100. The F/M ratio was computed by dividing the female ASRs by the male ASRs of each epidemiological index. The definition of what has been used is accessible via <https://www.healthdata.org/terms-defined> and <https://www.healthdata.org/gbd/>.

3 | RESULTS

3.1 | Incidence rate of ThC in Asia

3.1.1 | Compared with global data and continents

In Asia, the number of ThC incidences increased from 98,632 (95% CI: 83,838–104,253) in 2010 to 127,008 (95% CI: 111,149–139,720)

in 2019, which is over a 1.28-fold increase. In 2019, more than 54% (127,008/233,847) of ThC cases happened in Asian countries.

During this period, the ASIR of ThC had a 5% change, increasing from 2.44 (95% CI: 2.07–2.57) per 100,000 in 2010 to 2.56 (95% CI: 2.23–2.82) per 100,000 in 2019. Similarly at the same time, this rate globally increased by 1% and in Africa by 14%. But this rate decreased in America by 1% and in Europe by 3%.

In Asian men, the number of ThC incidences increased from 29,253 (95% CI: 24,129–31,446) in 2010 to 40,021 (95% CI: 33,634–45,216) in 2019, which is approximately a 73.1% increase.

In 2019, more than 31.5% (40,021/127,008) of Asian ThC new cases occurred in Asian men, which included 52.6% (40,021/76,014) of global male ThC incidence cases.

During this period, the ASIR of ThC had a 10% change, increasing from 1.50 (95% CI: 1.23–1.61) per 100,000 in 2010 to 1.65 (95% CI: 1.39–1.86) per 100,000 in 2019. Also at the same time, this rate globally increased by 5%, in America by 3%, and in Africa by 19%, while Europe had a stable trend.

In Asian women, the number of ThC incidences increased from 69,379 (95% CI: 56,407–74,309) in 2010 to 86,988 (95% CI: 73,241–97,296) in 2019, which is over a 1.25-fold increase. In 2019, approximately 68.5% (86,988/127,008) of new Asian ThC cases occurred in Asian women, which included 55.1% (86,988/157,833) of global female ThC incidence cases. During this period, the ASIR of ThC had a 3% change, increasing from 3.38 (95% CI: 2.77–3.62) per 100,000 in 2010 to 3.49 (95% CI: 2.93–3.90) per 100,000 in 2019. At the same time, this rate increased in Africa by 12%, while this rate globally decreased by 1%, in Europe by 5%, and in American countries by 3%. More details are presented in [Table 1](#).

3.1.2 | Age distribution

In 2019, age-specific incidence cases of ThC were peaking at +85 in both males and females. In all age groups, the incidence cases of ThC in females were higher ([Figure 1](#)). In 2019, 19,624 new cases of ThC were diagnosed in people aged ≥ 70 years in Asia, accounting for 15.45% of ThC cases in all ages. This rate was 17.67% in men and 14.43% in women. Meanwhile, in the world, 40,773 new cases of ThC have been diagnosed in people ≥ 70 years, which includes 17.44% of ThC cases in all ages. This rate was 18.65% in men and 16.85% in women. Overall, 48.13% of new cases of ThC were detected in the elderly aged ≥ 70 years in Asia ([Table 2](#)).

3.1.3 | Within Asian regions

In 2019, the highest ASIR of ThC was observed in high-income Asia Pacific countries (4.98 (95% CI: 4.19–5.79)), with a 34% decrease compared with 2010. All Asian regions experienced an increasing trend from 12% (Southeast Asia) to 23% (North Africa and Middle East) from 2010 to 2019, except high-income Asia Pacific countries that reported a decreasing trend of 34%.

In men, the highest ASIR of ThC was observed in high-income Asia Pacific countries (2.75 (95% CI: 2.21–3.30)), with a 30% decrease compared with 2010. Other Asian regions experienced an increasing trend from 16% (South Asia) to 34% (North Africa and Middle East) from 2010 to 2019.

In women, the highest ASIR of ThC was observed in high-income Asia Pacific countries (7.20 (95% CI: 5.84–8.59)), with a 35%

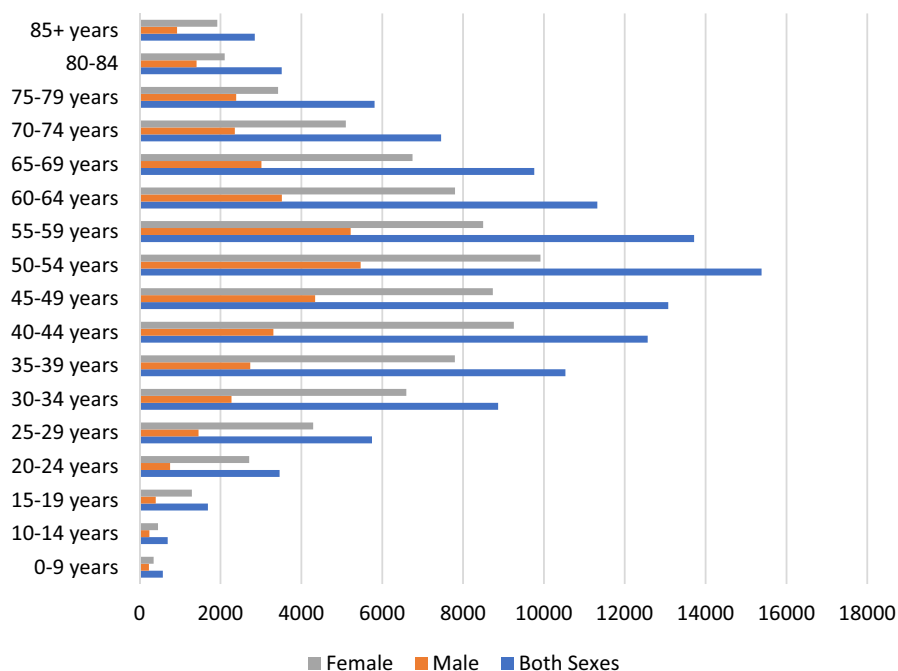


FIGURE 1 Age-specific incidence cases of ThC among people in Asia, 2019.

TABLE 2 Comparison of incidence, death, prevalence, and DALYs number of thyroid cancer in age <70 and ≥70 in Asia with global data.

| Location | Measure | Male | | Female | | Both | |
|----------|------------|------------------------------|------------------------------|------------------------------------|------------------------------|------------------------------------|------------------------------|
| | | <70 | ≥70 | <70 | ≥70 | <70 | ≥70 |
| Global | Incidence | 61,836 (55,017–67,624) | 14,178 (12,535–15,467) | 131,238 (115,909–144,055) | 26,595 (23,177–29,299) | 193,073 (174,684–208,931) | 40,773 (36,131–44,073) |
| | Death | 10,115 (9168–11,076) | 8520 (7442–9244) | 13,163 (11,292–14,400) | 13,778 (11,872–15,017) | 23,278 (21,116–25,069) | 22,298 (19,518–23,859) |
| | Prevalence | 507,398 (450,902–555,879) | 55,344 (48,199–61,515) | 1,139,795 (1,005,830–1,253,793) | 129,223 (113,353–142,871) | 1,647,193 (1,484,083–1,785,830) | 184,567 (164,339–200,974) |
| | DALY | 385,618 (347,249–421,224) | 124,224 (110,564–135,121) | 527,437 (450,033–584,525) | 194,563 (170,961–211,812) | 913,055 (819,893–990,759) | 318,786 (283,892–342,040) |
| Asia | Incidence | 32,947 (27,658–37,464) | 7073 (6025–7958) | 74,437 (62,109–83,816) | 12,550 (10,637–14,334) | 107,384 (93,399–118,277) | 19,624 (16,873–21,594) |
| | Death | 6392 (5529–7225) | 5074 (4246–5689) | 8191 (6691–9235) | 7325 (6153–8218) | 14,583 (12,836–15,995) | 12,399 (10,705–13,587) |
| | Prevalence | 264,795 (221,360–301,754) | 20,547 (17,471–23,667) | 643,274 (537,321–726,363) | 53,725 (45,037–62,060) | 908,069 (786,711–1,001,776) | 74,272 (63,777–83,495) |
| | DALY | 243,304 (209,750–272,823) | 73,517 (62,506–82,547) | 329,588 (270,330–372,713) | 104,575 (88,602–116,807) | 107,384 (93,399–118,277) | 178,092 (155,623–194,846) |

TABLE 3 The incidence distribution of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019, by geographical region and SDI.

| Location | SDI 2019 | Both | | | | | Male | |
|----------------------------|----------|-------------------------|-----------------------|-------------------------|----------------------|---------------------------|---------------------|---------------------|
| | | 2010 | | 2019 | | | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 1990–2010 | Number | ASR per 1,000,000 |
| High SDI | | | | | | | | |
| Brunei Darussalam | 0.823 | 14 (12–17) | 4.92 (4.03–5.7) | 20 (16–25) | 5.09 (4.08–6.15) | 0.03 (–0.15–0.25) | 3 (2–3) | 2.06 (1.7–2.42) |
| Cyprus | 0.841 | 50 (41–57) | 3.64 (3.02–4.11) | 56 (45–68) | 3.13 (2.55–3.85) | –0.14 (–0.28–0.03) | 20 (16–25) | 3.12 (2.42–3.75) |
| Israel | 0.803 | 381 (341–424) | 4.60 (4.09–5.12) | 436 (331–564) | 4.22 (3.2–5.47) | –0.08 (–0.31–0.2) | 134 (106–154) | 3.43 (2.73–3.96) |
| Japan | 0.87 | 10,521 (9499–11,241) | 4.72 (4.38–5.05) | 10,134 (8281–12,092) | 4.22 (3.5–5.09) | –0.11 (–0.25–0.08) | 2912 (2550–3202) | 2.73 (2.44–3.01) |
| Kuwait | 0.851 | 87 (76–98) | 3.88 (3.48–4.34) | 149 (120–186) | 3.79 (3.09–4.67) | –0.02 (–0.21–0.19) | 24 (20–29) | 1.82 (1.55–2.1) |
| Qatar | 0.83 | 34 (27–43) | 3.39 (2.74–4.08) | 59 (41–85) | 2.93 (2.19–3.95) | –0.14 (–0.34–0.13) | 17 (12–23) | 1.88 (1.33–2.52) |
| Republic of Korea | 0.878 | 9263 (2875–10,905) | 14.62 (4.54–17.21) | 5209 (3564–6623) | 6.77 (4.46–8.69) | –0.54 (–0.65 to –0.01) | 2288 (719–2774) | 7.19 (2.41–8.57) |
| Saudi Arabia | 0.805 | 1037 (762–1289) | 4.55 (3.65–5.39) | 2259 (1528–3157) | 5.98 (4.36–7.91) | 0.31 (–0.02–0.7) | 274 (215–350) | 2.17 (1.77–2.69) |
| Singapore | 0.861 | 257 (225–291) | 4.36 (3.86–4.91) | 298 (226–381) | 3.73 (2.85–4.75) | –0.14 (–0.34–0.1) | 58 (49–69) | 2.04 (1.74–2.44) |
| Taiwan (Province of China) | 0.868 | 1443 (1288–1615) | 4.79 (4.3–5.34) | 1737 (1310–2357) | 5.01 (3.73–6.83) | 0.05 (–0.22–0.42) | 452 (382–528) | 2.99 (2.56–3.45) |
| United Arab Emirates | 0.88 | 189 (112–270) | 3.50 (1.94–5.08) | 444 (229–710) | 3.88 (2.1–5.93) | 0.11 (–0.16–0.49) | 135 (70–205) | 2.75 (1.45–4.11) |
| High-middle SDI | | | | | | | | |
| Bahrain | 0.751 | 28 (22–33) | 3.85 (2.61–4.56) | 45 (34–58) | 3.43 (2.56–4.34) | –0.11 (–0.3–0.18) | 7 (6–9) | 1.48 (1.17–1.8) |
| Georgia | 0.702 | 102 (89–115) | 1.99 (1.73–2.25) | 123 (96–150) | 2.46 (1.9–3.01) | 0.24 (–0.02–0.54) | 21 (17–25) | 0.92 (0.73–1.08) |
| Jordan | 0.731 | 160 (132–194) | 3.31 (2.77–3.98) | 321 (249–417) | 3.60 (2.83–4.69) | 0.09 (–0.13–0.35) | 39 (31–47) | 1.58 (1.27–1.9) |
| Kazakhstan | 0.723 | 407 (369–451) | 2.50 (2.28–2.77) | 580 (480–701) | 3.00 (2.48–3.59) | 0.20 (–0.01–0.45) | 93 (81–110) | 1.29 (1.13–1.51) |
| Lebanon | 0.708 | 261 (208–329) | 6.25 (4.94–7.89) | 431 (306–582) | 7.95 (5.67–10.79) | 0.27 (–0.04–0.61) | 67 (52–85) | 3.40 (2.62–4.3) |
| Malaysia | 0.737 | 872 (762–1014) | 3.67 (3.22–4.28) | 1379 (1025–1813) | 4.49 (3.35–5.88) | 0.22 (–0.08–0.59) | 212 (176–256) | 1.79 (1.5–2.15) |
| Oman | 0.783 | 73 (53–86) | 3.75 (2.9–4.32) | 112 (82–146) | 3.26 (2.53–3.97) | –0.13 (–0.28–0.07) | 21 (17–25) | 1.85 (1.54–2.17) |
| Sri Lanka | 0.69 | 579 (503–714) | 2.73 (2.4–3.35) | 886 (622–1273) | 3.47 (2.44–4.97) | 0.27 (–0.1–0.77) | 156 (131–190) | 1.60 (1.37–1.92) |
| Turkey | 0.748 | 2537 (2118–3013) | 3.44 (2.9–4.08) | 3271 (2493–4322) | 3.54 (2.72–4.67) | 0.03 (–0.23–0.37) | 783 (643–962) | 2.15 (1.77–2.63) |

| | | | Female | | | | | |
|-------------|-------------------|--------------------|-------------|-------------------|-------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | F/M Ratio |
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | |
| 4 | 2.23 | 0.08 | 12 | 7.73 | 16 | 8.00 | 0.04 | 3.59 |
| (3–5) | (1.78–2.76) | (–0.16–0.36) | (9–14) | (6.23–9.26) | (12–21) | (6.2–10.12) | (–0.18–0.31) | |
| 24 | 2.86 | –0.08 | 30 | 4.12 | 32 | 3.38 | –0.18 | 1.18 |
| (17–31) | (2.06–3.74) | (–0.3–0.21) | (24–35) | (3.42–4.92) | (25–42) | (2.66–4.58) | (–0.36–0.06) | |
| 157 | 3.21 | –0.06 | 247 | 5.65 | 279 | 5.14 | –0.09 | 1.60 |
| (114–211) | (2.33–4.32) | (–0.33–0.28) | (213–283) | (4.87–6.51) | (207–370) | (3.83–6.83) | (–0.33–0.22) | |
| 2882 | 2.49 | –0.09 | 7609 | 6.63 | 7251 | 5.90 | –0.11 | 2.37 |
| (2207–3695) | (1.93–3.21) | (–0.29–0.16) | (6842–8221) | (6.09–7.17) | (5694–8919) | (4.67–7.36) | (–0.29–0.12) | |
| 54 | 2.47 | 0.36 | 62 | 7.24 | 95 | 5.61 | –0.22 | 2.27 |
| (41–73) | (1.87–3.23) | (0.04–0.78) | (53–73) | (6.22–8.33) | (71–129) | (4.37–7.34) | (–0.4–0.01) | |
| 29 | 1.76 | –0.06 | 17 | 7.75 | 30 | 6.66 | –0.14 | 3.79 |
| (19–41) | (1.17–2.47) | (–0.37–0.31) | (13–23) | (6–9.88) | (20–49) | (4.74–9.53) | (–0.38–0.21) | |
| 1321 | 3.37 | –0.53 | 6975 | 21.88 | 3888 | 10.25 | –0.53 | 3.04 |
| (883–1747) | (2.27–4.41) | (–0.65–0) | (2143–8474) | (6.43–26.75) | (2596–5134) | (6.37–13.62) | (–0.66–0.12) | |
| 708 | 3.23 | 0.49 | 763 | 8.10 | 1551 | 10.20 | 0.26 | 3.16 |
| (491–1047) | (2.35–4.38) | (0.11–0.95) | (479–973) | (6.03–10) | (886–2292) | (6.88–14.25) | (–0.09–0.7) | |
| 76 | 1.94 | –0.05 | 199 | 6.84 | 222 | 5.68 | –0.17 | 2.92 |
| (57–104) | (1.47–2.63) | (–0.27–0.25) | (170–230) | (5.88–7.85) | (166–288) | (4.25–7.44) | (–0.37–0.08) | |
| 578 | 3.35 | 0.12 | 992 | 6.54 | 1159 | 6.61 | 0.01 | 1.97 |
| (424–792) | (2.48–4.56) | (–0.18–0.51) | (864–1149) | (5.71–7.53) | (850–1581) | (4.8–9.16) | (–0.27–0.41) | |
| 314 | 3.53 | 0.28 | 54 | 5.15 | 130 | 4.95 | –0.04 | 1.40 |
| (147–522) | (1.72–5.61) | (–0.07–0.75) | (36–77) | (2.63–7.95) | (67–207) | (2.58–7.75) | (–0.29–0.41) | |
| 14 | 1.46 | –0.01 | 21 | 6.97 | 32 | 6.53 | –0.06 | 4.46 |
| (9–19) | (1.05–1.93) | (–0.28–0.33) | (15–25) | (4.49–8.54) | (23–42) | (4.63–8.47) | (–0.28–0.27) | |
| 29 | 1.28 | 0.40 | 81 | 2.90 | 94 | 3.50 | 0.21 | 2.73 |
| (18–37) | (0.79–1.61) | (0.02–0.78) | (68–93) | (2.46–3.38) | (73–114) | (2.71–4.34) | (–0.07–0.54) | |
| 93 | 1.88 | 0.19 | 121 | 5.20 | 229 | 5.58 | 0.07 | 2.97 |
| (67–125) | (1.39–2.53) | (–0.12–0.59) | (96–154) | (4.18–6.45) | (164–319) | (4.04–7.71) | (–0.19–0.42) | |
| 128 | 1.47 | 0.14 | 314 | 3.51 | 452 | 4.29 | 0.22 | 2.92 |
| (101–168) | (1.17–1.96) | (–0.09–0.44) | (277–353) | (3.11–3.92) | (369–555) | (3.5–5.23) | (–0.01–0.51) | |
| 123 | 4.91 | 0.44 | 194 | 8.77 | 308 | 10.67 | 0.22 | 2.17 |
| (85–164) | (3.38–6.48) | (0.09–0.89) | (142–254) | (6.49–11.55) | (204–443) | (7.12–15.42) | (–0.11–0.63) | |
| 380 | 2.46 | 0.38 | 661 | 5.60 | 999 | 6.63 | 0.19 | 2.70 |
| (278–510) | (1.8–3.26) | (0.02–0.83) | (558–788) | (4.77–6.69) | (718–1343) | (4.8–8.9) | (–0.13–0.59) | |
| 37 | 1.67 | –0.09 | 52 | 6.59 | 74 | 5.97 | –0.09 | 3.57 |
| (25–54) | (1.2–2.21) | (–0.33–0.22) | (34–64) | (4.54–7.92) | (48–102) | (4.25–7.8) | (–0.29–0.2) | |
| 242 | 2.05 | 0.28 | 423 | 3.73 | 644 | 4.74 | 0.27 | 2.32 |
| (164–342) | (1.4–2.87) | (–0.14–0.75) | (355–551) | (3.14–4.84) | (444–949) | (3.27–6.99) | (–0.11–0.82) | |
| 1130 | 2.46 | 0.15 | 1754 | 4.65 | 2141 | 4.55 | –0.02 | 1.85 |
| (837–1599) | (1.83–3.52) | (–0.17–0.54) | (1393–2120) | (3.71–5.6) | (1597–2881) | (3.4–6.13) | (–0.29–0.34) | |

(Continues)

TABLE 3 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|--|-------------|-------------------------------|----------------------|-------------------------------|----------------------|-----------------------|-----------------------------|---------------------|
| | | 2010 | | 2019 | | | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 1990–2010 | Number | ASR per 1,000,000 |
| Middle SDI | | | | | | | | |
| Armenia | 0.689 | 46 (42–56) | 1.28 (1.16–1.55) | 91 (74–110) | 2.33 (1.92–2.79) | 0.82 (0.42–1.25) | 14 (12–23) | 0.91 (0.79–1.38) |
| Azerbaijan | 0.683 | 141 (117–170) | 1.59 (1.34–1.91) | 195 (149–250) | 1.75 (1.37–2.23) | 0.11 (–0.11–0.38) | 33 (26–42) | 0.82 (0.67–1.03) |
| China | 0.686 | 29,177 (25,992– 33,001) | 1.79 (1.6–2.02) | 39,079 (32,279– 47,658) | 2.05 (1.7–2.5) | 0.15 (–0.05–0.38) | 11,289 (9494– 12,803) | 1.44 (1.21–1.63) |
| Indonesia | 0.66 | 5065 (3360–6080) | 2.50 (1.69–2.96) | 6672 (4626–8372) | 2.66 (1.88–3.3) | 0.06 (–0.15–0.33) | 1130 (867–1364) | 1.21 (0.95–1.44) |
| Iran (Islamic Republic of) | 0.67 | 1762 (1242–1943) | 2.54 (1.81–2.8) | 3198 (1999–3649) | 3.63 (2.31–4.12) | 0.43 (0.24–0.59) | 491 (373–557) | 1.42 (1.12–1.59) |
| Iraq | 0.671 | 686 (504–921) | 2.96 (2.21–3.94) | 1282 (895–1779) | 4.03 (2.85–5.49) | 0.36 (0.03–0.78) | 179 (130–244) | 1.63 (1.2–2.2) |
| Philippines | 0.623 | 2773 (2397–3156) | 3.82 (3.35–4.35) | 4015 (3102–5169) | 4.30 (3.34–5.5) | 0.12 (–0.12–0.42) | 637 (537–741) | 1.87 (1.6–2.16) |
| Syrian Arab Republic | 0.619 | 124 (88–153) | 0.86 (0.58–1.07) | 138 (89–190) | 0.97 (0.63–1.32) | 0.13 (–0.17–0.48) | 43 (31–56) | 0.59 (0.41–0.77) |
| Thailand | 0.687 | 2261 (1843–3372) | 2.87 (2.35–4.15) | 2667 (1794–4452) | 2.74 (1.86–4.59) | –0.04 (–0.34–0.35) | 599 (477–793) | 1.60 (1.28–2.06) |
| Turkmenistan | 0.67 | 50 (45–55) | 1.29 (1.18–1.42) | 80 (63–103) | 1.66 (1.3–2.13) | 0.29 (0.01–0.67) | 15 (13–17) | 0.81 (0.71–0.93) |
| Uzbekistan | 0.631 | 123 (112–136) | 0.66 (0.61–0.72) | 247 (200–299) | 0.93 (0.77–1.12) | 0.41 (0.15–0.71) | 38 (32–43) | 0.44 (0.38–0.5) |
| Vietnam | 0.617 | 5276 (3244–6837) | 6.08 (4.04–7.73) | 7789 (5009–10,487) | 7.25 (4.77–9.6) | 0.19 (–0.08–0.54) | 1361 (810–1778) | 3.57 (2.33–4.46) |
| Low-middle SDI | | | | | | | | |
| Bangladesh | 0.483 | 1504 (1125–2104) | 1.30 (1–1.74) | 2322 (1587–3465) | 1.54 (1.06–2.25) | 0.18 (–0.09–0.53) | 375 (264–517) | 0.70 (0.49–0.94) |
| Bhutan | 0.455 | 10 (7–14) | 1.69 (1.23–2.34) | 14 (9–21) | 2.07 (1.43–2.94) | 0.22 (–0.05–0.55) | 2 (2–4) | 0.89 (0.56–1.28) |
| Cambodia | 0.469 | 298 (185–393) | 2.90 (1.83–3.79) | 495 (305–676) | 3.61 (2.26–4.87) | 0.24 (–0.01–0.56) | 54 (40–73) | 1.26 (0.94–1.66) |
| Democratic People's Republic of Korea | 0.558 | 682 (485–959) | 2.41 (1.76–3.35) | 763 (544–1072) | 2.39 (1.7–3.37) | –0.01 (–0.23–0.28) | 155 (101–241) | 1.26 (0.86–1.9) |
| India | 0.566 | 16,357 (13,758– 18,296) | 1.55 (1.31–1.74) | 23,823 (19,467– 28,644) | 1.81 (1.48–2.17) | 0.16 (–0.03–0.4) | 4240 (3620–4793) | 0.86 (0.73–0.97) |
| Kyrgyzstan | 0.596 | 61 (54–68) | 1.39 (1.25–1.55) | 83 (68–101) | 1.51 (1.26–1.82) | 0.09 (–0.11–0.32) | 11 (10–13) | 0.57 (0.49–0.65) |
| Lao People's Democratic Republic | 0.49 | 96 (58–131) | 2.35 (1.45–3.14) | 140 (86–196) | 2.61 (1.62–3.55) | 0.11 (–0.11–0.39) | 20 (13–27) | 1.05 (0.73–1.41) |
| Maldives | 0.562 | 7 (6–8) | 2.86 (2.5–3.27) | 13 (10–16) | 3.20 (2.59–3.94) | 0.12 (–0.09–0.37) | 4 (3–4) | 2.97 (2.48–3.63) |
| Mongolia | 0.606 | 26 (15–34) | 1.45 (0.67–1.88) | 41 (22–56) | 1.48 (0.71–2.03) | 0.02 (–0.21–0.37) | 10 (5–13) | 1.01 (0.44–1.35) |

| | | | Female | | | | | |
|-----------------|-------------------|--------------------|-----------------|-------------------|-----------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | F/M Ratio |
| Number | ASR per 1,000,000 | % change 2010-2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010-2019 | |
| 27 | 1.58 | 0.74 | 32 | 1.59 | 64 | 2.95 | 0.86 | 1.87 |
| (22-33) | (1.27-1.92) | (0.12-1.19) | (28-36) | (1.41-1.79) | (51-78) | (2.39-3.6) | (0.42-1.33) | |
| 50 | 0.98 | 0.20 | 108 | 2.27 | 144 | 2.46 | 0.08 | 2.50 |
| (34-69) | (0.69-1.33) | (-0.1-0.56) | (86-135) | (1.83-2.85) | (104-193) | (1.81-3.24) | (-0.18-0.43) | |
| 16,111 | 1.74 | 0.20 | 17,887 | 2.18 | 22,968 | 2.41 | 0.10 | 1.39 |
| (12,076-20,192) | (1.32-2.16) | (-0.06-0.53) | (15,433-21,440) | (1.88-2.6) | (17,457-30,160) | (1.83-3.17) | (-0.16-0.43) | |
| 1700 | 1.44 | 0.19 | 3935 | 3.74 | 4972 | 3.83 | 0.02 | 2.67 |
| (1235-2308) | (1.07-1.9) | (-0.1-0.56) | (2295-4901) | (2.21-4.62) | (3009-6548) | (2.34-4.97) | (-0.22-0.39) | |
| 956 | 2.15 | 0.51 | 1270 | 3.67 | 2242 | 5.11 | 0.39 | 2.38 |
| (634-1129) | (1.46-2.52) | (0.24-0.78) | (871-1439) | (2.54-4.15) | (1310-2643) | (3.08-5.96) | (0.16-0.59) | |
| 367 | 2.39 | 0.47 | 507 | 4.34 | 915 | 5.71 | 0.32 | 2.39 |
| (252-510) | (1.7-3.24) | (0.08-0.99) | (352-718) | (3.09-6.11) | (597-1329) | (3.85-8.04) | (-0.05-0.79) | |
| 984 | 2.22 | 0.18 | 2137 | 5.69 | 3031 | 6.31 | 0.11 | 2.85 |
| (706-1299) | (1.61-2.91) | (-0.16-0.59) | (1766-2533) | (4.74-6.71) | (2181-4159) | (4.57-8.57) | (-0.17-0.5) | |
| 49 | 0.68 | 0.16 | 80 | 1.16 | 89 | 1.25 | 0.08 | 1.83 |
| (32-70) | (0.45-0.96) | (-0.19-0.65) | (53-104) | (0.69-1.49) | (52-124) | (0.73-1.72) | (-0.21-0.46) | |
| 796 | 1.74 | 0.09 | 1662 | 4.01 | 1871 | 3.64 | -0.09 | 2.09 |
| (543-1256) | (1.21-2.74) | (-0.26-0.6) | (1312-2677) | (3.18-6.28) | (1215-3461) | (2.34-6.83) | (-0.39-0.33) | |
| 26 | 1.09 | 0.33 | 35 | 1.73 | 54 | 2.21 | 0.28 | 2.03 |
| (20-33) | (0.85-1.41) | (0.03-0.73) | (31-40) | (1.55-1.94) | (42-71) | (1.69-2.87) | (-0.02-0.67) | |
| 73 | 0.61 | 0.38 | 86 | 0.85 | 174 | 1.22 | 0.44 | 2.01 |
| (56-92) | (0.46-0.74) | (0.09-0.72) | (75-97) | (0.76-0.95) | (138-214) | (0.98-1.48) | (0.14-0.78) | |
| 2146 | 4.35 | 0.22 | 3916 | 8.44 | 5643 | 10.04 | 0.19 | 2.31 |
| (1348-2993) | (2.86-5.88) | (-0.08-0.58) | (2177-5287) | (4.94-11.19) | (3281-7827) | (5.93-13.81) | (-0.1-0.59) | |
| 551 | 0.76 | 0.10 | 1129 | 1.93 | 1772 | 2.29 | 0.19 | 3.00 |
| (378-828) | (0.52-1.13) | (-0.18-0.46) | (786-1704) | (1.41-2.77) | (1133-2841) | (1.5-3.63) | (-0.11-0.59) | |
| 4 | 1.11 | 0.24 | 7 | 2.61 | 11 | 3.12 | 0.19 | 2.82 |
| (2-6) | (0.69-1.68) | (-0.06-0.6) | (5-11) | (1.75-3.73) | (7-16) | (2.04-4.74) | (-0.1-0.58) | |
| 93 | 1.60 | 0.26 | 244 | 4.18 | 401 | 5.25 | 0.26 | 3.29 |
| (66-123) | (1.13-2.06) | (-0.02-0.61) | (141-331) | (2.46-5.57) | (226-560) | (2.98-7.3) | (-0.02-0.64) | |
| 202 | 1.32 | 0.05 | 527 | 3.51 | 561 | 3.49 | -0.01 | 2.64 |
| (131-305) | (0.89-1.94) | (-0.18-0.36) | (352-791) | (2.33-5.22) | (375-845) | (2.28-5.39) | (-0.26-0.36) | |
| 6276 | 1.00 | 0.16 | 12,118 | 2.27 | 17,547 | 2.64 | 0.16 | 2.64 |
| (5050-7557) | (0.8-1.2) | (-0.08-0.44) | (9506-13,963) | (1.78-2.6) | (13,225-22,175) | (1.99-3.32) | (-0.08-0.46) | |
| 17 | 0.65 | 0.15 | 50 | 2.10 | 67 | 2.25 | 0.07 | 3.46 |
| (13-21) | (0.53-0.8) | (-0.07-0.43) | (43-57) | (1.84-2.4) | (53-83) | (1.81-2.77) | (-0.14-0.33) | |
| 30 | 1.20 | 0.14 | 76 | 3.59 | 110 | 3.96 | 0.10 | 3.28 |
| (21-41) | (0.86-1.59) | (-0.12-0.52) | (40-108) | (1.93-4.96) | (59-160) | (2.15-5.64) | (-0.14-0.42) | |
| 8 | 3.52 | 0.18 | 3 | 2.71 | 5 | 2.88 | 0.06 | 0.82 |
| (6-11) | (2.77-4.48) | (-0.09-0.51) | (3-4) | (2.19-3.23) | (4-6) | (2.2-3.67) | (-0.17-0.35) | |
| 15 | 1.09 | 0.08 | 17 | 1.79 | 26 | 1.76 | -0.02 | 1.62 |
| (7-22) | (0.51-1.52) | (-0.23-0.46) | (9-22) | (0.73-2.38) | (13-37) | (0.79-2.5) | (-0.27-0.36) | |

(Continues)

TABLE 3 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|-------------|----------|---------------------|---------------------|---------------------|---------------------|----------------------|-------------------|---------------------|
| | | 2010 | | 2019 | | | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 1990–2010 | Number | ASR per 1,000,000 |
| Myanmar | 0.521 | 1045 (681–1366) | 2.48 (1.66–3.18) | 1437 (996–1902) | 2.77 (1.96–3.64) | 0.12 (–0.14–0.42) | 212 (149–284) | 1.15 (0.83–1.51) |
| Palestine | 0.588 | 52 (44–61) | 2.31 (1.93–2.68) | 110 (77–139) | 3.43 (2.41–4.26) | 0.49 (0.12–0.86) | 10 (8–12) | 0.94 (0.77–1.12) |
| Tajikistan | 0.539 | 19 (15–22) | 0.44 (0.32–0.52) | 28 (22–35) | 0.48 (0.34–0.6) | 0.09 (–0.14–0.38) | 7 (5–8) | 0.33 (0.22–0.42) |
| Timor-Leste | 0.514 | 13 (8–17) | 1.82 (1.13–2.46) | 21 (13–29) | 2.38 (1.49–3.27) | 0.31 (0.02–0.7) | 2 (2–4) | 0.72 (0.47–1.11) |
| Low SDI | | | | | | | | |
| Afghanistan | 0.343 | 280 (138–460) | 2.00 (1.1–3.11) | 439 (221–726) | 2.23 (1.26–3.44) | 0.11 (–0.14–0.41) | 45 (27–76) | 0.73 (0.43–1.19) |
| Nepal | 0.422 | 299 (225–406) | 1.41 (1.1–1.89) | 490 (341–681) | 1.87 (1.34–2.55) | 0.33 (0.02–0.69) | 59 (38–83) | 0.63 (0.41–0.86) |
| Pakistan | 0.449 | 3152 (2465–3900) | 2.57 (2.08–3.11) | 4885 (3650–6521) | 2.96 (2.3–3.81) | 0.15 (–0.13–0.52) | 840 (642–1069) | 1.48 (1.15–1.86) |
| Yemen | 0.412 | 213 (138–317) | 1.59 (1.1–2.26) | 356 (228–517) | 1.86 (1.26–2.66) | 0.17 (–0.09–0.49) | 45 (29–69) | 0.69 (0.46–1.05) |

decrease compared with 2010. Other Asian regions experienced an increasing trend from 9% (East Asia) to 20% (Central Asia and North Africa and the Middle East).

3.1.4 | Based on SDI

Among high SDI Asian countries, the Republic of Korea (6.77) and Saudi Arabia (5.98) have the highest ASIR of ThC, and Qatar (2.93) and Cyprus (3.13) have the lowest rate. In this group, Brunei Darussalam (3%), Taiwan (Province of China) (5%), Saudi Arabia (31%), and the United Arab Emirates (11%) reported an upward trend, and other countries reported a downward trend from 2% (Kuwait) to 54% (Republic of Korea) from 2010 to 2019.

Among high-middle SDI Asian countries, Lebanon (7.95) has the highest ASIR of ThC, and Georgia (2.46) has the lowest rate. In this group, Bahrain and Oman reported an 11% and 13% decrease in ASIR from 2010 to 2019, respectively. Other countries reported an upward trend from 3% (Turkey) to 27% (Lebanon and Sri Lanka).

Among middle SDI Asian countries, Vietnam (7.25) has the highest ASIR of ThC, and Uzbekistan (0.93) and the Syrian Arab Republic (0.97) have the lowest rate. In this group, Thailand recorded a downward trend of 4%. Other countries had an upward trend from 6% (Indonesia) to 82% (Armenia) from 2010 to 2019. Among low-middle SDI Asian countries, Cambodia (3.61) has the highest ASIR of ThC, and Tajikistan (0.48) has the lowest rate. In this group, all countries had an upward trend from 2% (Mongolia) to 49% (Palestine) from 2010 to 2019, except for the Democratic

People's Republic of Korea, which experienced a downward trend of 1%. Among low SDI Asian countries, Pakistan (2.96) has the highest ASIR of ThC, and Yemen (1.86) has the lowest rate. In this group, all countries experienced an upward trend of 11% (Afghanistan) to 33% (Nepal) from 2010 to 2019. More details are presented in Table 3.

3.1.5 | National comparison

Among Asian countries, 11 countries experienced a decreasing trend in the ThC morbidity rate between 2010 and 2019; the greatest decrease was detected in the Republic of Korea (decrease in ASIR = –0.54 (95% CI: –0.65 to –0.01)), and the greatest increase was detected in Armenia (increase in ASIR = 0.82 (95% CI: 0.42–1.25)) (Figure 2).

In 2019, the highest ASIR (per 100,000) of ThC was reported in Lebanon (7.95), Vietnam (7.25), the Republic of Korea (6.77), Saudi Arabia (5.98), Brunei Darussalam (5.09), and Taiwan (5.01). The lowest ASIR of ThC was reported in Tajikistan (0.48), Uzbekistan (0.93), and Syrian Arab Republic (0.97).

In 2019, the highest ASIR (per 100,000) of ThC in men was reported in Lebanon (4.91), Vietnam (4.35), the United Arab Emirates (3.53), Maldives (3.52), the Republic of Korea (3.37), Taiwan (3.35), Saudi Arabia (3.23), and Israel (3.21). The lowest ASIR of ThC was reported in Tajikistan (0.37), Uzbekistan (0.61), Kyrgyzstan (0.65), Syrian Arab Republic (0.68), Bangladesh (0.76), Yemen (0.80), Afghanistan (0.83), Nepal (0.90), and Azerbaijan (0.98).

| 2019 | | | 2010 | | | 2019 | | | F/M Ratio |
|--------------------|---------------------|----------------------|---------------------|---------------------|--------------------|---------------------|---------------------|----------------------|-----------|
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | % change 2010–2019 | |
| 312 (225–412) | 1.37 (1–1.79) | 0.19 (–0.11–0.59) | 833 (482–1123) | 3.62 (2.15–4.79) | | 1125 (709–1528) | 3.94 (2.51–5.3) | 0.09 (–0.19–0.45) | 2.88 |
| 19 (15–24) | 1.23 (0.96–1.54) | 0.32 (0.02–0.68) | 42 (34–51) | 3.55 (2.88–4.23) | | 91 (59–118) | 5.57 (3.65–7) | 0.57 (0.1–1.04) | 4.51 |
| 10 (7–13) | 0.37 (0.24–0.48) | 0.11 (–0.16–0.45) | 12 (9–14) | 0.54 (0.37–0.65) | | 18 (14–23) | 0.58 (0.4–0.74) | 0.07 (–0.18–0.39) | 1.56 |
| 4 (3–6) | 1.00 (0.65–1.43) | 0.39 (0.08–0.87) | 10 (6–14) | 2.96 (1.75–4.08) | | 17 (10–24) | 3.80 (2.19–5.4) | 0.28 (–0.03–0.7) | 3.78 |
| 75 (47–120) | 0.83 (0.53–1.29) | 0.14 (–0.12–0.49) | 235 (94–411) | 3.21 (1.44–5.36) | | 364 (154–635) | 3.60 (1.72–5.87) | 0.12 (–0.15–0.44) | 4.33 |
| 103 (63–150) | 0.90 (0.56–1.32) | 0.43 (0.06–0.84) | 240 (173–345) | 2.13 (1.59–2.96) | | 387 (264–566) | 2.70 (1.89–3.85) | 0.26 (–0.05–0.65) | 2.99 |
| 1267 (911–1766) | 1.67 (1.21–2.29) | 0.13 (–0.21–0.6) | 2312 (1677–3034) | 3.71 (2.79–4.73) | | 3618 (2410–5381) | 4.29 (2.95–6.08) | 0.15 (–0.2–0.69) | 2.56 |
| 73 (46–114) | 0.80 (0.51–1.24) | 0.16 (–0.13–0.53) | 168 (103–261) | 2.49 (1.62–3.69) | | 283 (167–434) | 2.91 (1.82–4.32) | 0.17 (–0.12–0.54) | 3.65 |

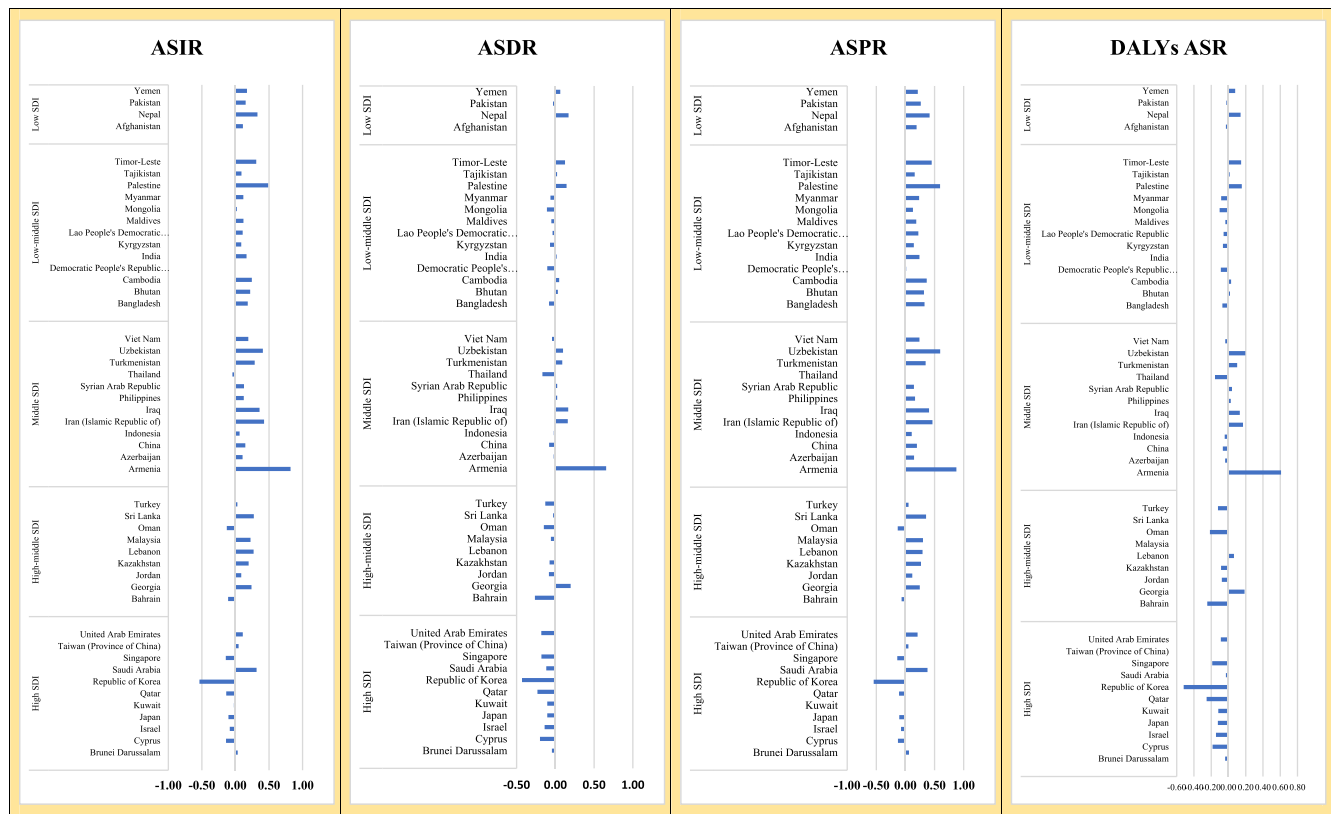


FIGURE 2 The relative change (%) in age-standardized incidence rate (ASIR), age-standardized death rate (ASMR), age-standardized DALYs rate (DALYs ASR), and age-standardized prevalence rate (ASPR) of ThC cancer in Asian countries from 2010 to 2019.

In 2019, the highest ASIR (per 100,000) of ThC in women was reported in Lebanon (10.67), Republic of Korea (10.25), Saudi Arabia (10.20), Vietnam (10.04), and Brunei Darussalam (8.00). The lowest

ASIR of ThC was reported in Tajikistan (0.58), Uzbekistan (1.22), the Syrian Arab Republic (1.25), and Mongolia (1.76). Results in detail are presented in Table 3.

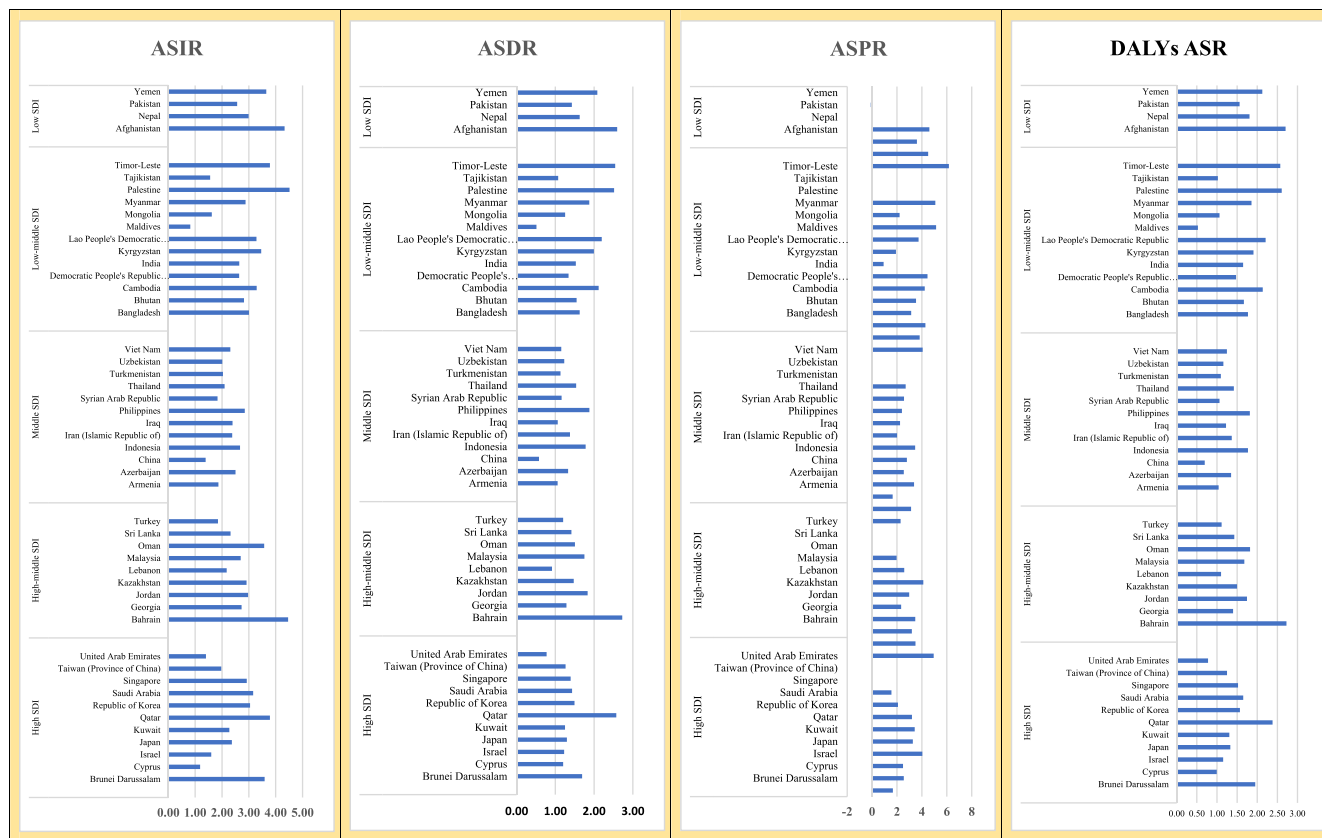


FIGURE 3 The female/male ratio in age-standardized incidence rate (ASIR), age-standardized death rate (ASMR), age-standardized DALYs rate (DALYs ASR), and age-standardized prevalence rate (ASPR) of ThC cancer in Asian countries based on SDI, 2019.

3.1.6 | Male/female ratio

In 2019, the ASIR of ThC in Maldives was reported to be higher in men than in women. In other countries, the incidence of THC in women was higher than in men. The highest ratio was reported in Palestine (4.51-fold) and the lowest ratio was recorded in Maldives (0.82-fold). Similarly, in 2010, this ratio in Maldives was higher in men than in women (Figure 3).

3.2 | Death rates of THC in Asia

3.2.1 | Compared with global data and continents

In Asia, the number of ThC deaths increased from 21,405 (95% CI: 18,846–22,632) in 2010 to 26,982 (95% CI: 23,978–29,391) in 2019, which is over a 1.26-fold increase. In 2019, more than 59% (26,982/45,576) of ThC deaths happened in Asia countries. During this period, the ASDR of ThC had a 6% change, decreasing from 0.63 (95% CI: 0.55–0.66) per 100,000 in 2010 to 0.59 (95% CI: 0.52–0.64) per 100,000 in 2019. Also, at the same time, this rate globally decreased by 5%, in America by 1%, and Europe by 9%. This rate was stable in Africa at this time (Figure 4 and Table 1).

In Asian men, the number of ThC deaths increased from 8867 (95% CI: 7483–9442) in 2010 to 11,465 (95% CI: 9819–12,908)

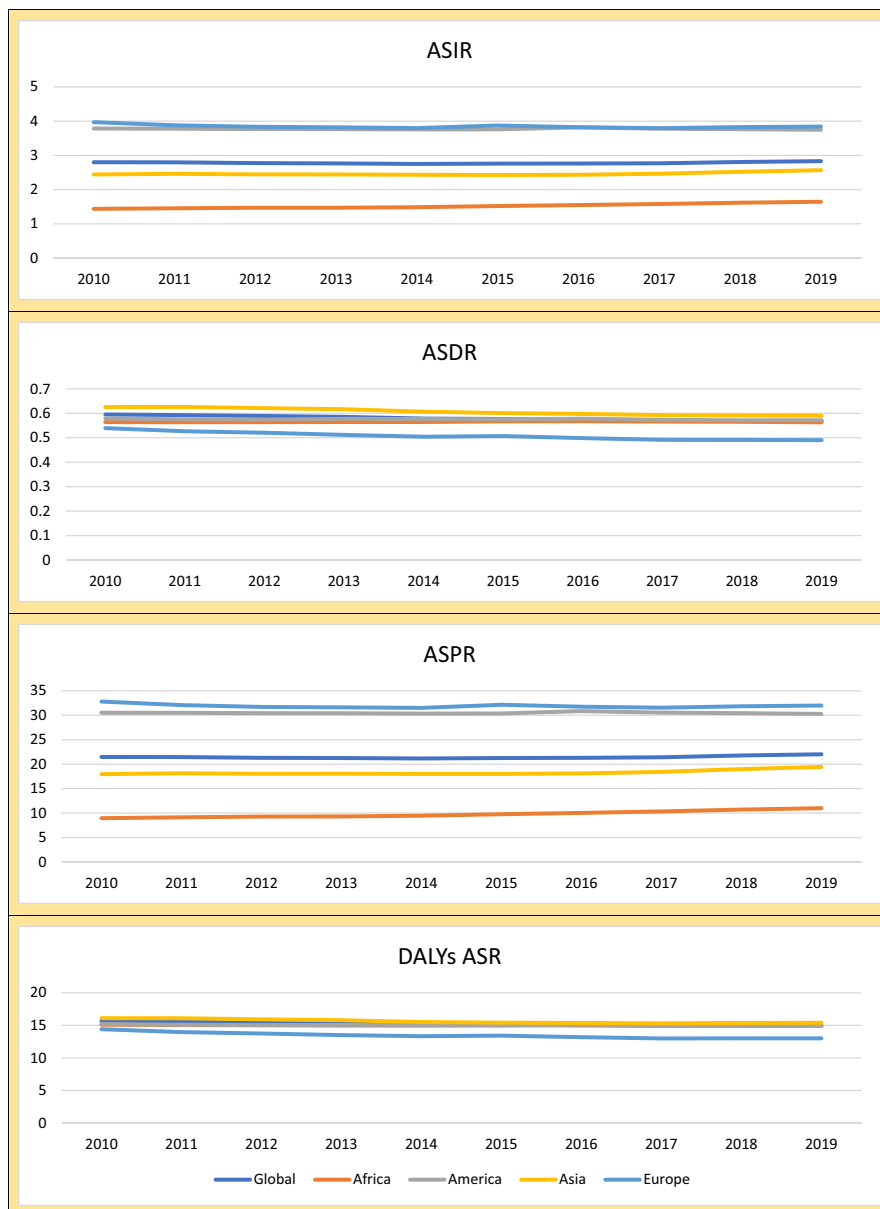
in 2019, which is over a 1.29-fold increase. In 2019, 42.49% (11,465/26,982) of Asian ThC deaths occurred in Asian men, which included 61.52% (11,465/18,635) of global male ThC death cases. During this period, the ASDR of ThC had a 2% change, decreasing from 0.55 (95% CI: 0.46–0.59) per 100,000 in 2010 to 0.54 (95% CI: 0.46–0.60) per 100,000 in 2019, while at the same time, this rate globally decreased by 1% and in Europe by 6%. This rate increased in America by 3% and in Africa by 4% (Table 4).

In Asian women, the number of ThC deaths increased from 12,538 (95% CI: 10,640–13,594) in 2010 to 15,517 (95% CI: 13,103–17,318) in 2019, which is over a 1.24-fold increase. In 2019, approximately 57.51% (15,517/26,982) of Asian ThC deaths occurred in Asian women, which included 42.75% (11,517/26,941) of global female ThC death cases. During this period, the ASIR of ThC had 8% changes, decreasing from 0.69 (95% CI: 0.59–0.75) per 100,000 in 2010 to 0.64 (95% CI: 0.54–0.71) per 100,000 in 2019. At the same time, this rate globally decreased by 6%, in Europe by 11%, and in America and Africa by 3% (Table 5).

3.2.2 | Age distribution

In 2019, age-specific death cases of ThC were peaking at 85 years and higher in both males and females. In all age groups, death cases of ThC in females were higher than in males, except in ages 75 to

FIGURE 4 Temporal trend of incidence, prevalence, death, and DALYs age standard rates (per 100,000 population) of thyroid cancer in Asia compared with global data and other continents from 2010 to 2019.



79 years and 80 to 84 years, which was higher in males. In the 0 to 14 years group, males and females almost had the same death rates (Figure 5). In 2019, 12,399 deaths due to ThC in people aged ≥ 70 years were diagnosed in Asia, accounting for 45.95% of ThC deaths in all ages. This rate was 44.25% in men and 47.21% in women. Meanwhile, in the world, 22,298 deaths due to ThC were diagnosed in people ≥ 70 years, which includes 17.44% of ThC deaths in all ages. This rate was 18.65% in men and 16.85% in women. Overall, 55.61% of ThC deaths were recorded in the elderly aged ≥ 70 years in Asia (Table 2).

3.2.3 | Within Asian regions

In 2019, the highest ASDR of ThC was observed in Southeast Asia regions (1.02 (95% CI: 0.88–1.15)), with a 4% decrease compared with 2010. Also in this period, East Asia and high-income

Asia Pacific had a decreasing trend of 8% and 22%, respectively. However, an increasing trend of 5% was observed in Central Asia. No changes in ASDR of ThC occurred in South Asia and North Africa and the Middle East from 2010 to 2019 (Figure 6 and Table 1).

In men, the highest ASDR of ThC was observed in Southeast Asia countries (0.75 (95% CI: 0.63–0.88)), with a 4% increase compared with 2010. Also in this period, Central Asia, South Asia, and North Africa and the Middle East had an increasing trend of 11%, 1%, and 9%, respectively. However, a decreasing trend was observed in East Asia (3%) and high-income Asia Pacific countries (24%).

In women, the highest ASDR of ThC was observed in Southeast Asia countries (1.22 (95% CI: 0.99–1.39)), with an 8% decrease compared with 2010. Also, in this period, all Asian regions had a decreasing trend of 1% (South Asia) to 20% (high-income Asia Pacific) except Central Asia, which had an increasing trend of 2% (Table 5).

TABLE 4 The comparing incidence, death, prevalence, and burden rates of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019 (males).

| Location | Incidence | | | | | Death | | | |
|---------------------------------|---------------------------|----------------------|---------------------------|----------------------|---------------------------|---------------------------|----------------------|-------------------------------|----------------------|
| | 2010 | | 2019 | | % change 2010-2019 | 2010 | | 2019 | |
| | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 |
| Global | 59,341 (52,845-62,189) | 1.81 (1.61-1.9) | 76,014 (68,232-82,923) | 1.90 (1.71-2.07) | 0.05 (-0.04-0.14) | 14,744 (13,094-15,502) | 0.51 (0.45-0.54) | 18,635 (16,822- 20,242) | 0.51 (0.46-0.55) |
| Continents | | | | | | | | | |
| Africa | 2194 (1898-2481) | 0.73 (0.63-0.83) | 3436 (2928-4020) | 0.86 (0.75-1.01) | 0.19 (0.02-0.34) | 936 (801-1097) | 0.40 (0.34-0.47) | 1261 (1092-1497) | 0.41 (0.36-0.49) |
| America | 13,672 (13,083-14,218) | 2.90 (2.76-3.01) | 17,131 (14,652-20,134) | 2.99 (2.56-3.51) | 0.03 (-0.11-0.2) | 2186 (2014-2270) | 0.49 (0.45-0.51) | 2872 (2629-3083) | 0.50 (0.46-0.54) |
| Asia | 29,253 (24,129-31,446) | 1.50 (1.23-1.61) | 40,021 (33,634-45,216) | 1.65 (1.39-1.86) | 0.10 (-0.05-0.24) | 8867 (7483-9442) | 0.55 (0.46-0.59) | 11,465 (9819- 12,908) | 0.54 (0.46-0.6) |
| Europe | 14,139 (12,523-14,790) | 2.66 (2.37-2.78) | 15,321 (13,383-17,349) | 2.67 (2.33-3.01) | 0.00 (-0.11-0.14) | 2733 (2554-2836) | 0.49 (0.46-0.51) | 3009 (2727-3250) | 0.47 (0.42-0.5) |
| Asian GBD regions | | | | | | | | | |
| Central Asia | 242 (224-263) | 0.77 (0.72-0.83) | 375 (323-424) | 0.96 (0.83-1.08) | 0.24 (0.09-0.4) | 86 (81-91) | 0.34 (0.32-0.36) | 115 (100-129) | 0.38 (0.33-0.42) |
| East Asia | 11,895 (10,040-13,394) | 1.47 (1.23-1.65) | 16,891 (12,854-20,999) | 1.75 (1.34-2.17) | 0.20 (-0.06-0.51) | 3426 (2735-3824) | 0.53 (0.42-0.59) | 4355 (3324-5373) | 0.52 (0.4-0.63) |
| High-income Asia Pacific | 5261 (3441-5833) | 3.94 (2.52-4.39) | 4283 (3405-5180) | 2.75 (2.21-3.3) | -0.30 (-0.43 to -0.03) | 889 (632-942) | 0.58 (0.4-0.62) | 899 (713-984) | 0.44 (0.35-0.48) |
| North Africa and Middle East | 3134 (2806-3484) | 1.47 (1.32-1.63) | 5667 (4601-6669) | 1.97 (1.63-2.31) | 0.34 (0.16-0.51) | 659 (595-761) | 0.41 (0.37-0.49) | 970 (820-1149) | 0.44 (0.38-0.54) |
| South Asia | 5516 (4812-6147) | 0.90 (0.78-1) | 8200 (6808-9674) | 1.04 (0.86-1.22) | 0.16 (-0.07-0.39) | 2637 (2289-2973) | 0.51 (0.44-0.57) | 3537 (2996-4155) | 0.52 (0.44-0.6) |
| Southeast Asia | 4400 (3678-4926) | 1.72 (1.47-1.91) | 6715 (5439-8040) | 2.07 (1.7-2.46) | 0.20 (0-0.42) | 1469 (1261-1606) | 0.72 (0.64-0.79) | 2012 (1698-2366) | 0.75 (0.63-0.88) |

3.2.4 | Based on SDI

In 2019, among high SDI Asian countries, Brunei Darussalam (1.25) and the United Arab Emirates (0.82) have the highest ASDR of ThC, and Singapore (0.44) has the lowest rate. In this classification, between 2010 and 2019, all countries recorded a downward trend between 1% (Taiwan (Province of China)) to 43% (Republic of Korea). Among high-middle SDI Asian countries, Malaysia (0.93) and Bahrain (0.73) have the highest ASDR of ThC and Oman (0.49) has the lowest rate. In this classification, between 2010 and 2019, all countries recorded a downward trend between 3% (Sri Lanka) to 26% (Bahrain) except Georgia, which had an increasing trend of 20%, and Lebanon, which had no changes. Among middle SDI Asian countries, the Philippines and Vietnam have the highest ASDR of ThC (1.34), and the Syrian

Arab Republic (0.18) has the lowest rate. In this group, five countries reported a downward trend and seven countries reported an upward trend; the most upward trend was observed by Armenia (65%) and the most downward trend was observed in Thailand (17%) from 2010 to 2019. Among low-middle SDI Asian countries, Cambodia (1.33) has the highest ASDR of ThC and Tajikistan (0.24) has the lowest rate. In this group, seven countries reported a downward trend and six countries reported an upward trend; Palestine experienced the most upward trend (15%) and Mongolia reported the most downward trend (11%) from 2010 to 2019. Among low SDI Asian countries, Pakistan (1.08) has the highest ASDR of ThC and Yemen (0.54) has the lowest rate. In this group, two countries experienced a downward trend and two countries reported an upward trend from 2010 to 2019. More details are presented in [Table 6](#).

| % change 2010–2019 | Prevalence | | | | | DALY | | | | |
|-------------------------|------------------------------|------------------------|------------------------------|------------------------|---------------------------|------------------------------|------------------------|------------------------------|------------------------|--------------------------|
| | 2010 | | 2019 | | % change 2010–2019 | 2010 | | 2019 | | % change 2010–2019 |
| | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | |
| -0.01 (-0.09–0.07) | 437,780 (388,455–457,734) | 12.77 (11.34–13.35) | 562,741 (502,727–615,420) | 13.70 (12.25–14.97) | 0.07 (-0.03–0.17) | 420,674 (375,586–445,036) | 13.14 (11.74–13.89) | 509,842 (461,647–553,336) | 12.93 (11.7–14.02) | -0.02 (-0.1–0.07) |
| 0.04 (-0.08–0.16) | 13,084 (11,304–14,693) | 3.56 (3.12–4.02) | 22,404 (18,829–26,306) | 4.76 (3.99–5.63) | 0.34 (0.15–0.52) | 30,806 (26,040–36,106) | 10.44 (8.93–12.25) | 41,146 (34,988–48,795) | 10.74 (9.27–12.77) | 0.03 (-0.1–0.15) |
| 0.03 (-0.03–0.09) | 108,873 (10,4295–11,3692) | 22.81 (21.79–23.78) | 135,052 (11,4872–15,9952) | 23.56 (20.07–27.88) | 0.03 (-0.12–0.21) | 60,584 (57,227–64,251) | 13.05 (12.29–13.84) | 75,968 (69,938–82,870) | 13.25 (12.22–14.45) | 0.02 (-0.04–0.09) |
| -0.02 (-0.14–0.09) | 205,125 (169,386–221,225) | 9.67 (7.98–10.41) | 285,342 (239,841–324,527) | 11.18 (9.42–12.69) | 0.16 (0–0.32) | 256,437 (217,071–275,000) | 13.54 (11.49–14.46) | 316,821 (272,355–354,527) | 13.30 (11.41–14.88) | -0.02 (-0.14–0.1) |
| -0.06 (-0.11–0) | 110,088 (96,454–115,495) | 20.94 (18.39–21.93) | 119,171 (103,553–136,208) | 21.24 (18.49–24.17) | 0.01 (-0.11–0.16) | 72,276 (67,619–76,240) | 13.26 (12.41–13.99) | 75,193 (68,124–83,253) | 12.37 (11.23–13.7) | -0.07 (-0.13–0.01) |
| 0.11 (-0.02–0.23) | 1596 (1463–1767) | 4.40 (4.03–4.87) | 2627 (2243–3002) | 5.88 (5.05–6.7) | 0.34 (0.16–0.54) | 2737 (2579–2933) | 9.09 (8.55–9.66) | 3629 (3132–4089) | 9.73 (8.44–10.91) | 0.07 (-0.06–0.2) |
| -0.03 (-0.22–0.19) | 85,588 (73,127–97,155) | 9.64 (8.28–10.92) | 124,587 (95,008–155,402) | 12.41 (9.55–15.43) | 0.29 (0.01–0.64) | 92,052 (75,140–103,306) | 11.90 (9.59–13.25) | 111,067 (85,215–137,095) | 11.64 (9–14.22) | -0.02 (-0.22–0.2) |
| -0.24 (-0.3 to -0.1) | 42,007 (26,849–47,081) | 32.22 (20.24–36.21) | 32,613 (25,657–39,972) | 22.20 (17.78–26.9) | -0.31 (-0.45 to -0.02) | 21,442 (14,309–23,288) | 14.94 (9.71–16.28) | 18,056 (14,954–20,085) | 10.26 (8.49–11.51) | -0.31 (-0.38 to -0.1) |
| 0.09 (-0.04–0.2) | 24,518 (21,504–27,385) | 10.61 (9.44–11.83) | 45,985 (36,968–54,279) | 15.07 (12.2–17.8) | 0.42 (0.22–0.61) | 21,146 (18,986–23,535) | 10.96 (9.89–12.32) | 31,063 (25,897–36,269) | 12.04 (10.13–14.02) | 0.10 (-0.04–0.21) |
| 0.01 (-0.17–0.21) | 30,649 (26,913–34,129) | 4.30 (3.77–4.77) | 48,976 (40,189–58,798) | 5.62 (4.61–6.72) | 0.31 (0.05–0.58) | 85,038 (74,075–95,358) | 13.85 (12.02–15.5) | 108,134 (91,579–126,638) | 13.85 (11.71–16.25) | 0.00 (-0.18–0.19) |
| 0.04 (-0.11–0.19) | 29,788 (24,526–34,014) | 10.32 (8.53–11.69) | 47,234 (37,607–57,180) | 13.36 (10.7–16.09) | 0.30 (0.06–0.55) | 44,013 (36,771–48,742) | 18.32 (15.58–20.1) | 58,747 (48,885–69,102) | 18.99 (15.96–22.24) | 0.04 (-0.11–0.2) |

3.2.5 | National comparison

Among Asian countries, 32 countries experienced a decreasing trend in the ThC death rate between 2010 and 2019; the greatest increase was detected in Armenia (increase in ASDR = 0.65 (95% CI: 0.27–0.97)) and the greatest decrease was detected in the Republic of Korea (decrease in ASDR = -0.43 (95% CI: -0.51 to -0.12)).

In 2019, the highest ASDR (per 100,000) of ThC was reported in Philippines (1.34), Vietnam (1.34), and Cambodia (1.33). The lowest ASDR of ThC was reported in the Syrian Arab Republic (0.18), Tajikistan (0.24), and Uzbekistan (0.31).

Among Asian men, the highest ASDR (per 100,000) of ThC was reported in Vietnam (1.23), Maldives (1.12), Pakistan (0.90), the Philippines (0.90), and Brunei Darussalam (0.90). The lowest ASDR of ThC was reported in the Syrian Arab Republic (0.17), Tajikistan (0.23), Kyrgyzstan (0.25), and Uzbekistan (0.27).

Among Asian women, the highest ASDR (per 100,000) of ThC was reported in the Philippines (1.69), Cambodia (1.69), Brunei Darussalam (1.53), and Lao People's Democratic Republic (1.50). The lowest ASDR of ThC was reported in the Syrian Arab Republic (0.20), Tajikistan (0.25), China (0.30), and Uzbekistan (0.34). Results in detail are presented in [Table 6](#).

3.2.6 | Male/female ratio

In 2019, the ASDR of ThC in the United Arab Emirates, Lebanon, China, and Maldives were reported to be higher in men than in women. In other countries, the incidence of ThC in women was higher than in men. The highest ratio was reported in Bahrain (2.72-fold) and the lowest ratio was recorded in Maldives (0.51-fold), while in 2010, the ASDR of ThC in China and Maldives were reported to

TABLE 5 The comparing incidence, death, prevalence, and burden rates of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019 (females).

| Location | Incidence | | | | | Death | | | |
|---------------------------------------|----------------------------------|-----------------------|----------------------------------|----------------------|-----------------------|-------------------------------|----------------------|-------------------------------|----------------------|
| | 2010 | | 2019 | | % change 2010–2019 | 2010 | | 2019 | |
| | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 |
| Global | 131,855 (116,108– 137,983) | 3.76 (3.32–3.93) | 157,833 (140,395– 173,068) | 3.74 (3.32–4.1) | –0.01 (–0.08–0.08) | 22,525 (19,946– 23,888) | 0.66 (0.59–0.7) | 26,941 (23,718– 29,329) | 0.62 (0.55–0.68) |
| Continents | | | | | | | | | |
| Africa | 7289 (5612–8352) | 2.12 (1.72–2.41) | 10,897 (8401–13,293) | 2.38 (1.91–2.83) | 0.12 (0–0.29) | 1802 (1479–2047) | 0.72 (0.59–0.81) | 2316 (1878–2748) | 0.70 (0.57–0.82) |
| America | 24,014 (23,117– 24,741) | 4.59 (4.43–4.73) | 28,094 (24,531–32,170) | 4.44 (3.88–5.1) | –0.03 (–0.16–0.11) | 3584 (3291–3752) | 0.65 (0.6–0.68) | 4415 (3969–4801) | 0.63 (0.57–0.68) |
| Asia | 69,379 (56,407– 74,309) | 3.38 (2.77–3.62) | 86,988 (73,241–97,296) | 3.49 (2.93–3.9) | 0.03 (–0.07–0.15) | 12,538 (10,640– 13,594) | 0.69 (0.59–0.75) | 15,517 (13,103– 17,318) | 0.64 (0.54–0.71) |
| Europe | 31,028 (29,881– 32,031) | 5.16 (4.98–5.33) | 31,688 (28,480– 35,551) | 4.92 (4.42–5.55) | –0.05 (–0.14–0.07) | 4574 (4196–4773) | 0.56 (0.53–0.59) | 4661 (4154–5028) | 0.50 (0.45–0.54) |
| Asian GBD regions | | | | | | | | | |
| Central Asia | 733 (685–786) | 1.94 (1.82–2.08) | 1092 (956–1242) | 2.34 (2.05–2.64) | 0.20 (0.06–0.36) | 158 (148–166) | 0.48 (0.46–0.51) | 193 (173–215) | 0.49 (0.44–0.55) |
| East Asia | 19,406 (16,919– 22,887) | 2.28 (2–2.68) | 24,688 (19,158–31,886) | 2.50 (1.94–3.23) | 0.09 (–0.15–0.39) | 2788 (2434–3291) | 0.36 (0.32–0.43) | 3266 (2627–3999) | 0.31 (0.25–0.38) |
| High-income Asia Pacific | 14,795 (9830–16,456) | 11.01 (6.59–12.46) | 11,377 (9300–13,534) | 7.20 (5.84–8.59) | –0.35 (–0.47–0) | 1675 (1296–1866) | 0.73 (0.57–0.81) | 1855 (1366–2114) | 0.59 (0.47–0.66) |
| North Africa and Middle East | 8739 (6682–9842) | 4.23 (3.4–4.73) | 13,586 (10,441–15,925) | 5.06 (4.01–5.88) | 0.20 (0.07–0.35) | 1047 (931–1239) | 0.68 (0.61–0.86) | 1319 (1133–1589) | 0.64 (0.56–0.8) |
| South Asia | 15,806 (12,602– 17,797) | 2.36 (1.91–2.65) | 23,334 (18,491–27,846) | 2.77 (2.2–3.32) | 0.17 (–0.02–0.42) | 4248 (3572–4813) | 0.79 (0.65–0.91) | 5658 (4532–6743) | 0.78 (0.63–0.94) |
| Southeast Asia | 13,939 (10,566– 15,808) | 4.80 (3.69–5.4) | 18,866 (14,094– 22,235) | 5.27 (3.96–6.19) | 0.10 (–0.05–0.28) | 3155 (2494–3524) | 1.33 (1.08–1.48) | 3850 (3097–4395) | 1.22 (0.99–1.39) |

be higher in men than in women. In other countries, the incidence of ThC in women was higher than in men; the highest ratio was reported in Qatar (2.95-fold) and the lowest ratio was recorded in Maldives (0.58-fold). Results in detail are presented in [Table 6](#) and [Figure 3](#).

3.3 | Prevalence of THC in Asia

3.3.1 | Compared with global data and continents

In Asia, the number of cases who lived with ThC increased from 759,981 (95% CI: 640,546–805,950) in 2010 to 982,341 (95% CI: 857,344–1,082,418) in 2019, which is a 1.3-fold increase. In 2019,

more than 53% (982,341/1,831,760) of ThC prevalence happened in Asian countries. During this period, the ASPR of ThC with an 8% change, increased from 17.94 (95% CI: 15.12–18.98) per 100,000 in 2010 to 19.42 (95% CI: 16.93–21.38) per 100,000 in 2019. Also, at the same time, this rate globally increased by 3% and Africa by 23%. This rate decreased by 1% in America and 2% in Europe ([Figure 4](#) and [Table 1](#)).

In Asian men, the number of ThC prevalence increased from 205,125 (95% CI: 169,386–221,225) in 2010 to 285,342 (95% CI: 239,841–324,527) in 2019, which is over a 1.39-fold increase. In 2019, approximately 29% (285,342/982,341) of patients who lived with ThC in Asia were men, which included 50.7% (285,342/562,741) of global male ThC prevalence cases. During this period, the ASPR of THC had a 16% change, increasing from

| % change 2010–2019 | Prevalence | | | | DALY | | | | | |
|---------------------------|----------------------------------|-------------------------|------------------------------------|------------------------|-----------------------|------------------------------|------------------------|------------------------------|------------------------|---------------------------|
| | 2010 | | 2019 | | % change 2010–2019 | 2010 | | 2019 | | % change 2010–2019 |
| | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | |
| -0.06 (-0.12 to -0.01) | 1,058,584 (925,303–1,106,520) | 29.97 (26.27–31.31) | 1,269,019 (1,123,383–1,393,452) | 30.17 (26.71–33.15) | 0.01 (-0.07–0.1) | 625,211 (544,936–672,424) | 18.01 (15.73–19.36) | 721,999 (627,829–792,461) | 16.94 (14.72–18.62) | -0.06 (-0.13–0.01) |
| -0.03 (-0.11–0.08) | 54,674 (41,671–63,223) | 14.19 (11.23–16.2) | 85,181 (65,133–104,159) | 16.95 (13.4–20.38) | 0.19 (0.04–0.38) | 61,288 (49,174–70,178) | 19.52 (15.84–22.19) | 78,174 (62,057–94,510) | 18.83 (15.07–22.52) | -0.04 (-0.14–0.09) |
| -0.03 (-0.09–0.03) | 195,286 (188,596–200,948) | 37.67 (36.4–38.75) | 227,004 (197,359–262,528) | 36.50 (31.72–42.27) | -0.03 (-0.16–0.12) | 90,138 (83,896–95,527) | 17.06 (15.89–18.08) | 107,238 (96,816–118,462) | 16.32 (14.72–18.11) | -0.04 (-0.11–0.03) |
| -0.08 (-0.16–0.01) | 554,856 (447,358–595,190) | 26.34 (21.31–28.2) | 696,999 (582,544–783,841) | 27.77 (23.15–31.19) | 0.05 (-0.05–0.19) | 368,534 (304,476–400,999) | 18.64 (15.61–20.23) | 434,163 (362,794–486,695) | 17.48 (14.65–19.64) | -0.06 (-0.15–0.03) |
| -0.11 (-0.16 to -0.05) | 252,625 (243,625–261,116) | 43.70 (42.18–45.23) | 258,523 (232,371–290,635) | 41.99 (37.58–47.26) | -0.04 (-0.13–0.08) | 104,553 (97,980–111,133) | 15.26 (14.26–16.34) | 101,636 (91,856–111,544) | 13.44 (12.15–14.87) | -0.12 (-0.17 to -0.05) |
| 0.02 (-0.08–0.12) | 5692 (5292–6147) | 14.51 (13.5–15.65) | 8827 (7693–101,23) | 18.14 (15.8–20.72) | 0.25 (0.09–0.43) | 4524 (4247–4804) | 12.74 (11.98–13.5) | 5603 (4955–6333) | 12.79 (11.38–14.38) | 0.00 (-0.1–0.12) |
| -0.14 (-0.31–0.06) | 160,700 (139,603–190,957) | 18.61 (16.21–21.97) | 206,107 (159,523–267,428) | 20.97 (16.27–27.17) | 0.13 (-0.13–0.44) | 77,637 (69,274–93,254) | 9.54 (8.5–11.42) | 86,270 (70,536–105,550) | 8.40 (6.89–10.26) | -0.12 (-0.28–0.07) |
| -0.20 (-0.25 to -0.06) | 124,506 (80,606–139,206) | 96.74 (56.95–109.69) | 90,936 (74,785–108,630) | 62.48 (50.5–74.44) | -0.35 (-0.47–0) | 34,765 (25,512–39,203) | 20.56 (13.76–23.72) | 30,964 (25,262–35,199) | 14.39 (11.97–16.61) | -0.30 (-0.37 to -0.07) |
| -0.06 (-0.14–0.04) | 73,939 (55,144–83,752) | 34.35 (26.59–38.72) | 117,063 (87,911–137,864) | 42.36 (32.74–49.32) | 0.23 (0.1–0.39) | 33,783 (28,203–38,291) | 18.42 (16.07–21.06) | 43,117 (35,094–50,876) | 17.87 (14.91–21.01) | -0.03 (-0.12–0.08) |
| -0.01 (-0.18–0.16) | 117,305 (91,885–132,495) | 16.22 (12.76–18.29) | 177,491 (139,963–213,055) | 20.16 (15.89–24.2) | 0.24 (0.04–0.51) | 146,730 (119,881–165,914) | 23.20 (19.21–26.18) | 183,441 (147,052–217,443) | 22.81 (18.27–27.02) | -0.02 (-0.18–0.16) |
| -0.08 (-0.18–0.04) | 106,624 (79,825–122,234) | 34.69 (26.26–39.68) | 147,665 (109,364–175,581) | 39.94 (29.61–47.51) | 0.15 (-0.01–0.36) | 88,689 (65,994–100,571) | 33.43 (25.43–37.65) | 105,556 (80,215–122,086) | 30.87 (23.84–35.46) | -0.08 (-0.19–0.06) |

9.67 (95% CI: 7.98–10.41) per 100,000 in 2010 to 11.18 (95% CI: 9.42–12.69) per 100,000 in 2019; in the same time, this rate globally increased by 7%, in Africa by 34%, in America by 3%, and in Europe and by 1% (Table 4).

In Asian women, the number of ThC prevalence increased from 554,856 (95% CI: 447,358–595,190) in 2010 to 696,999 (95% CI: 582,544–783,841) in 2019, which is over a 1.25-fold increase. In 2019, approximately 71% (696,999/982,341) of patients who lived with ThC in Asia were women, which included 54.9% (696,999/1,269,019) of global female ThC prevalence cases. During this period, the ASPR of ThC had a 5% change, increasing from 26.34 (95% CI: 21.31–28.20) per 100,000 in 2010 to 27.77 (95% CI: 23.15–31.19) per 100,000 in 2019; at the same time, this rate

globally increased by 1% and in Africa by 19%. This rate decreased in America by 3% and in Europe by 4% (Table 5).

3.3.2 | Age distribution

In 2019, age-specific prevalence cases of ThC were peaking at 55 to 59 years generally and in males, and 60 to 64 in females. In all age groups, the prevalence cases of ThC in females were higher than in males (Figure 7). In 2019, there were 74,272 ThC patients aged ≥ 70 living in Asia, accounting for 7.56% of all ThC cases of all ages. This rate was 7.2% in men and 7.71% in women. Meanwhile, in the world, 184,567 patients ≥ 70 years lived with ThC, which includes 10.08%

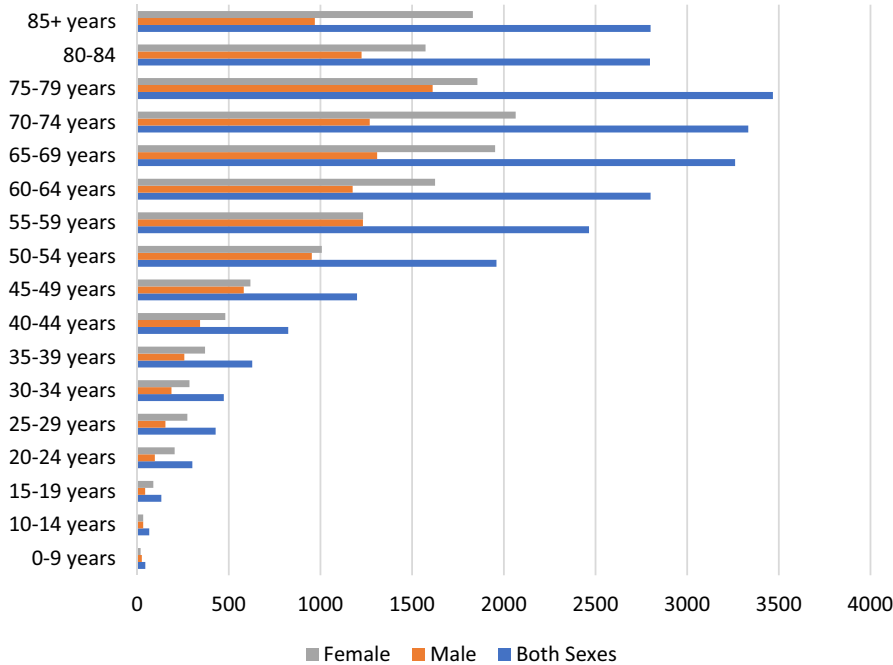


FIGURE 5 Age-specific death cases of ThC cancer among genders in Asia, 2019.

of ThC cases in all ages. This rate was 9.84% in men and 10.18% in women. Overall, 40.24% of ThC patients aged ≥ 70 years lived in Asia (Table 2).

3.3.3 | Within Asian regions

In 2019, the highest ASPR of ThC was observed in high-income Asia Pacific countries (42.29 (95% CI: 35.62–49.33)), with a 35% decrease compared with 2010, while all Asian regions experienced an increasing trend of 18% (Southeast Asia and East Asia) and 27% (Central Asia and North Africa and the Middle East) (Figure 6).

In men, the highest ASPR of ThC was observed in high-income Asia Pacific countries (22.20 (95% CI: 17.78–26.90)), with a 31% decrease compared with 2010, while all Asian regions experienced an increasing trend of 29% (East Asia) and 42% (North Africa and the Middle East).

In women, the highest ASPR of ThC was observed in high-income Asia Pacific countries (62.48 (95% CI: 50.50–74.44)), with a 35% decrease compared with 2010, while all Asian regions experienced an increasing trend of 13% (East Asia) and 25% (Central Asia) (Figure 6).

3.3.4 | Based on SDI

Among high SDI Asian countries, the Republic of Korea (57.73) and Saudi Arabia (50.55) have the highest ASPR of ThC, and Qatar (22.54) has the lowest rate. In this group, four countries experienced an upward trend from 5% to 38%, and seven countries reported a downward trend from 1% to 55% from 2010 to 2019.

Among high-middle SDI Asian countries, Lebanon (68.50) had the highest ASPR of ThC, and Georgia (18.91) had the lowest rate.

In this group, Bahrain and Oman had a downward trend of 7% and 13%, respectively. Other countries reported an upward trend from 5% (Turkey) to 35% (Sri Lanka).

Among middle SDI Asian countries, Vietnam (57.61) has the highest ASPR of ThC, and Uzbekistan (6.26) has the lowest rate. In this group, all countries experienced an upward trend from 11% (Indonesia) to 87% (Armenia) except Thailand, which reported a downward trend of 1% from 2010 to 2019.

Among low-middle SDI Asian countries, Palestine (26.33) has the highest ASPR of ThC, and Tajikistan (2.51) has the lowest rate. In this group, all countries reported an upward trend from 1% (Democratic People's Republic of Korea) to 59% (Palestine). Among low SDI Asian countries, Pakistan (19.41) has the highest ASPR of ThC, and Nepal (12.17) has the lowest rate. In this group, all countries experienced an upward trend of 19% (Afghanistan) to 42% (Nepal). More details are presented in Table 7.

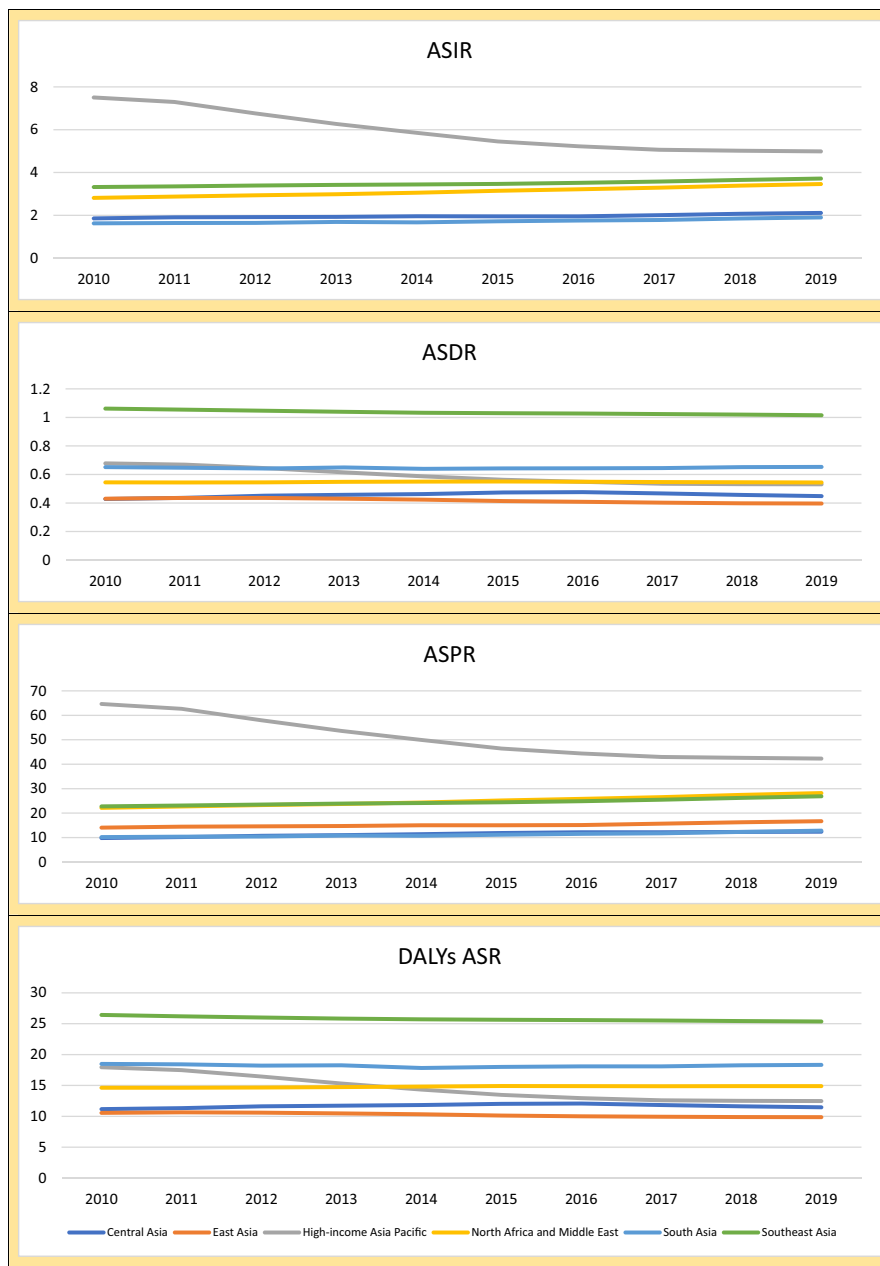
3.3.5 | National comparison

Among Asian countries, 10 countries experienced a decreasing trend in the ThC prevalence rate between 2010 and 2019; the greatest increase was detected in Armenia (increase in ASPR=0.87 (95% CI: 0.46–1.35)) and the greatest decrease was detected in the Republic of Korea (decrease in ASPR=−0.55 (95% CI: −0.66–0.00)) (Figure 2).

In 2019, the highest ASPR (per 100,000) of ThC was reported in Lebanon (68.50), the Republic of Korea (57.73), Vietnam (57.61), and Saudi Arabia (50.55). The lowest ASPR of ThC was reported in Tajikistan (2.51), Uzbekistan (6.26), the Syrian Arab Republic (7.63), and Mongolia (9.07).

In Asian men, the highest ASPR (per 100,000) of ThC was reported in Lebanon (40.26), Vietnam (30.94), the Republic of Korea

FIGURE 6 Temporal trend of incidence, prevalence, death, and DALYs age standard rates (per 100,000 population) of stomach cancer in Asian regions from 1990 to 2019.



(27.33), and Taiwan (Province of China) (27.28). The lowest ASPR (per 100,000) of ThC was reported in Tajikistan (1.55), Uzbekistan (3.43), and Afghanistan (3.84).

In women, the highest ASPR (per 100,000) of ThC was reported in Lebanon (93.81), Republic of Korea (89.36), Saudi Arabia (88.58), and Vietnam (83.48). The lowest ASPR (per 100,000) of ThC was reported in Tajikistan (3.43), Uzbekistan (8.79), Syrian Arab Republic (10.13), and Mongolia (11.47). Results in detail are presented in [Table 7](#).

3.3.6 | Male/female ratio

In 2010, the ASPR of ThC in women was higher than in men in all countries, and in 2019, the ASPR of ThC in Maldives was reported to

be higher in men than in women. In other countries, the prevalence of ThC in women was higher than in men. The highest ratio was reported in Afghanistan (6.17-fold) and the lowest ratio was recorded in Maldives (0.93-fold) ([Figure 3](#)).

3.4 | Burden of THC in Asia

3.4.1 | Comparison with global data and continents

In Asia, the number of ThC DALYs increased from 624,971 (95% CI: 545,913–666,046) in 2010 to 750,984 (95% CI: 665,083–819,813) in 2019, which is a 1.2-fold increase. In 2019, approximately 61% (750,984/1,231,841) of ThC DALYs happened in Asian countries. During this period, the DALYs ASR of ThC had a 4% change,

TABLE 6 The death distribution of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019, by geographical region and SDI.

| Location | SDI 2019 | Both | | | | | Male | |
|----------------------------|-------------|---------------------|----------------------|---------------------|----------------------|---------------------------|------------------|----------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| High SDI | | | | | | | | |
| Brunei Darussalam | 0.823 | 2 (2–2) | 1.31 (1.05–1.48) | 3 (2–3) | 1.25 (1.01–1.45) | –0.04 (–0.18–0.11) | 1 (1–1) | 0.87 (0.7–1.01) |
| Cyprus | 0.841 | 8 (6–9) | 0.61 (0.49–0.68) | 9 (7–11) | 0.49 (0.4–0.57) | –0.20 (–0.31 to –0.06) | 3 (3–4) | 0.56 (0.45–0.64) |
| Israel | 0.803 | 76 (65–83) | 0.84 (0.72–0.91) | 86 (74–97) | 0.73 (0.62–0.81) | –0.14 (–0.22 to –0.05) | 29 (22–32) | 0.73 (0.56–0.81) |
| Japan | 0.87 | 1827 (1433–2004) | 0.55 (0.45–0.59) | 2139 (1611–2403) | 0.49 (0.39–0.54) | –0.10 (–0.14 to –0.06) | 619 (509–655) | 0.47 (0.39–0.5) |
| Kuwait | 0.851 | 8 (7–9) | 0.62 (0.55–0.69) | 12 (10–14) | 0.56 (0.45–0.67) | –0.10 (–0.24–0.07) | 4 (3–4) | 0.44 (0.37–0.5) |
| Qatar | 0.83 | 2 (2–3) | 0.75 (0.58–0.89) | 3 (2–5) | 0.58 (0.44–0.75) | –0.23 (–0.4–0) | 1 (1–2) | 0.49 (0.33–0.63) |
| Republic of Korea | 0.878 | 710 (323–785) | 1.19 (0.57–1.32) | 580 (426–679) | 0.68 (0.5–0.79) | –0.43 (–0.51 to –0.12) | 261 (112–291) | 0.98 (0.47–1.08) |
| Saudi Arabia | 0.805 | 86 (73–98) | 0.74 (0.64–0.83) | 121 (93–154) | 0.66 (0.52–0.81) | –0.12 (–0.27–0.06) | 38 (32–45) | 0.57 (0.49–0.66) |
| Singapore | 0.861 | 25 (22–27) | 0.53 (0.48–0.59) | 33 (28–37) | 0.44 (0.37–0.5) | –0.18 (–0.26 to –0.08) | 9 (8–10) | 0.40 (0.36–0.46) |
| Taiwan (Province of China) | 0.868 | 166 (147–178) | 0.56 (0.49–0.6) | 217 (166–279) | 0.55 (0.42–0.71) | –0.01 (–0.22–0.27) | 68 (59–74) | 0.46 (0.4–0.51) |
| United Arab Emirates | 0.88 | 19 (11–27) | 1.00 (0.49–1.47) | 42 (22–66) | 0.82 (0.41–1.23) | –0.18 (–0.37–0.04) | 15 (8–22) | 0.85 (0.39–1.27) |
| High-middle SDI | | | | | | | | |
| Bahrain | 0.751 | 3 (2–4) | 0.99 (0.58–1.18) | 5 (3–6) | 0.73 (0.49–0.93) | –0.26 (–0.42 to –0.06) | 1 (1–1) | 0.51 (0.39–0.62) |
| Georgia | 0.702 | 27 (24–30) | 0.46 (0.41–0.51) | 32 (25–38) | 0.55 (0.43–0.66) | 0.20 (–0.03–0.42) | 9 (6–10) | 0.36 (0.27–0.41) |
| Jordan | 0.731 | 19 (17–23) | 0.63 (0.54–0.75) | 34 (28–43) | 0.58 (0.47–0.73) | –0.08 (–0.26–0.11) | 7 (6–9) | 0.45 (0.37–0.55) |
| Kazakhstan | 0.723 | 90 (84–97) | 0.63 (0.59–0.68) | 99 (83–116) | 0.58 (0.49–0.68) | –0.08 (–0.21–0.07) | 29 (27–35) | 0.49 (0.44–0.6) |
| Lebanon | 0.708 | 28 (23–36) | 0.67 (0.55–0.86) | 35 (28–46) | 0.67 (0.52–0.88) | 0.00 (–0.16–0.17) | 13 (10–17) | 0.64 (0.5–0.83) |
| Malaysia | 0.737 | 171 (152–202) | 0.98 (0.86–1.17) | 234 (180–304) | 0.93 (0.71–1.19) | –0.06 (–0.26–0.17) | 56 (47–66) | 0.61 (0.51–0.72) |
| Oman | 0.783 | 6 (5–7) | 0.58 (0.49–0.64) | 7 (6–9) | 0.49 (0.41–0.57) | –0.15 (–0.27 to –0.01) | 3 (2–3) | 0.45 (0.38–0.52) |
| Sri Lanka | 0.69 | 121 (109–146) | 0.67 (0.6–0.82) | 160 (117–215) | 0.65 (0.48–0.86) | –0.03 (–0.28–0.26) | 44 (39–52) | 0.54 (0.47–0.64) |
| Turkey | 0.748 | 399 (346–478) | 0.61 (0.53–0.74) | 455 (353–635) | 0.53 (0.41–0.75) | –0.13 (–0.32–0.1) | 157 (133–207) | 0.50 (0.42–0.68) |

| | | | Female | | | | | |
|-----------|-------------------|--------------------|------------|-------------------|-------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | F/M Ratio |
| Number | ASR per 1,000,000 | % change 2010-2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010-2019 | |
| 1 | 0.90 | 0.04 | 1 | 1.65 | 2 | 1.53 | -0.08 | 1.69 |
| (1-1) | (0.71-1.12) | (-0.16-0.27) | (1-2) | (1.23-1.94) | (2-2) | (1.17-1.83) | (-0.23-0.11) | |
| 4 | 0.43 | -0.23 | 5 | 0.64 | 5 | 0.52 | -0.19 | 1.20 |
| (3-5) | (0.35-0.52) | (-0.37 to -0.06) | (4-6) | (0.48-0.75) | (4-7) | (0.42-0.63) | (-0.33-0.01) | |
| 34 | 0.64 | -0.12 | 47 | 0.93 | 53 | 0.79 | -0.15 | 1.23 |
| (27-39) | (0.53-0.74) | (-0.24-0.02) | (41-52) | (0.81-1.02) | (44-61) | (0.66-0.91) | (-0.26 to -0.03) | |
| 694 | 0.41 | -0.12 | 1208 | 0.59 | 1445 | 0.54 | -0.09 | 1.30 |
| (562-767) | (0.35-0.46) | (-0.17 to -0.05) | (911-1358) | (0.48-0.65) | (1041-1652) | (0.43-0.6) | (-0.12 to -0.04) | |
| 7 | 0.51 | 0.17 | 5 | 0.94 | 5 | 0.64 | -0.32 | 1.25 |
| (5-8) | (0.39-0.65) | (-0.09-0.51) | (4-5) | (0.8-1.07) | (4-7) | (0.5-0.81) | (-0.45 to -0.16) | |
| 2 | 0.42 | -0.13 | 1 | 1.44 | 1 | 1.09 | -0.25 | 2.57 |
| (1-3) | (0.29-0.59) | (-0.39-0.2) | (1-1) | (0.86-1.81) | (1-2) | (0.79-1.48) | (-0.46-0.11) | |
| 192 | 0.52 | -0.47 | 449 | 1.30 | 388 | 0.78 | -0.40 | 1.49 |
| (143-230) | (0.39-0.61) | (-0.56 to -0.15) | (208-509) | (0.6-1.48) | (272-474) | (0.54-0.95) | (-0.5 to -0.05) | |
| 61 | 0.56 | -0.03 | 48 | 0.97 | 60 | 0.80 | -0.17 | 1.43 |
| (46-79) | (0.43-0.69) | (-0.22-0.2) | (39-57) | (0.8-1.12) | (44-81) | (0.61-1.06) | (-0.36-0.06) | |
| 12 | 0.36 | -0.10 | 16 | 0.63 | 20 | 0.50 | -0.21 | 1.39 |
| (10-15) | (0.3-0.44) | (-0.24-0.06) | (14-18) | (0.55-0.71) | (17-24) | (0.42-0.58) | (-0.31 to -0.08) | |
| 87 | 0.48 | 0.04 | 98 | 0.65 | 130 | 0.61 | -0.06 | 1.26 |
| (64-114) | (0.36-0.63) | (-0.2-0.35) | (86-107) | (0.56-0.71) | (98-167) | (0.46-0.78) | (-0.26-0.21) | |
| 35 | 0.87 | 0.02 | 4 | 1.29 | 7 | 0.67 | -0.48 | 0.77 |
| (16-55) | (0.4-1.38) | (-0.22-0.32) | (2-6) | (0.54-2.16) | (4-12) | (0.33-1.11) | (-0.6 to -0.26) | |
| 2 | 0.40 | -0.21 | 2 | 1.47 | 3 | 1.10 | -0.25 | 2.73 |
| (1-2) | (0.29-0.53) | (-0.43-0.05) | (1-3) | (0.72-1.82) | (2-4) | (0.61-1.44) | (-0.42 to -0.01) | |
| 11 | 0.48 | 0.33 | 19 | 0.54 | 21 | 0.61 | 0.13 | 1.29 |
| (6-14) | (0.27-0.58) | (-0.05-0.66) | (16-21) | (0.47-0.61) | (17-25) | (0.49-0.73) | (-0.09-0.37) | |
| 14 | 0.41 | -0.07 | 12 | 0.84 | 21 | 0.76 | -0.10 | 1.83 |
| (10-19) | (0.31-0.56) | (-0.3-0.2) | (10-15) | (0.68-1.05) | (15-28) | (0.57-1.02) | (-0.31-0.15) | |
| 32 | 0.45 | -0.08 | 60 | 0.71 | 66 | 0.66 | -0.07 | 1.47 |
| (26-42) | (0.37-0.59) | (-0.24-0.13) | (55-66) | (0.66-0.77) | (56-77) | (0.56-0.77) | (-0.21-0.09) | |
| 17 | 0.70 | 0.10 | 15 | 0.70 | 18 | 0.64 | -0.08 | 0.91 |
| (12-22) | (0.51-0.93) | (-0.12-0.33) | (12-20) | (0.54-0.94) | (14-26) | (0.48-0.9) | (-0.25-0.12) | |
| 87 | 0.67 | 0.10 | 115 | 1.33 | 147 | 1.18 | -0.11 | 1.75 |
| (63-115) | (0.48-0.88) | (-0.16-0.42) | (99-140) | (1.12-1.62) | (111-198) | (0.89-1.58) | (-0.31-0.13) | |
| 3 | 0.40 | -0.10 | 3 | 0.74 | 4 | 0.60 | -0.18 | 1.51 |
| (2-4) | (0.31-0.5) | (-0.3-0.12) | (3-4) | (0.58-0.87) | (3-5) | (0.47-0.75) | (-0.34-0.01) | |
| 57 | 0.53 | -0.03 | 77 | 0.77 | 103 | 0.74 | -0.03 | 1.41 |
| (39-79) | (0.36-0.72) | (-0.32-0.3) | (67-97) | (0.67-0.99) | (73-143) | (0.54-1.03) | (-0.29-0.28) | |
| 193 | 0.48 | -0.05 | 242 | 0.69 | 261 | 0.57 | -0.17 | 1.20 |
| (145-293) | (0.36-0.73) | (-0.29-0.24) | (203-289) | (0.58-0.83) | (200-342) | (0.44-0.75) | (-0.37-0.06) | |

(Continues)

TABLE 6 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|--|-------------|---------------------|----------------------|---------------------|----------------------|-----------------------|---------------------|----------------------|
| | | 2010 | | 2019 | | | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 1990–2010 | Number | ASR per 1,000,000 |
| Middle SDI | | | | | | | | |
| Armenia | 0.689 | 14 (13–17) | 0.38 (0.35–0.46) | 25 (21–30) | 0.63 (0.52–0.74) | 0.65 (0.27–0.97) | 6 (5–8) | 0.38 (0.34–0.5) |
| Azerbaijan | 0.683 | 34 (29–43) | 0.48 (0.4–0.64) | 41 (33–55) | 0.47 (0.36–0.64) | –0.02 (–0.18–0.17) | 12 (10–15) | 0.37 (0.3–0.48) |
| China | 0.686 | 5900 (5254–6472) | 0.42 (0.37–0.46) | 7239 (6012–8476) | 0.39 (0.32–0.45) | –0.08 (–0.22–0.07) | 3315 (2642–3714) | 0.54 (0.42–0.6) |
| Indonesia | 0.66 | 1607 (1172–1850) | 1.02 (0.76–1.16) | 1998 (1459–2389) | 1.00 (0.75–1.18) | –0.02 (–0.18–0.14) | 487 (396–581) | 0.65 (0.54–0.76) |
| Iran (Islamic Republic of) | 0.67 | 220 (180–234) | 0.42 (0.35–0.45) | 341 (245–375) | 0.49 (0.36–0.53) | 0.16 (0.01–0.27) | 91 (80–97) | 0.34 (0.3–0.36) |
| Iraq | 0.671 | 97 (75–123) | 0.60 (0.47–0.77) | 159 (120–201) | 0.70 (0.54–0.86) | 0.17 (–0.07–0.43) | 41 (31–54) | 0.53 (0.4–0.7) |
| Philippines | 0.623 | 733 (662–809) | 1.31 (1.19–1.48) | 1010 (812–1225) | 1.34 (1.08–1.63) | 0.02 (–0.16–0.23) | 225 (196–257) | 0.83 (0.74–0.96) |
| Syrian Arab Republic | 0.619 | 17 (11–20) | 0.18 (0.12–0.22) | 21 (13–28) | 0.18 (0.12–0.24) | 0.02 (–0.22–0.31) | 8 (6–11) | 0.16 (0.12–0.21) |
| Thailand | 0.687 | 475 (408–589) | 0.70 (0.6–0.84) | 577 (433–793) | 0.58 (0.43–0.79) | –0.17 (–0.39–0.12) | 150 (124–185) | 0.47 (0.39–0.58) |
| Turkmenistan | 0.67 | 11 (11–12) | 0.37 (0.34–0.39) | 16 (13–20) | 0.40 (0.32–0.5) | 0.09 (–0.12–0.36) | 5 (4–5) | 0.33 (0.29–0.37) |
| Uzbekistan | 0.631 | 34 (32–37) | 0.29 (0.26–0.31) | 54 (45–65) | 0.31 (0.26–0.37) | 0.10 (–0.07–0.29) | 14 (12–16) | 0.24 (0.19–0.27) |
| Vietnam | 0.617 | 971 (803–1137) | 1.41 (1.19–1.65) | 1204 (925–1533) | 1.34 (1.04–1.69) | –0.04 (–0.23–0.15) | 359 (258–434) | 1.22 (0.94–1.46) |
| Low-middle SDI | | | | | | | | |
| Bangladesh | 0.483 | 479 (376–617) | 0.54 (0.43–0.68) | 646 (472–888) | 0.49 (0.37–0.68) | –0.08 (–0.26–0.13) | 193 (136–258) | 0.42 (0.3–0.55) |
| Bhutan | 0.455 | 3 (2–4) | 0.68 (0.53–0.92) | 4 (3–5) | 0.71 (0.53–0.97) | 0.03 (–0.14–0.22) | 1 (1–2) | 0.51 (0.33–0.72) |
| Cambodia | 0.469 | 105 (69–133) | 1.27 (0.86–1.6) | 150 (100–192) | 1.33 (0.9–1.67) | 0.05 (–0.13–0.25) | 26 (19–33) | 0.73 (0.56–0.94) |
| Democratic People's Republic of Korea | 0.558 | 148 (116–186) | 0.58 (0.46–0.72) | 165 (130–206) | 0.52 (0.42–0.65) | –0.10 (–0.24–0.07) | 44 (31–65) | 0.46 (0.33–0.65) |
| India | 0.566 | 5270 (4583–5850) | 0.62 (0.53–0.68) | 7075 (5979–8315) | 0.63 (0.53–0.73) | 0.02 (–0.13–0.18) | 1991 (1683–2300) | 0.48 (0.4–0.55) |
| Kyrgyzstan | 0.596 | 16 (14–17) | 0.43 (0.39–0.47) | 18 (15–21) | 0.40 (0.35–0.47) | –0.07 (–0.21–0.09) | 4 (4–5) | 0.26 (0.23–0.29) |
| Lao People's Democratic Republic | 0.49 | 37 (24–48) | 1.16 (0.76–1.47) | 47 (31–61) | 1.11 (0.75–1.45) | –0.04 (–0.2–0.17) | 10 (7–14) | 0.67 (0.48–0.88) |
| Maldives | 0.562 | 2 (1–2) | 0.91 (0.73–1.06) | 2 (2–3) | 0.87 (0.68–1.07) | –0.05 (–0.23–0.15) | 1 (1–1) | 1.12 (0.89–1.36) |
| Mongolia | 0.606 | 10 (4–13) | 0.66 (0.24–0.85) | 13 (5–17) | 0.58 (0.22–0.79) | –0.11 (–0.3–0.16) | 4 (2–5) | 0.52 (0.22–0.69) |

| | | | Female | | | | | |
|-------------|-------------------|--------------------|-------------|-------------------|-------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | |
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | F/M Ratio |
| 10 | 0.61 | 0.60 | 8 | 0.38 | 15 | 0.64 | 0.69 | 1.06 |
| (8–12) | (0.47–0.73) | (0–0.97) | (7–9) | (0.34–0.42) | (12–18) | (0.52–0.76) | (0.37–1.02) | |
| 16 | 0.39 | 0.06 | 22 | 0.56 | 25 | 0.52 | –0.06 | 1.33 |
| (11–22) | (0.28–0.52) | (–0.18–0.37) | (18–30) | (0.46–0.78) | (19–36) | (0.39–0.76) | (–0.26–0.18) | |
| 4212 | 0.52 | –0.04 | 2586 | 0.35 | 3027 | 0.30 | –0.14 | 0.58 |
| (3178–5241) | (0.4–0.64) | (–0.22–0.19) | (2244–3082) | (0.31–0.42) | (2395–3759) | (0.24–0.38) | (–0.32–0.07) | |
| 677 | 0.70 | 0.09 | 1120 | 1.35 | 1321 | 1.25 | –0.07 | 1.78 |
| (493–891) | (0.53–0.91) | (–0.16–0.36) | (687–1349) | (0.85–1.61) | (828–1665) | (0.8–1.55) | (–0.27–0.16) | |
| 147 | 0.41 | 0.21 | 129 | 0.50 | 195 | 0.56 | 0.12 | 1.38 |
| (112–163) | (0.32–0.45) | (0.04–0.34) | (98–141) | (0.39–0.55) | (131–220) | (0.39–0.64) | (–0.06–0.24) | |
| 74 | 0.68 | 0.28 | 56 | 0.67 | 85 | 0.72 | 0.08 | 1.06 |
| (54–93) | (0.5–0.84) | (–0.03–0.67) | (42–74) | (0.5–0.9) | (63–110) | (0.55–0.92) | (–0.18–0.42) | |
| 325 | 0.90 | 0.08 | 508 | 1.70 | 685 | 1.69 | –0.01 | 1.88 |
| (243–421) | (0.68–1.16) | (–0.19–0.4) | (446–580) | (1.5–2) | (513–880) | (1.28–2.16) | (–0.23–0.26) | |
| 11 | 0.17 | 0.06 | 8 | 0.20 | 10 | 0.20 | –0.03 | 1.16 |
| (7–15) | (0.12–0.24) | (–0.24–0.45) | (5–10) | (0.11–0.26) | (5–14) | (0.11–0.27) | (–0.26–0.27) | |
| 198 | 0.44 | –0.06 | 325 | 0.87 | 379 | 0.68 | –0.21 | 1.54 |
| (142–275) | (0.32–0.61) | (–0.34–0.32) | (269–421) | (0.72–1.1) | (274–559) | (0.5–1.01) | (–0.42–0.08) | |
| 7 | 0.37 | 0.13 | 7 | 0.40 | 9 | 0.42 | 0.06 | 1.13 |
| (6–9) | (0.29–0.47) | (–0.11–0.45) | (6–7) | (0.36–0.43) | (7–11) | (0.33–0.53) | (–0.16–0.34) | |
| 23 | 0.27 | 0.16 | 20 | 0.31 | 31 | 0.34 | 0.09 | 1.23 |
| (17–29) | (0.19–0.33) | (–0.05–0.43) | (18–22) | (0.28–0.34) | (26–37) | (0.28–0.4) | (–0.09–0.31) | |
| 474 | 1.23 | 0.01 | 612 | 1.53 | 730 | 1.42 | –0.07 | 1.15 |
| (334–613) | (0.92–1.56) | (–0.21–0.25) | (487–751) | (1.21–1.89) | (530–967) | (1.03–1.9) | (–0.29–0.16) | |
| 253 | 0.38 | –0.10 | 287 | 0.67 | 393 | 0.62 | –0.08 | 1.63 |
| (177–367) | (0.26–0.55) | (–0.33–0.18) | (213–396) | (0.51–0.91) | (269–589) | (0.42–0.92) | (–0.28–0.2) | |
| 2 | 0.56 | 0.09 | 2 | 0.87 | 2 | 0.86 | –0.01 | 1.55 |
| (1–2) | (0.35–0.82) | (–0.14–0.36) | (1–3) | (0.64–1.22) | (2–3) | (0.63–1.21) | (–0.19–0.22) | |
| 38 | 0.80 | 0.09 | 79 | 1.63 | 112 | 1.69 | 0.03 | 2.12 |
| (27–48) | (0.58–1) | (–0.13–0.36) | (48–102) | (1.01–2.09) | (65–150) | (1.01–2.22) | (–0.15–0.27) | |
| 55 | 0.44 | –0.05 | 104 | 0.67 | 110 | 0.59 | –0.12 | 1.34 |
| (40–76) | (0.32–0.6) | (–0.21–0.16) | (77–139) | (0.5–0.88) | (83–146) | (0.44–0.79) | (–0.29–0.09) | |
| 2687 | 0.49 | 0.03 | 3279 | 0.75 | 4388 | 0.75 | 0.00 | 1.53 |
| (2179–3229) | (0.4–0.59) | (–0.18–0.28) | (2665–3769) | (0.61–0.86) | (3319–5468) | (0.58–0.94) | (–0.2–0.22) | |
| 5 | 0.25 | 0.00 | 11 | 0.56 | 13 | 0.51 | –0.09 | 1.99 |
| (4–6) | (0.21–0.3) | (–0.18–0.2) | (10–13) | (0.5–0.62) | (11–15) | (0.43–0.6) | (–0.24–0.09) | |
| 14 | 0.68 | 0.02 | 27 | 1.59 | 33 | 1.50 | –0.05 | 2.20 |
| (10–18) | (0.5–0.87) | (–0.21–0.32) | (15–36) | (0.93–2.09) | (19–45) | (0.89–2.01) | (–0.24–0.17) | |
| 2 | 1.12 | –0.01 | 1 | 0.65 | 1 | 0.57 | –0.12 | 0.51 |
| (1–2) | (0.86–1.41) | (–0.23–0.26) | (0–1) | (0.43–0.79) | (0–1) | (0.39–0.72) | (–0.3–0.11) | |
| 6 | 0.50 | –0.04 | 6 | 0.74 | 7 | 0.63 | –0.15 | 1.25 |
| (2–8) | (0.22–0.69) | (–0.29–0.26) | (2–8) | (0.22–1) | (3–10) | (0.2–0.89) | (–0.36–0.14) | |

(Continues)

TABLE 6 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|-------------|----------|--------------------|---------------------|---------------------|---------------------|-----------------------|------------------|---------------------|
| | | 2010 | | 2019 | | | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 1990–2010 | Number | ASR per 1,000,000 |
| Myanmar | 0.521 | 386 (276–480) | 1.10 (0.8–1.36) | 456 (342–565) | 1.03 (0.79–1.27) | –0.06 (–0.23–0.13) | 106 (78–140) | 0.67 (0.51–0.88) |
| Palestine | 0.588 | 10 (8–11) | 0.63 (0.53–0.72) | 15 (11–18) | 0.73 (0.5–0.89) | 0.15 (–0.11–0.39) | 3 (2–3) | 0.37 (0.31–0.44) |
| Tajikistan | 0.539 | 8 (5–10) | 0.24 (0.14–0.3) | 10 (7–12) | 0.24 (0.14–0.31) | 0.02 (–0.19–0.3) | 4 (2–4) | 0.22 (0.13–0.28) |
| Timor-Leste | 0.514 | 5 (4–7) | 0.89 (0.63–1.18) | 8 (5–11) | 1.00 (0.68–1.33) | 0.12 (–0.09–0.37) | 1 (1–2) | 0.46 (0.31–0.68) |
| Low SDI | | | | | | | | |
| Afghanistan | 0.343 | 92 (57–133) | 0.90 (0.6–1.27) | 118 (75–173) | 0.89 (0.62–1.24) | –0.01 (–0.19–0.22) | 23 (14–37) | 0.47 (0.28–0.76) |
| Nepal | 0.422 | 103 (83–132) | 0.60 (0.49–0.75) | 154 (117–207) | 0.70 (0.53–0.93) | 0.17 (–0.07–0.42) | 33 (22–45) | 0.40 (0.26–0.55) |
| Pakistan | 0.449 | 1030 (869–1214) | 1.12 (0.95–1.31) | 1317 (1077–1610) | 1.08 (0.9–1.32) | –0.03 (–0.21–0.2) | 419 (325–523) | 0.91 (0.7–1.14) |
| Yemen | 0.412 | 49 (36–65) | 0.51 (0.38–0.69) | 72 (52–97) | 0.54 (0.4–0.73) | 0.06 (–0.12–0.3) | 16 (11–23) | 0.32 (0.23–0.48) |

decreasing from 16.10 (95% CI: 14.08–17.12) per 100,000 in 2010 to 15.39 (95% CI: 13.60–16.79) per 100,000 in 2019. In the same period, this rate globally decreased by 4%, in Africa by 1%, in America by 2%, and in Europe by 10% (Figure 4 and Table 1).

In Asian men, the number of ThC DALYs increased from 256,437 (95% CI: 217,071–275,000) in 2010 to 316,821 (95% CI: 272,355–354,527) in 2019, which is over a 1.24-fold increase. In 2019, approximately 42% (316,821/750,984) of ThC DALYs in Asia occurred in men, which included 62.14% (316,821/509,842) of global male ThC DALYs cases. During this period, the DALYs ASR of ThC had a 2% change, decreasing from 13.54 (95% CI: 11.49–14.46) per 100,000 in 2010 to 13.30 (95% CI: 11.41–14.88) per 100,000 in 2019. In the same period, this rate globally decreased by 2%, in Europe by 7%. This rate increased in Africa and America by 3% and 2%, respectively (Table 4).

In Asian women, the number of ThC DALYs increased from 368,534 (95% CI: 304,476–400,999) in 2010 to 434,163 (95% CI: 362,794–486,695) in 2019, which is approximately a 1.18-fold increase. In 2019, more than 57% (434,163/750,984) of DALYs related to ThC in Asia were women, which included 60.13% (434,163/721,999) of global female ThC DALYs cases. During this period, the DALYs ASR of ThC had a 6% change, decreasing from 18.64 (95% CI: 15.61–20.23) per 100,000 in 2010 to 17.48 (95% CI: 14.65–19.64) per 100,000 in 2019. At the same time, this rate globally decreased by 6%, in American and African countries by 4%, and in European countries by 12% (Table 5).

3.4.2 | Age distribution

In 2019, DALY cases of ThC were peaking at 75 to 79 generally and in females, and 85 years and higher in males. In all age groups, DALY cases of ThC in females were higher than in males, except in ages 80 to 84 years and 85 years and higher, which in males was higher (Figure 8). In 2019, 178,092 DALYs were attributed to ThC in Asians aged ≥ 70 years, accounting for 62.38% of the burden of ThC in all ages. This rate was 23.20% in men and 24.09% in women. Meanwhile, in the world, 318,786 DALY cases were diagnosed due to ThC in people ≥ 70 years old, which includes 25.88% of the burden caused by ThC in all ages. This rate was 24.36% in men and 26.95% in women. In general, 55.87% of the burden caused by ThC has been borne by the elderly ≥ 70 years (Table 2).

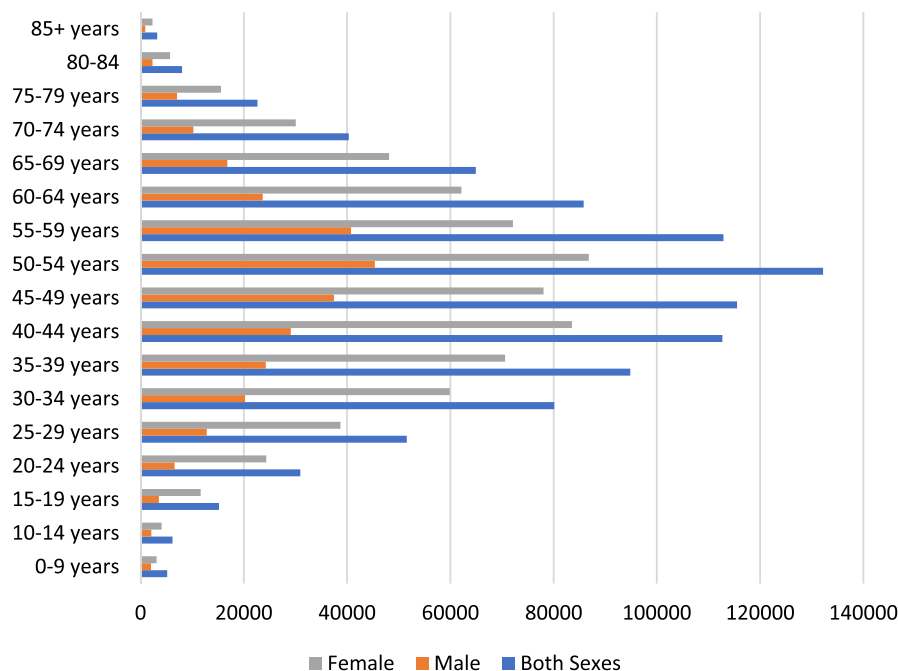
3.4.3 | Within Asian regions

In 2019, the highest DALYs ASR of ThC was observed in Southeast Asia countries (25.34 (95% CI: 21.37–28.88)), with a 4% decrease compared with 2010. Central Asia and North Africa and the Middle East experienced an increasing trend of 3% and 2%, respectively. Other regions recorded a decreasing trend of 1% (South Asia) to 31% (high-income Asia Pacific) (Figure 6 and Table 1).

In men, the highest DALYs ASR of ThC was observed in Southeast Asia countries (18.99 (95% CI: 15.96–22.24)) with a 4% increase

| 2019 | | | Female | | | | 2019 | | | F/M Ratio |
|------------------|---------------------|-----------------------|------------------|------------------------|-------------------|------------------------|-----------------------|------|--|-----------|
| Number | ASR per 1,000,000 | % change 2010-2019 | 2010 Number | 2010 ASR per 1,000,000 | 2019 Number | 2019 ASR per 1,000,000 | % change 2010-2019 | | | |
| 134 (100-171) | 0.68 (0.52-0.87) | 0.02 (-0.21-0.31) | 280 (179-356) | 1.43 (0.94-1.79) | 323 (217-411) | 1.28 (0.88-1.61) | -0.10 (-0.28-0.1) | 1.87 | | |
| 4 (3-5) | 0.40 (0.31-0.48) | 0.06 (-0.15-0.32) | 7 (6-8) | 0.83 (0.67-0.99) | 11 (7-14) | 1.00 (0.63-1.24) | 0.20 (-0.14-0.51) | 2.52 | | |
| 5 (3-6) | 0.23 (0.13-0.3) | 0.06 (-0.2-0.38) | 4 (2-5) | 0.25 (0.12-0.32) | 5 (3-7) | 0.25 (0.13-0.33) | -0.01 (-0.23-0.27) | 1.07 | | |
| 2 (1-3) | 0.57 (0.38-0.78) | 0.24 (-0.03-0.59) | 4 (2-6) | 1.34 (0.85-1.84) | 6 (3-8) | 1.44 (0.89-1.96) | 0.07 (-0.15-0.32) | 2.54 | | |
| 31 (20-48) | 0.49 (0.31-0.72) | 0.03 (-0.19-0.33) | 69 (35-108) | 1.30 (0.74-1.99) | 87 (46-137) | 1.26 (0.76-1.88) | -0.03 (-0.22-0.23) | 2.60 | | |
| 54 (33-79) | 0.53 (0.32-0.78) | 0.30 (-0.05-0.67) | 70 (56-95) | 0.79 (0.63-1.04) | 101 (75-137) | 0.86 (0.64-1.16) | 0.09 (-0.14-0.36) | 1.63 | | |
| 542 (388-723) | 0.90 (0.65-1.19) | -0.01 (-0.28-0.36) | 610 (473-756) | 1.34 (1.07-1.66) | 775 (569-1043) | 1.28 (0.96-1.69) | -0.05 (-0.28-0.3) | 1.42 | | |
| 23 (15-36) | 0.35 (0.23-0.53) | 0.07 (-0.17-0.37) | 33 (23-46) | 0.69 (0.5-0.97) | 49 (33-68) | 0.73 (0.51-1.01) | 0.05 (-0.15-0.33) | 2.08 | | |

FIGURE 7 Age-specific prevalence cases of ThC cancer among genders in Asia, 2019.



compared with 2010. Central Asia and North Africa and the Middle East had an increasing trend of 7% and 10%. South Asia had a stable trend. High-income Asia Pacific countries and East Asia countries reported a decreasing trend of 31% and 2%, respectively (Table 4).

In women, the highest DALYs ASR of ThC was observed in Southeast Asia countries (30.87 (95% CI: 23.84-35.46)), with an 8% decrease compared with 2010. Central Asia had a stable trend and other regions recorded a decreasing trend of 2 (South Asia) to 12% (East Asia) (Table 5).

3.4.4 | Based on SDI

In 2019, among high SDI Asian countries, Brunei Darussalam (26.03) and the United Arab Emirates (22.60) have the highest DALYs ASR of ThC, and Singapore (10.43) and Japan (10.96) have the lowest rate. In this group, all countries experienced a downward trend from 2% (Taiwan (Province of China)) to 52% (Republic of Korea) from 2010 to 2019. Among high-middle SDI Asian countries, Malaysia (23.10) and Lebanon (20.19) have the highest DALYs ASR of ThC, and Oman

TABLE 7 The prevalence distribution of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019, by geographical region and SDI.

| Location | SDI 2019 | Both | | | | | Male | |
|----------------------------|----------|---------------------------|--------------------------|---------------------------|------------------------|-----------------------|---------------------------|------------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| High SDI | | | | | | | | |
| Brunei Darussalam | 0.823 | 119 (97–143) | 35.34 (28.98–41.66) | 165 (129–208) | 37.47 (29.58–46.51) | 0.06 (–0.15–0.32) | 20 (16–25) | 11.94 (9.69–14.47) |
| Cyprus | 0.841 | 408 (335–468) | 29.37 (24.17–33.6) | 452 (365–562) | 25.61 (20.71–32.17) | –0.13 (–0.28–0.05) | 166 (126–204) | 24.75 (18.76–30.38) |
| Israel | 0.803 | 2991 (2636–3365) | 36.86 (32.52–41.32) | 3436 (2567–4494) | 34.09 (25.39–44.64) | –0.08 (–0.31–0.22) | 1038 (829–1218) | 26.72 (21.41–31.34) |
| Japan | 0.87 | 83,303 (76,730–89,153) | 39.67 (36.95–42.52) | 76,771 (63,058–92,419) | 35.51 (29.33–42.99) | –0.10 (–0.25–0.09) | 22,059 (19,533–24,580) | 21.63 (19.24–24.18) |
| Kuwait | 0.851 | 748 (652–849) | 31.56 (27.9–35.52) | 1306 (1037–1644) | 31.25 (25.29–38.88) | –0.01 (–0.2–0.22) | 203 (167–243) | 13.74 (11.51–16.18) |
| Qatar | 0.83 | 301 (236–385) | 25.31 (20.42–30.82) | 525 (367–757) | 22.54 (16.34–30.84) | –0.11 (–0.32–0.18) | 148 (105–204) | 13.60 (9.58–18.62) |
| Republic of Korea | 0.878 | 80,876 (24,303–95,538) | 126.93 (37.62–150.47) | 44,075 (29,771–56,704) | 57.73 (37.52–74.76) | –0.55 (–0.66–0) | 19,447 (5872–23,746) | 59.56 (18.71–71.94) |
| Saudi Arabia | 0.805 | 9068 (6563–11,335) | 36.64 (28.82–44.17) | 20,142 (13,443–28,317) | 50.55 (36.23–67.54) | 0.38 (0.02–0.81) | 2303 (1784–2973) | 15.79 (12.45–20.07) |
| Singapore | 0.861 | 2216 (1920–2526) | 36.67 (32.06–41.48) | 2537 (1912–3263) | 31.55 (23.94–40.48) | –0.14 (–0.34–0.11) | 481 (402–574) | 15.91 (13.33–19.01) |
| Taiwan (Province of China) | 0.868 | 12,132 (10,779–13,697) | 40.19 (35.93–45.21) | 14,466 (10,800–19,758) | 42.24 (31.3–57.91) | 0.05 (–0.23–0.44) | 3668 (3065–4347) | 24.21 (20.5–28.33) |
| United Arab Emirates | 0.88 | 1653 (986–2369) | 24.78 (13.91–36.51) | 3898 (1996–6221) | 29.94 (16.08–45.83) | 0.21 (–0.11–0.63) | 1181 (608–1798) | 19.08 (10.21–28.77) |
| High-middle SDI | | | | | | | | |
| Bahrain | 0.751 | 236 (188–283) | 27.73 (19.19–33.12) | 387 (291–499) | 25.92 (19.39–33.27) | –0.07 (–0.27–0.24) | 61 (49–78) | 9.77 (7.48–12.24) |
| Georgia | 0.702 | 740 (629–854) | 15.18 (13–17.43) | 906 (702–1115) | 18.91 (14.49–23.27) | 0.25 (–0.03–0.56) | 128 (101–156) | 5.73 (4.57–7.01) |
| Jordan | 0.731 | 1353 (1112–1653) | 26.11 (21.54–31.75) | 2750 (2123–3579) | 29.21 (22.66–38.04) | 0.12 (–0.11–0.4) | 310 (243–382) | 11.41 (8.92–14.1) |
| Kazakhstan | 0.723 | 3132 (2803–3504) | 18.61 (16.74–20.73) | 4690 (3854–5711) | 23.60 (19.37–28.71) | 0.27 (0.04–0.58) | 641 (542–773) | 8.10 (6.87–9.78) |
| Lebanon | 0.708 | 2206 (1713–2776) | 52.94 (41.22–66.77) | 3727 (2593–5084) | 68.50 (48.1–93.3) | 0.29 (–0.03–0.66) | 522 (393–676) | 26.73 (20.3–34.33) |
| Malaysia | 0.737 | 6868 (5928–8086) | 26.60 (23.06–31.21) | 11,091 (8112–14,685) | 34.64 (25.42–45.81) | 0.30 (–0.03–0.73) | 1560 (1274–1923) | 11.88 (9.73–14.65) |
| Oman | 0.783 | 636 (457–754) | 30.46 (23.08–35.47) | 984 (721–1300) | 26.47 (20.14–32.74) | –0.13 (–0.29–0.09) | 180 (138–218) | 13.68 (11.11–16.44) |
| Sri Lanka | 0.69 | 4513 (3877–5548) | 20.34 (17.47–25.09) | 7099 (4928–10,294) | 27.54 (19.14–39.71) | 0.35 (–0.05–0.91) | 1120 (908–1395) | 10.66 (8.73–13.15) |
| Turkey | 0.748 | 20,738 (17,083–24,773) | 27.56 (22.74–32.69) | 27,170 (20,659–35,897) | 29.04 (22.18–38.23) | 0.05 (–0.22–0.41) | 6163 (4977–7681) | 16.26 (13.14–20.19) |

| | | | Female | | | | | |
|-----------------|-------------------|--------------------|-----------------|-------------------|-----------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | F/M Ratio |
| Number | ASR per 1,000,000 | % change 2010-2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010-2019 | |
| 30 | 13.32 | 0.12 | 99 | 59.01 | 136 | 62.57 | 0.06 | 4.70 |
| (23-39) | (10.17-17.07) | (-0.17-0.48) | (79-122) | (47.57-71.43) | (101-178) | (47.61-80.67) | (-0.18-0.38) | |
| 193 | 23.39 | -0.05 | 242 | 33.75 | 258 | 27.87 | -0.17 | 1.19 |
| (138-256) | (16.6-31.01) | (-0.29-0.26) | (198-291) | (27.81-40.5) | (198-353) | (21.43-38.66) | (-0.37-0.08) | |
| 1223 | 25.31 | -0.05 | 1954 | 46.07 | 2213 | 42.23 | -0.08 | 1.67 |
| (871-1672) | (18.08-34.57) | (-0.33-0.31) | (1663-2264) | (39.22-53.52) | (1640-2947) | (31.12-56.46) | (-0.33-0.24) | |
| 21,079 | 19.94 | -0.08 | 61,244 | 57.14 | 55,691 | 50.82 | -0.11 | 2.55 |
| (15,911-27,535) | (15.37-25.98) | (-0.29-0.19) | (55,920-66,394) | (52.55-62.13) | (44,003-69,105) | (40.07-63.6) | (-0.29-0.12) | |
| 461 | 19.24 | 0.40 | 545 | 60.60 | 845 | 47.85 | -0.21 | 2.49 |
| (338-621) | (14.46-25.61) | (0.04-0.85) | (459-649) | (51.86-70.32) | (626-1155) | (37.09-62.89) | (-0.39-0.03) | |
| 255 | 13.01 | -0.04 | 153 | 59.35 | 270 | 52.52 | -0.12 | 4.04 |
| (165-365) | (8.55-18.42) | (-0.37-0.37) | (112-209) | (45.45-76.97) | (177-441) | (36.54-77.33) | (-0.37-0.24) | |
| 10,884 | 27.33 | -0.54 | 61,428 | 193.40 | 33,191 | 89.36 | -0.54 | 3.27 |
| (7186-14,581) | (17.89-36.28) | (-0.66-0.03) | (18,340-75,067) | (55.06-238.07) | (21,750-44,233) | (54.62-119.68) | (-0.67-0.14) | |
| 6183 | 25.84 | 0.64 | 6765 | 68.09 | 13,959 | 88.58 | 0.30 | 3.43 |
| (4272-9232) | (18.43-35.92) | (0.19-1.22) | (4161-8664) | (49.04-84.9) | (7901-20,675) | (58.17-125.03) | (-0.07-0.77) | |
| 619 | 15.38 | -0.03 | 1735 | 59.04 | 1918 | 49.27 | -0.17 | 3.20 |
| (460-862) | (11.51-21.2) | (-0.27-0.29) | (1466-2020) | (50.22-68.26) | (1417-2510) | (36.47-64.46) | (-0.37-0.1) | |
| 4682 | 27.28 | 0.13 | 8464 | 55.86 | 9784 | 56.76 | 0.02 | 2.08 |
| (3360-6526) | (19.84-37.53) | (-0.19-0.55) | (7286-9896) | (48.44-64.79) | (7085-13,437) | (40.84-78.99) | (-0.27-0.43) | |
| 2733 | 26.23 | 0.37 | 472 | 37.43 | 1165 | 40.83 | 0.09 | 1.56 |
| (1280-4566) | (12.69-42.64) | (-0.03-0.95) | (318-673) | (20.11-57.52) | (604-1849) | (21.06-63.92) | (-0.2-0.57) | |
| 115 | 10.46 | 0.07 | 175 | 52.91 | 272 | 51.73 | -0.02 | 4.94 |
| (79-161) | (7.37-14.11) | (-0.24-0.48) | (129-218) | (35.28-65.52) | (195-373) | (36.98-67.55) | (-0.25-0.31) | |
| 181 | 8.17 | 0.43 | 612 | 23.34 | 724 | 28.44 | 0.22 | 3.48 |
| (113-234) | (5.24-10.44) | (0.02-0.85) | (509-723) | (19.49-27.56) | (556-904) | (21.98-35.53) | (-0.07-0.57) | |
| 769 | 14.46 | 0.27 | 1043 | 42.00 | 1982 | 46.20 | 0.10 | 3.19 |
| (554-1043) | (10.54-19.51) | (-0.08-0.73) | (818-1329) | (33.13-53.18) | (1404-2789) | (33.18-64.57) | (-0.17-0.47) | |
| 949 | 10.17 | 0.26 | 2491 | 27.53 | 3742 | 35.25 | 0.28 | 3.46 |
| (736-1267) | (7.93-13.51) | (-0.02-0.66) | (2170-2829) | (24.13-31.13) | (3035-4606) | (28.58-43.44) | (0.02-0.6) | |
| 1019 | 40.26 | 0.51 | 1684 | 76.12 | 2708 | 93.81 | 0.23 | 2.33 |
| (693-1370) | (27.55-53.79) | (0.11-1.02) | (1214-2217) | (54.89-100.68) | (1767-3910) | (61.51-136.48) | (-0.11-0.66) | |
| 2889 | 17.67 | 0.49 | 5308 | 42.02 | 8202 | 52.72 | 0.25 | 2.98 |
| (2060-3931) | (12.61-24.07) | (0.07-1.02) | (4418-6407) | (35.14-50.65) | (5776-11,152) | (37.37-72.03) | (-0.09-0.74) | |
| 322 | 12.35 | -0.10 | 457 | 55.72 | 662 | 50.81 | -0.09 | 4.12 |
| (214-475) | (8.68-16.95) | (-0.35-0.27) | (296-566) | (37.76-67.52) | (425-911) | (35.73-67.23) | (-0.3-0.23) | |
| 1831 | 15.03 | 0.41 | 3394 | 29.14 | 5268 | 38.80 | 0.33 | 2.58 |
| (1212-2610) | (10.04-21.33) | (-0.06-1.01) | (2796-4422) | (24.11-38.02) | (3585-7785) | (26.51-57.1) | (-0.08-0.94) | |
| 9131 | 19.38 | 0.19 | 14,575 | 38.31 | 18,039 | 38.20 | 0.00 | 1.97 |
| (6728-12,900) | (14.28-27.23) | (-0.16-0.64) | (11,456-17,715) | (30.13-46.46) | (13,388-24,219) | (28.4-51.14) | (-0.28-0.38) | |

(Continues)

TABLE 7 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|---------------------------------------|----------|------------------------------|------------------------|------------------------------|------------------------|----------------------|---------------------------|------------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| Middle SDI | | | | | | | | |
| Armenia | 0.689 | 321 (283–398) | 9.06 (8.06–11.15) | 658 (531–800) | 16.98 (13.76–20.58) | 0.87 (0.46–1.35) | 88 (73–151) | 5.49 (4.57–9.09) |
| Azerbaijan | 0.683 | 1077 (877–1309) | 11.28 (9.32–13.64) | 1531 (1175–1979) | 12.96 (9.92–16.63) | 0.15 (–0.1–0.48) | 220 (167–284) | 4.76 (3.7–6.09) |
| China | 0.686 | 228,906 (204,094–262,191) | 13.51 (12.05–15.43) | 310,328 (255,041–382,138) | 16.17 (13.28–19.83) | 0.20 (–0.02–0.45) | 80,801 (68,490–92,183) | 9.41 (8.02–10.72) |
| Indonesia | 0.66 | 35,011 (22,706–42,901) | 15.27 (9.95–18.62) | 47,136 (31,955–60,457) | 16.93 (11.57–21.58) | 0.11 (–0.14–0.47) | 6747 (5129–8258) | 6.05 (4.59–7.37) |
| Iran (Islamic Republic of) | 0.67 | 14,839 (10,198–16,496) | 20.61 (14.23–22.97) | 27,337 (16,709–31,333) | 30.19 (18.75–34.55) | 0.46 (0.27–0.64) | 3926 (2876–4520) | 10.75 (8.05–12.32) |
| Iraq | 0.671 | 5726 (4147–7751) | 23.18 (16.94–31.38) | 10,904 (7428–15,294) | 32.60 (22.45–45.18) | 0.41 (0.05–0.87) | 1380 (989–1901) | 11.19 (7.96–15.52) |
| Philippines | 0.623 | 20,333 (17,328–23,408) | 25.39 (21.55–29.28) | 29,778 (22,714–39,024) | 29.61 (22.63–38.56) | 0.17 (–0.11–0.52) | 4172 (3403–5012) | 10.60 (8.64–12.68) |
| Syrian Arab Republic | 0.619 | 1034 (742–1290) | 6.66 (4.46–8.39) | 1139 (733–1576) | 7.63 (4.95–10.56) | 0.15 (–0.16–0.52) | 345 (250–454) | 4.26 (2.94–5.66) |
| Thailand | 0.687 | 17,508 (13,893–27,201) | 21.38 (17.14–32.59) | 20,577 (13,389–36,196) | 21.14 (13.94–37.43) | –0.01 (–0.33–0.4) | 4472 (3470–6054) | 11.30 (8.76–15.31) |
| Turkmenistan | 0.67 | 389 (348–435) | 9.35 (8.43–10.41) | 635 (488–824) | 12.59 (9.71–16.32) | 0.35 (0.04–0.77) | 107 (87–128) | 5.10 (4.18–6.06) |
| Uzbekistan | 0.631 | 890 (799–1004) | 3.92 (3.53–4.38) | 1911 (1534–2330) | 6.26 (5.03–7.65) | 0.60 (0.26–0.99) | 244 (203–291) | 2.15 (1.78–2.56) |
| Vietnam | 0.617 | 42,287 (23,507–56,042) | 46.42 (27.31–60.81) | 64,088 (38,833–87,569) | 57.61 (35.62–77.76) | 0.24 (–0.06–0.64) | 10,065 (5609–13,667) | 23.76 (14.38–31.61) |
| Low-middle SDI | | | | | | | | |
| Bangladesh | 0.483 | 10,582 (7607–15,478) | 8.08 (5.99–11.46) | 17,036 (11,359–25,991) | 10.74 (7.25–16.19) | 0.33 (0–0.79) | 1984 (1338–2898) | 3.14 (2.14–4.53) |
| Bhutan | 0.455 | 68 (45–99) | 10.59 (7.25–15.11) | 104 (65–159) | 13.97 (9.08–20.68) | 0.32 (–0.02–0.76) | 14 (9–21) | 4.24 (2.61–6.42) |
| Cambodia | 0.469 | 1977 (1186–2710) | 17.09 (10.18–23.31) | 3474 (2075–4924) | 23.33 (13.94–32.81) | 0.37 (0.05–0.81) | 301 (209–422) | 5.80 (4.02–8.17) |
| Democratic People's Republic of Korea | 0.558 | 5250 (3608–7563) | 18.14 (12.55–25.97) | 5900 (4056–8544) | 18.38 (12.54–26.97) | 0.01 (–0.24–0.35) | 1119 (713–1777) | 8.20 (5.26–12.93) |
| India | 0.566 | 113,286 (93,562–127,781) | 9.78 (8.1–11) | 169,543 (136,587–205,896) | 12.14 (9.79–14.74) | 0.24 (0.02–0.51) | 23,802 (20,423–26,877) | 4.19 (3.6–4.72) |
| Kyrgyzstan | 0.596 | 456 (397–521) | 9.76 (8.55–11.09) | 654 (526–798) | 11.18 (9.05–13.56) | 0.14 (–0.08–0.43) | 76 (63–92) | 3.24 (2.68–3.91) |
| Lao People's Democratic Republic | 0.49 | 608 (351–870) | 12.74 (7.35–18.01) | 952 (559–1416) | 15.56 (9.29–22.83) | 0.22 (–0.07–0.6) | 101 (65–143) | 4.31 (2.8–6.06) |
| Maldives | 0.562 | 52 (44–60) | 19.65 (16.89–22.97) | 103 (80–135) | 23.32 (18.53–29.4) | 0.19 (–0.04–0.48) | 26 (21–33) | 19.02 (15.26–24.03) |

| | | | Female | | | | | |
|------------------|-------------------|--------------------|-------------------|-------------------|-------------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | |
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | F/M Ratio |
| 174 | 9.97 | 0.82 | 233 | 12.02 | 484 | 22.84 | 0.90 | 2.29 |
| (135–220) | (7.87–12.52) | (0.18–1.37) | (203–268) | (10.47–13.83) | (387–599) | (18.29–28.19) | (0.43–1.43) | |
| 353 | 6.15 | 0.29 | 857 | 17.24 | 1179 | 19.26 | 0.12 | 3.13 |
| (236–487) | (4.14–8.52) | (–0.08–0.75) | (665–1086) | (13.68–21.83) | (845–1591) | (14–25.66) | (–0.18–0.51) | |
| 118,423 | 12.22 | 0.30 | 148,106 | 17.77 | 191,904 | 20.21 | 0.14 | 1.65 |
| (89,065–149,034) | (9.29–15.34) | (0–0.68) | (127,562–178,960) | (15.29–21.35) | (145,570–253,044) | (15.32–26.45) | (–0.14–0.48) | |
| 10,604 | 7.75 | 0.28 | 28,264 | 24.47 | 36,532 | 26.12 | 0.07 | 3.37 |
| (7512–14,621) | (5.51–10.59) | (–0.06–0.76) | (16,421–35,824) | (14.2–30.78) | (21,901–49,115) | (15.71–35.07) | (–0.21–0.51) | |
| 7875 | 17.03 | 0.58 | 10,913 | 30.53 | 19,462 | 43.43 | 0.42 | 2.55 |
| (5156–9410) | (11.25–20.26) | (0.3–0.89) | (7365–12,430) | (20.69–34.73) | (11,236–23,044) | (25.73–51.01) | (0.18–0.64) | |
| 2928 | 17.32 | 0.55 | 4346 | 35.57 | 7976 | 48.33 | 0.36 | 2.79 |
| (1953–4182) | (11.82–24.13) | (0.1–1.19) | (2993–6172) | (24.61–50.82) | (5088–11,693) | (31.49–68.98) | (–0.03–0.87) | |
| 6615 | 13.29 | 0.25 | 16,161 | 40.05 | 23,163 | 45.97 | 0.15 | 3.46 |
| (4667–8845) | (9.32–17.82) | (–0.12–0.75) | (13,215–19,115) | (32.74–47.35) | (16,523–32,079) | (32.84–63.47) | (–0.16–0.59) | |
| 381 | 5.06 | 0.19 | 690 | 9.24 | 757 | 10.13 | 0.10 | 2.00 |
| (245–553) | (3.32–7.24) | (–0.18–0.72) | (465–895) | (5.63–12.11) | (449–1061) | (5.96–14.06) | (–0.21–0.5) | |
| 5944 | 12.83 | 0.14 | 13,036 | 30.75 | 14,634 | 28.84 | –0.06 | 2.25 |
| (3917–9622) | (8.63–21.08) | (–0.24–0.69) | (10,032–21,892) | (23.76–50.67) | (9177–28,105) | (18.04–56.81) | (–0.4–0.36) | |
| 188 | 7.34 | 0.44 | 282 | 13.30 | 447 | 17.61 | 0.32 | 2.40 |
| (139–246) | (5.47–9.61) | (0.08–0.89) | (247–322) | (11.73–15.09) | (339–588) | (13.34–23.15) | (0.01–0.77) | |
| 508 | 3.43 | 0.60 | 646 | 5.51 | 1402 | 8.79 | 0.60 | 2.57 |
| (384–639) | (2.54–4.31) | (0.21–1.08) | (558–748) | (4.81–6.32) | (1094–1738) | (6.94–10.84) | (0.22–1.03) | |
| 16,543 | 30.94 | 0.30 | 32,222 | 67.91 | 47,545 | 83.48 | 0.23 | 2.70 |
| (9828–23,789) | (18.97–43.49) | (–0.05–0.76) | (16,521–44,547) | (36.38–92.91) | (25,548–66,947) | (45.23–116.31) | (–0.1–0.66) | |
| 3184 | 4.19 | 0.33 | 8598 | 13.15 | 13,852 | 17.02 | 0.29 | 4.07 |
| (2117–4996) | (2.78–6.51) | (–0.04–0.83) | (5822–13,468) | (9.22–19.61) | (8655–22,397) | (10.87–27.25) | (–0.06–0.8) | |
| 23 | 5.98 | 0.41 | 54 | 17.98 | 82 | 22.86 | 0.27 | 3.82 |
| (13–36) | (3.42–9.57) | (–0.02–0.92) | (33–80) | (11.4–26.6) | (48–132) | (13.97–35.73) | (–0.08–0.75) | |
| 573 | 8.43 | 0.46 | 1676 | 26.25 | 2901 | 36.12 | 0.38 | 4.28 |
| (396–784) | (5.82–11.37) | (0.06–0.99) | (928–2362) | (14.71–36.76) | (1606–4192) | (20.01–52.12) | (0.03–0.87) | |
| 1482 | 8.98 | 0.09 | 4130 | 27.80 | 4419 | 28.24 | 0.02 | 3.14 |
| (923–2287) | (5.66–13.83) | (–0.2–0.5) | (2644–6319) | (17.63–42.25) | (2815–6826) | (17.99–44.66) | (–0.27–0.43) | |
| 37,508 | 5.41 | 0.29 | 89,483 | 15.61 | 132,035 | 19.11 | 0.22 | 3.53 |
| (29,944–45,585) | (4.33–6.6) | (0.03–0.61) | (69,006–103,229) | (12.1–17.96) | (99,160–167,160) | (14.36–24.16) | (–0.03–0.56) | |
| 119 | 4.11 | 0.27 | 380 | 15.53 | 536 | 17.42 | 0.12 | 4.23 |
| (92–151) | (3.21–5.2) | (–0.02–0.63) | (325–445) | (13.31–18.13) | (423–671) | (13.85–21.74) | (–0.13–0.43) | |
| 170 | 5.68 | 0.32 | 507 | 20.99 | 782 | 25.32 | 0.21 | 4.46 |
| (110–241) | (3.81–8.08) | (–0.04–0.87) | (256–749) | (10.67–30.73) | (414–1201) | (13.29–38.03) | (–0.11–0.65) | |
| 62 | 24.26 | 0.28 | 26 | 20.33 | 41 | 22.56 | 0.11 | 0.93 |
| (47–88) | (18.38–31.96) | (–0.04–0.68) | (21–32) | (16.35–24.87) | (30–55) | (16.9–29.3) | (–0.16–0.43) | |

(Continues)

TABLE 7 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|-------------|----------|---------------------------|------------------------|---------------------------|------------------------|----------------------|---------------------|---------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| Mongolia | 0.606 | 167 (109–214) | 8.03 (4.35–10.61) | 281 (166–388) | 9.07 (4.92–12.68) | 0.13 (–0.17–0.54) | 57 (29–79) | 4.96 (2.3–6.9) |
| Myanmar | 0.521 | 6774 (4192–9188) | 14.44 (9.04–19.43) | 9942 (6626–13,643) | 17.84 (11.95–24.42) | 0.24 (–0.1–0.67) | 1119 (737–1556) | 5.17 (3.51–7.18) |
| Palestine | 0.588 | 414 (344–492) | 16.51 (13.85–19.5) | 922 (636–1173) | 26.33 (18.46–32.91) | 0.59 (0.18–1.04) | 76 (60–93) | 5.93 (4.69–7.37) |
| Tajikistan | 0.539 | 115 (97–137) | 2.16 (1.77–2.6) | 188 (147–242) | 2.51 (1.95–3.21) | 0.16 (–0.11–0.5) | 36 (28–44) | 1.30 (0.98–1.64) |
| Timor-Leste | 0.514 | 75 (38–107) | 9.87 (5.23–14.03) | 136 (75–197) | 14.33 (8.19–20.65) | 0.45 (0.06–1.07) | 12 (6–19) | 3.01 (1.45–4.75) |
| Low SDI | | | | | | | | |
| Afghanistan | 0.343 | 1924 (793–3380) | 11.53 (5.1–19.41) | 3253 (1487–5607) | 13.74 (6.66–23.08) | 0.19 (–0.1–0.6) | 246 (140–433) | 2.93 (1.65–5.08) |
| Nepal | 0.422 | 2031 (1446–2921) | 8.60 (6.24–12.18) | 3423 (2327–4897) | 12.17 (8.24–17.14) | 0.42 (0.05–0.93) | 286 (172–427) | 2.63 (1.59–3.87) |
| Pakistan | 0.449 | 21,988 (16,616–28,109) | 15.36 (11.84–19.39) | 36,361 (25,890–50,429) | 19.41 (14.17–26.2) | 0.26 (–0.1–0.76) | 4563 (3359–6032) | 6.53 (4.86–8.6) |
| Yemen | 0.412 | 1638 (1019–2478) | 10.92 (6.97–16.26) | 2806 (1699–4195) | 13.26 (8.36–19.62) | 0.21 (–0.1–0.61) | 301 (190–469) | 3.87 (2.45–6.03) |

(11.85) has the lowest rate. In this group, Malaysia had a stable trend. Five countries experienced a downward trend and three countries reported an upward trend from 2010 to 2019. In middle SDI Asian countries, Vietnam (36.32) and the Philippines (34.27) have the highest DALYs ASR of ThC, and the Syrian Arab Republic (4.62) and Uzbekistan (7.42) have the lowest rate. In this group, seven countries experienced an upward trend from 3% (Philippines) to 61% (Armenia), and Vietnam, Indonesia, and Azerbaijan reported a decreasing trend of 4%, China by 7%, and Thailand by 16% from 2010 to 2019.

Among low-middle SDI Asian countries, Cambodia (32.50) has the highest ASPR of ThC, and Tajikistan (5.35) has the lowest rate. In this group, eight countries reported a downward trend from 1% (India) to 10% (Mongolia), and five countries experienced an upward trend from 1% (Tajikistan) to 15% (Timor-Leste and Palestine) from 2010 to 2019.

Among low SDI Asian countries, Pakistan (32.29) has the highest DALY ASR of ThC, and Yemen (14.19) has the lowest rate. In this group, Nepal and Yemen reported an increasing trend of 14% and 8%, and Pakistan and Afghanistan experienced a downward trend of 2% and 3%, respectively, from 2010 to 2019. More details are presented in [Table 8](#).

3.4.5 | National comparison

Among Asian countries, 31 countries experienced a decreasing trend in the ThC DALYs ASR between 2010 and 2019; the greatest

increase was detected in Armenia (increase in DALYs ASR=0.61 (95% CI: 0.20–0.94)) and the greatest decrease was detected in the Republic of Korea (decrease in DALYs ASR=–0.52 (95% CI: –0.59 to –0.12)) ([Figure 2](#)).

In 2019, the highest DALYs ASR (per 100,000) of ThC was reported in Vietnam (36.32), the Philippines (34.27), Cambodia (32.50), and Pakistan (32.29). The lowest DALYs ASR of ThC was reported in the Syrian Arab Republic (4.62), Tajikistan (5.35), Uzbekistan (7.42), and China (9.70).

In Asian men, the highest DALYs ASR (per 100,000) of ThC was reported in Vietnam (32.14), Pakistan (25.34), and the United Arab Emirates (24.00). The lowest DALYs ASR (per 100,000) of ThC was reported in the Syrian Arab Republic (4.51), Tajikistan (5.28), Uzbekistan (6.77), and Kyrgyzstan (6.98).

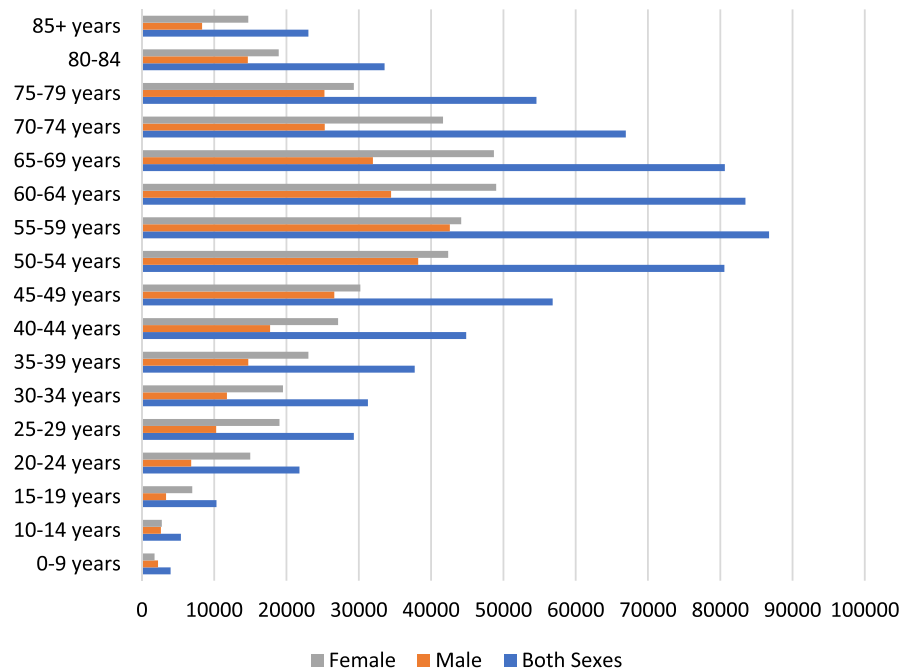
In women, the highest DALYs ASR (per 100,000) of ThC was reported in the Philippines (43.37), Cambodia (42.02), Vietnam (40.08), Pakistan (39.53), and Lao People's Democratic Republic (37.74). The lowest DALYs ASR (per 100,000) of ThC was reported in the Syrian Arab Republic (4.79), Tajikistan (5.39), Uzbekistan (7.84), and China (8.11). Results in detail are presented in [Table 8](#).

3.5 | Male/female ratio

In 2010, only in Armenia, Maldives and China, the DALYs ASR of ThC in males was higher than in women. In 2019, the DALYs ASR of ThC in China, Maldives, and the United Arab Emirates were reported to

| 2019 | | | Female | | 2019 | | | F/M Ratio |
|-----------------------|----------------------|----------------------|---------------------------|------------------------|---------------------------|------------------------|----------------------|-----------|
| Number | ASR per 1,000,000 | % change 2010-2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010-2019 | |
| 97 (51-142) | 5.99 (2.97-8.69) | 0.21 (-0.16-0.74) | 111 (67-146) | 10.60 (5.2-14.17) | 184 (106-269) | 11.47 (5.94-16.55) | 0.08 (-0.23-0.51) | 1.92 |
| 1844 (1260-2609) | 7.23 (4.98-10.15) | 0.40 (-0.02-1) | 5654 (3145-7906) | 22.64 (12.65-31.37) | 8098 (4914-11,395) | 26.98 (16.41-37.86) | 0.19 (-0.15-0.69) | 3.73 |
| 150 (115-191) | 8.59 (6.54-11.02) | 0.45 (0.09-0.92) | 339 (272-414) | 26.54 (21.59-31.82) | 771 (503-1010) | 44.19 (29.19-56.37) | 0.66 (0.15-1.22) | 5.15 |
| 59 (43-77) | 1.55 (1.11-2.06) | 0.19 (-0.14-0.64) | 80 (64-98) | 3.02 (2.38-3.73) | 129 (98-170) | 3.43 (2.59-4.48) | 0.13 (-0.15-0.51) | 2.21 |
| 23 (12-35) | 4.78 (2.59-7.16) | 0.59 (0.15-1.4) | 63 (32-92) | 17.02 (8.85-24.76) | 113 (60-168) | 24.29 (12.92-35.99) | 0.43 (0.03-1.08) | 5.08 |
| 472 (281-779) | 3.84 (2.31-6.34) | 0.31 (-0.04-0.85) | 1678 (586-3057) | 19.70 (7.44-34.68) | 2781 (1077-5042) | 23.72 (9.72-41.39) | 0.20 (-0.1-0.63) | 6.17 |
| 526 (310-806) | 4.19 (2.48-6.4) | 0.59 (0.14-1.23) | 1745 (1205-2569) | 14.06 (9.91-20.64) | 2896 (1923-4306) | 18.87 (12.51-27.7) | 0.34 (-0.03-0.86) | 4.51 |
| 7734 (5418-11,109) | 8.51 (5.94-12.17) | 0.30 (-0.12-0.92) | 17,425 (12,163-23,458) | 24.68 (17.52-32.6) | 28,626 (18,610-43,193) | 30.68 (20.43-45.46) | 0.24 (-0.18-0.89) | 3.60 |
| 511 (315-816) | 4.71 (2.87-7.47) | 0.22 (-0.14-0.71) | 1337 (779-2137) | 18.04 (11.02-27.83) | 2295 (1288-3605) | 21.71 (12.85-33.28) | 0.20 (-0.13-0.63) | 4.61 |

FIGURE 8 Age-specific DALYs cases of ThC cancer among genders in Asia, 2019.



be higher in men than in women. In other countries, the incidence of ThC in women was higher than in men. The highest ratio was reported in Bahrain (2.72-fold) and the lowest ratio was recorded in Maldives (0.53-fold) (Figure 3).

4 | DISCUSSION

This study determined the time trend of the incidence, mortality, and burden of ThC from 2010 to 2019 in 49 Asian countries. Also,

TABLE 8 The DALY distribution of thyroid cancer in Asian countries in 2010 and 2019 and the temporal trends between 2010 and 2019, by geographical region and SDI.

| Location | SDI 2019 | Both | | | | | Male | |
|----------------------------|----------|---------------------------|------------------------|---------------------------|------------------------|---------------------------|---------------------------|------------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| High SDI | | | | | | | | |
| Brunei Darussalam | 0.823 | 58 (49–67) | 27.08 (22.05–30.92) | 81 (66–96) | 26.03 (21.17–30.3) | –0.04 (–0.18–0.11) | 18 (15–21) | 17.38 (14.59–20.13) |
| Cyprus | 0.841 | 195 (157–220) | 13.95 (11.32–15.62) | 211 (173–252) | 11.38 (9.38–13.59) | –0.18 (–0.3 to –0.04) | 88 (67–101) | 13.53 (10.41–15.44) |
| Israel | 0.803 | 1665 (1454–1811) | 19.47 (17.01–21.21) | 1826 (1597–2064) | 16.65 (14.51–18.81) | –0.14 (–0.24 to –0.04) | 686 (539–769) | 17.51 (13.77–19.66) |
| Japan | 0.87 | 33,764 (29,178–36,742) | 12.50 (11.09–13.64) | 34,347 (28,947–38,324) | 10.96 (9.64–12.28) | –0.12 (–0.17 to –0.06) | 12,742 (11,084–13,590) | 10.71 (9.49–11.44) |
| Kuwait | 0.851 | 243 (218–270) | 14.40 (12.9–15.87) | 372 (303–459) | 12.70 (10.41–15.31) | –0.12 (–0.26–0.06) | 102 (89–116) | 9.79 (8.51–11.1) |
| Qatar | 0.83 | 91 (71–112) | 15.36 (12.27–18.29) | 137 (99–194) | 11.47 (8.71–15.23) | –0.25 (–0.41 to –0.03) | 56 (40–74) | 10.73 (7.41–13.92) |
| Republic of Korea | 0.878 | 21,708 (8014–25,086) | 34.42 (12.96–39.75) | 13,779 (9787–16,466) | 16.56 (11.45–19.76) | –0.52 (–0.59 to –0.12) | 8442 (3056–9637) | 27.77 (10.76–31.45) |
| Saudi Arabia | 0.805 | 3337 (2700–3966) | 19.49 (16.71–22.2) | 5380 (3862–7281) | 18.92 (14.49–24) | –0.03 (–0.22–0.19) | 1365 (1130–1655) | 14.16 (11.99–16.64) |
| Singapore | 0.861 | 677 (604–764) | 12.84 (11.54–14.33) | 811 (693–964) | 10.43 (8.95–12.38) | –0.19 (–0.28 to –0.08) | 240 (211–278) | 9.37 (8.27–10.77) |
| Taiwan (Province of China) | 0.868 | 4330 (3903–4716) | 14.46 (13.07–15.75) | 5301 (4010–6962) | 14.22 (10.86–18.68) | –0.02 (–0.24–0.26) | 1808 (1595–2011) | 12.23 (10.84–13.54) |
| United Arab Emirates | 0.88 | 907 (520–1303) | 24.78 (12.92–36.04) | 1873 (966–2948) | 22.60 (11.68–34.23) | –0.09 (–0.31–0.19) | 732 (386–1092) | 22.47 (11.33–33.27) |
| High-middle SDI | | | | | | | | |
| Bahrain | 0.751 | 99 (73–116) | 19.40 (12.35–23.01) | 142 (109–183) | 14.63 (10.42–18.65) | –0.25 (–0.4 to –0.04) | 36 (29–44) | 10.50 (8.23–12.46) |
| Georgia | 0.702 | 706 (626–780) | 13.01 (11.5–14.38) | 825 (635–991) | 15.42 (11.96–18.55) | 0.19 (–0.04–0.43) | 224 (173–259) | 9.62 (7.47–11.06) |
| Jordan | 0.731 | 619 (532–728) | 15.60 (13.36–18.32) | 1084 (877–1371) | 14.39 (11.71–18.22) | –0.08 (–0.25–0.13) | 230 (190–270) | 11.05 (9.11–13.17) |
| Kazakhstan | 0.723 | 2778 (2597–3019) | 17.85 (16.7–19.44) | 3031 (2540–3620) | 16.32 (13.77–19.41) | –0.09 (–0.22–0.09) | 983 (890–1137) | 14.20 (12.93–16.8) |
| Lebanon | 0.708 | 798 (663–982) | 18.98 (15.84–23.4) | 1070 (817–1377) | 20.19 (15.5–25.89) | 0.06 (–0.14–0.28) | 335 (269–422) | 16.61 (13.29–20.95) |
| Malaysia | 0.737 | 4829 (4314–5629) | 23.02 (20.45–27.08) | 6583 (5087–8478) | 23.10 (17.83–29.86) | 0.00 (–0.21–0.26) | 1652 (1421–1965) | 15.10 (12.91–17.93) |
| Oman | 0.783 | 223 (173–254) | 15.09 (12.4–16.94) | 284 (216–359) | 11.85 (9.68–14.02) | –0.21 (–0.34 to –0.06) | 95 (78–109) | 11.05 (9.35–12.73) |
| Sri Lanka | 0.69 | 3245 (2926–3853) | 16.11 (14.57–19.27) | 4189 (3009–5766) | 16.20 (11.67–22.22) | 0.01 (–0.27–0.35) | 1210 (1041–1426) | 13.00 (11.31–15.19) |
| Turkey | 0.748 | 10,722 (9360–12,666) | 15.32 (13.36–18.02) | 12,071 (9272–16,054) | 13.45 (10.35–17.88) | –0.12 (–0.33–0.14) | 4568 (3886–5552) | 13.35 (11.35–16.6) |

| | | | Female | | | | | |
|-----------------|-------------------|--------------------|-----------------|-------------------|-----------------|-------------------|--------------------|-----------|
| 2019 | | | 2010 | | 2019 | | | |
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | F/M Ratio |
| 25 | 17.43 | 0.00 | 40 | 35.78 | 56 | 34.02 | -0.05 | 1.95 |
| (20–32) | (14.17–21.21) | (-0.19–0.24) | (31–48) | (27.44–42.26) | (43–69) | (26.45–41.69) | (-0.21–0.13) | |
| 99 | 11.36 | -0.16 | 107 | 14.26 | 112 | 11.32 | -0.21 | 1.00 |
| (76–121) | (8.7–13.91) | (-0.31–0.02) | (81–125) | (11.04–16.75) | (88–139) | (8.97–14.08) | (-0.36 to -0.01) | |
| 775 | 15.34 | -0.12 | 979 | 20.99 | 1051 | 17.67 | -0.16 | 1.15 |
| (648–900) | (12.79–17.77) | (-0.24–0.02) | (863–1083) | (18.58–23.25) | (891–1226) | (14.99–20.67) | (-0.27 to -0.03) | |
| 12,651 | 9.29 | -0.13 | 21,022 | 13.99 | 21,697 | 12.37 | -0.12 | 1.33 |
| (10,750–14,165) | (8.18–10.51) | (-0.19 to -0.04) | (17,676–23,206) | (12.3–15.49) | (17,539–24,613) | (10.7–14.18) | (-0.17 to -0.04) | |
| 193 | 11.30 | 0.15 | 141 | 22.07 | 179 | 14.78 | -0.33 | 1.31 |
| (146–249) | (8.63–14.44) | (-0.11–0.49) | (122–162) | (19.27–24.89) | (139–236) | (11.69–19.07) | (-0.46 to -0.16) | |
| 86 | 8.61 | -0.20 | 34 | 27.62 | 52 | 20.50 | -0.26 | 2.38 |
| (56–123) | (5.84–12.04) | (-0.43–0.11) | (26–45) | (20.55–34.54) | (35–81) | (15.04–27.84) | (-0.45–0.06) | |
| 5065 | 12.69 | -0.54 | 13,266 | 39.86 | 8714 | 19.92 | -0.50 | 1.57 |
| (3588–6223) | (9.06–15.36) | (-0.63 to -0.15) | (4991–15,930) | (14.57–48.25) | (5787–10,851) | (12.82–24.67) | (-0.6 to -0.02) | |
| 2475 | 15.02 | 0.06 | 1972 | 27.20 | 2905 | 24.82 | -0.09 | 1.65 |
| (1801–3381) | (11.39–19.17) | (-0.17–0.33) | (1350–2456) | (21.97–32.35) | (1896–4176) | (18.01–32.91) | (-0.31–0.18) | |
| 314 | 8.27 | -0.12 | 437 | 16.12 | 497 | 12.61 | -0.22 | 1.52 |
| (261–395) | (6.92–10.3) | (-0.25–0.04) | (379–497) | (13.98–18.21) | (411–590) | (10.45–14.97) | (-0.32 to -0.08) | |
| 2239 | 12.56 | 0.03 | 2522 | 16.58 | 3062 | 15.68 | -0.05 | 1.25 |
| (1649–2958) | (9.33–16.53) | (-0.23–0.35) | (2230–2826) | (14.7–18.51) | (2284–4018) | (11.62–20.74) | (-0.28–0.24) | |
| 1531 | 24.00 | 0.07 | 174 | 28.58 | 343 | 18.71 | -0.35 | 0.78 |
| (716–2473) | (11.72–37.34) | (-0.2–0.43) | (111–244) | (12.95–45.48) | (174–544) | (9.26–30) | (-0.5 to -0.05) | |
| 57 | 8.44 | -0.20 | 63 | 29.42 | 85 | 23.00 | -0.22 | 2.72 |
| (41–78) | (6.16–11.06) | (-0.41–0.08) | (41–77) | (16.38–35.9) | (59–111) | (14.13–30.05) | (-0.39–0.03) | |
| 295 | 12.66 | 0.32 | 482 | 15.74 | 530 | 17.72 | 0.13 | 1.40 |
| (173–362) | (7.58–15.48) | (-0.04–0.63) | (416–543) | (13.55–17.9) | (421–643) | (13.81–21.56) | (-0.11–0.38) | |
| 444 | 10.63 | -0.04 | 390 | 20.56 | 640 | 18.54 | -0.10 | 1.74 |
| (326–588) | (7.84–14.21) | (-0.28–0.26) | (315–483) | (16.72–25.45) | (470–866) | (13.71–24.97) | (-0.3–0.16) | |
| 1051 | 12.69 | -0.11 | 1796 | 20.46 | 1980 | 19.00 | -0.07 | 1.50 |
| (843–1374) | (10.32–16.51) | (-0.27–0.12) | (1645–1976) | (18.73–22.52) | (1631–2391) | (15.74–22.93) | (-0.22–0.11) | |
| 467 | 19.20 | 0.16 | 464 | 21.09 | 603 | 21.16 | 0.00 | 1.10 |
| (332–604) | (13.77–25.01) | (-0.08–0.42) | (365–596) | (16.64–27.18) | (441–844) | (15.43–29.61) | (-0.23–0.27) | |
| 2520 | 17.26 | 0.14 | 3177 | 30.80 | 4063 | 29.00 | -0.06 | 1.68 |
| (1861–3351) | (12.68–22.87) | (-0.15–0.49) | (2738–3784) | (26.58–36.92) | (3018–5446) | (21.68–38.89) | (-0.28–0.22) | |
| 129 | 8.93 | -0.19 | 128 | 20.70 | 155 | 16.28 | -0.21 | 1.82 |
| (93–182) | (6.74–11.3) | (-0.38–0.04) | (87–153) | (14.93–24.36) | (107–204) | (12.08–20.28) | (-0.37 to -0.01) | |
| 1539 | 13.10 | 0.01 | 2036 | 18.72 | 2650 | 18.73 | 0.00 | 1.43 |
| (1040–2127) | (8.9–18.02) | (-0.31–0.36) | (1767–2527) | (16.31–23.74) | (1883–3765) | (13.37–26.47) | (-0.28–0.36) | |
| 5526 | 12.61 | -0.06 | 6154 | 16.93 | 6544 | 14.06 | -0.17 | 1.12 |
| (4158–8042) | (9.57–18.49) | (-0.3–0.27) | (5100–7361) | (14.03–20.24) | (4951–8494) | (10.66–18.19) | (-0.37–0.1) | |

(Continues)

TABLE 8 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|---------------------------------------|----------|------------------------------|------------------------|------------------------------|------------------------|-----------------------|---------------------------|------------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| Middle SDI | | | | | | | | |
| Armenia | 0.689 | 327 (301–426) | 8.97 (8.3–11.6) | 578 (479–688) | 14.43 (11.99–17.07) | 0.61 (0.2–0.94) | 141 (124–217) | 8.99 (7.94–13.47) |
| Azerbaijan | 0.683 | 1070 (918–1285) | 12.97 (11.21–16.09) | 1300 (1033–1661) | 12.47 (9.96–16.22) | –0.04 (–0.2–0.16) | 391 (319–485) | 10.10 (8.21–12.64) |
| China | 0.686 | 160,968 (14,3708–178,093) | 10.37 (9.27–11.43) | 187,319 (156,236–219,112) | 9.70 (8.11–11.27) | –0.07 (–0.21–0.09) | 88,822 (72,504–99,841) | 11.92 (9.63–13.3) |
| Indonesia | 0.66 | 45,923 (32,903–53,740) | 24.89 (17.99–28.73) | 55,359 (40,142–67,329) | 23.79 (17.49–28.57) | –0.04 (–0.21–0.13) | 14,358 (11,456–17,244) | 15.93 (12.81–18.95) |
| Iran (Islamic Republic of) | 0.67 | 6928 (5232–7503) | 11.27 (8.61–12.17) | 10,469 (6928–11,742) | 13.16 (8.93–14.62) | 0.17 (0.01–0.26) | 2851 (2280–3050) | 9.15 (7.59–9.73) |
| Iraq | 0.671 | 3386 (2583–4337) | 16.90 (12.94–21.71) | 5290 (3807–6979) | 19.13 (14.14–24.62) | 0.13 (–0.11–0.42) | 1371 (1010–1804) | 14.10 (10.42–18.35) |
| Philippines | 0.623 | 21,800 (19,658–24,027) | 33.39 (30.02–36.76) | 29,535 (23,648–35,586) | 34.27 (27.58–41.26) | 0.03 (–0.17–0.23) | 7066 (6165–8033) | 22.09 (19.28–25.28) |
| Syrian Arab Republic | 0.619 | 543 (381–664) | 4.44 (2.93–5.45) | 619 (396–840) | 4.62 (2.99–6.27) | 0.04 (–0.23–0.37) | 272 (200–345) | 4.19 (2.97–5.41) |
| Thailand | 0.687 | 11,838 (9995–16,178) | 15.88 (13.52–21.16) | 13,375 (9579–19,927) | 13.40 (9.65–20.03) | –0.16 (–0.39–0.14) | 4121 (3393–5324) | 11.61 (9.67–14.74) |
| Turkmenistan | 0.67 | 396 (366–429) | 10.95 (10.19–11.81) | 550 (436–698) | 12.05 (9.6–15.28) | 0.10 (–0.12–0.39) | 176 (156–198) | 9.99 (8.91–11.13) |
| Uzbekistan | 0.631 | 1020 (947–1097) | 6.21 (5.74–6.68) | 1731 (1429–2084) | 7.42 (6.07–8.77) | 0.20 (–0.01–0.42) | 449 (398–496) | 5.53 (4.86–6.13) |
| Vietnam | 0.617 | 29,405 (21,578–35,904) | 37.74 (29.3–45.44) | 36,453 (26,526–47,439) | 36.32 (27.08–46.92) | –0.04 (–0.24–0.19) | 11,205 (7248–13,888) | 32.11 (22.22–39.16) |
| Low-middle SDI | | | | | | | | |
| Bangladesh | 0.483 | 16,099 (12,379–21,148) | 14.80 (11.58–18.99) | 19,906 (14,232–28,069) | 13.76 (9.9–19.08) | –0.07 (–0.26–0.17) | 5910 (4191–8019) | 10.88 (7.75–14.48) |
| Bhutan | 0.455 | 94 (69–127) | 17.67 (13.31–23.85) | 114 (80–164) | 17.99 (12.9–25.45) | 0.02 (–0.18–0.24) | 35 (22–50) | 12.72 (8.11–18.33) |
| Cambodia | 0.469 | 3012 (1944–3906) | 31.56 (20.61–40.45) | 4174 (2685–5483) | 32.50 (20.95–42.23) | 0.03 (–0.16–0.26) | 768 (565–1022) | 18.40 (13.61–24.1) |
| Democratic People's Republic of Korea | 0.558 | 4392 (3318–5664) | 16.02 (12.3–20.48) | 4718 (3560–6067) | 14.60 (11.06–18.82) | –0.09 (–0.25–0.12) | 1422 (963–2156) | 12.20 (8.51–17.81) |
| India | 0.566 | 173,924 (150,428–192,558) | 17.32 (15.07–19.19) | 217,465 (181,112–254,846) | 17.20 (14.37–20.14) | –0.01 (–0.16–0.15) | 63,503 (54,426–73,117) | 12.94 (10.99–14.85) |
| Kyrgyzstan | 0.596 | 458 (420–495) | 11.29 (10.29–12.2) | 537 (454–637) | 10.56 (8.99–12.44) | –0.06 (–0.21–0.09) | 134 (119–150) | 6.99 (6.23–7.87) |
| Lao People's Democratic Republic | 0.49 | 1116 (710–1473) | 29.39 (18.88–38.16) | 1367 (882–1838) | 27.73 (18.23–36.56) | –0.06 (–0.23–0.16) | 324 (221–435) | 17.16 (11.9–22.75) |

| 2019 | | | Female | | 2019 | | | F/M Ratio |
|------------------|-------------------|--------------------|------------------|-------------------|-------------------|-------------------|--------------------|-----------|
| Number | ASR per 1,000,000 | % change 2010-2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010-2019 | |
| 242 | 14.03 | 0.56 | 186 | 8.87 | 336 | 14.62 | 0.65 | 1.04 |
| (198-292) | (11.37-16.82) | (-0.02-0.92) | (168-208) | (8.07-9.83) | (272-405) | (11.95-17.53) | (0.31-0.98) | |
| 518 | 10.48 | 0.04 | 679 | 15.38 | 782 | 14.15 | -0.08 | 1.35 |
| (359-705) | (7.42-13.99) | (-0.21-0.35) | (559-844) | (12.87-19.69) | (573-1048) | (10.57-18.95) | (-0.29-0.17) | |
| 107,110 | 11.64 | -0.02 | 72,146 | 9.21 | 80,208 | 8.11 | -0.12 | 0.70 |
| (81,449-133,260) | (8.91-14.29) | (-0.22-0.2) | (63,840-87,579) | (8.18-11.1) | (64,737-99,491) | (6.55-10.07) | (-0.29-0.08) | |
| 19,316 | 16.95 | 0.06 | 31,565 | 33.10 | 36,043 | 30.02 | -0.09 | 1.77 |
| (14,091-25,688) | (12.47-22.23) | (-0.19-0.36) | (18,835-38,661) | (20.04-40.14) | (22,173-46,237) | (18.54-37.95) | (-0.29-0.17) | |
| 4474 | 11.12 | 0.22 | 4076 | 13.43 | 5995 | 15.19 | 0.13 | 1.37 |
| (3132-5029) | (7.97-12.44) | (0.04-0.34) | (2873-4529) | (9.71-14.89) | (3638-6924) | (9.52-17.42) | (-0.04-0.25) | |
| 2309 | 17.24 | 0.22 | 2015 | 19.76 | 2981 | 21.12 | 0.07 | 1.23 |
| (1638-3082) | (12.46-22.32) | (-0.08-0.62) | (1466-2686) | (14.52-26.16) | (2047-4097) | (14.96-28.14) | (-0.2-0.41) | |
| 10,064 | 23.88 | 0.08 | 14,734 | 43.41 | 19,470 | 43.37 | 0.00 | 1.82 |
| (7623-13,035) | (18.17-30.75) | (-0.19-0.4) | (12,727-16,763) | (37.67-49.51) | (14,511-25,065) | (32.54-55.48) | (-0.23-0.28) | |
| 312 | 4.51 | 0.08 | 271 | 4.81 | 307 | 4.79 | 0.00 | 1.06 |
| (207-437) | (3.03-6.22) | (-0.22-0.49) | (171-345) | (2.71-6.11) | (175-423) | (2.69-6.52) | (-0.26-0.31) | |
| 5013 | 10.88 | -0.06 | 7717 | 19.40 | 8362 | 15.45 | -0.20 | 1.42 |
| (3508-7664) | (7.71-16.62) | (-0.35-0.33) | (6360-11,494) | (16.1-28.01) | (5898-13,949) | (10.9-25.83) | (-0.44-0.11) | |
| 256 | 11.40 | 0.14 | 220 | 11.70 | 294 | 12.50 | 0.07 | 1.10 |
| (202-331) | (8.99-14.62) | (-0.11-0.46) | (200-244) | (10.71-12.85) | (228-379) | (9.78-16) | (-0.17-0.36) | |
| 763 | 6.77 | 0.22 | 571 | 6.59 | 967 | 7.84 | 0.19 | 1.16 |
| (587-943) | (5.02-8.22) | (-0.02-0.51) | (518-633) | (5.95-7.23) | (789-1175) | (6.48-9.36) | (-0.03-0.44) | |
| 14,687 | 32.14 | 0.00 | 18,200 | 42.51 | 21,766 | 40.08 | -0.06 | 1.25 |
| (9690-19,722) | (22.11-41.97) | (-0.24-0.27) | (12,470-23,011) | (30.34-52.94) | (14,617-29,047) | (27.31-52.85) | (-0.27-0.19) | |
| 7139 | 9.94 | -0.09 | 10,189 | 18.99 | 12,766 | 17.59 | -0.07 | 1.77 |
| (4979-10,641) | (6.96-14.74) | (-0.33-0.2) | (7391-14,873) | (14.11-26.39) | (8454-19,874) | (11.75-27.01) | (-0.3-0.23) | |
| 44 | 13.62 | 0.07 | 59 | 23.24 | 71 | 22.73 | -0.02 | 1.67 |
| (27-68) | (8.4-20.47) | (-0.17-0.36) | (40-83) | (16.44-32.14) | (47-105) | (15.64-32.9) | (-0.23-0.23) | |
| 1106 | 19.68 | 0.07 | 2244 | 41.16 | 3068 | 42.02 | 0.02 | 2.14 |
| (781-1432) | (14.09-25.11) | (-0.17-0.35) | (1323-2999) | (24.34-54.07) | (1719-4212) | (23.89-56.81) | (-0.17-0.3) | |
| 1718 | 11.71 | -0.04 | 2970 | 19.19 | 3000 | 17.28 | -0.10 | 1.47 |
| (1156-2473) | (8.24-16.47) | (-0.22-0.19) | (2128-4096) | (13.64-26.36) | (2145-4158) | (12.25-24.21) | (-0.28-0.15) | |
| 80,375 | 12.97 | 0.00 | 110,421 | 21.73 | 137,090 | 21.41 | -0.01 | 1.65 |
| (64,969-97,045) | (10.48-15.62) | (-0.2-0.25) | (88,326-127,264) | (17.45-25.06) | (104,668-170,556) | (16.41-26.51) | (-0.21-0.21) | |
| 170 | 6.98 | 0.00 | 324 | 14.63 | 367 | 13.31 | -0.09 | 1.91 |
| (139-205) | (5.79-8.35) | (-0.18-0.2) | (288-359) | (13.02-16.21) | (298-443) | (10.95-16) | (-0.25-0.09) | |
| 417 | 17.10 | 0.00 | 792 | 40.77 | 950 | 37.74 | -0.07 | 2.21 |
| (291-556) | (12.12-22.6) | (-0.24-0.31) | (428-1103) | (22.82-55.46) | (527-1334) | (21.37-52.31) | (-0.26-0.17) | |

(Continues)

TABLE 8 (Continued)

| Location | SDI 2019 | Both | | | | | Male | |
|-------------|----------|---------------------------|------------------------|---------------------------|------------------------|-----------------------|---------------------------|------------------------|
| | | 2010 | | 2019 | | % change 1990–2010 | 2010 | |
| | | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | | Number | ASR per 1,000,000 |
| Maldives | 0.562 | 40 (35–45) | 19.02 (16.25–21.59) | 60 (49–74) | 18.32 (14.73–22.41) | –0.04 (–0.22–0.18) | 26 (22–31) | 23.40 (19.72–27.82) |
| Mongolia | 0.606 | 291 (140–369) | 16.73 (6.8–21.52) | 390 (184–526) | 15.02 (6.37–20.31) | –0.10 (–0.3–0.19) | 135 (63–179) | 14.95 (6.38–19.77) |
| Myanmar | 0.521 | 11,022 (7630–14,080) | 27.89 (19.65–35.13) | 12,605 (9186–16,043) | 25.52 (18.89–32.17) | –0.09 (–0.26–0.14) | 3133 (2263–4153) | 17.29 (12.76–22.96) |
| Palestine | 0.588 | 276 (232–315) | 14.37 (12.03–16.38) | 444 (316–548) | 16.59 (11.76–20.3) | 0.15 (–0.11–0.42) | 81 (67–95) | 8.58 (7.03–10.17) |
| Tajikistan | 0.539 | 213 (164–249) | 5.27 (3.57–6.33) | 290 (216–364) | 5.35 (3.53–6.75) | 0.01 (–0.2–0.3) | 103 (73–124) | 5.06 (3.24–6.25) |
| Timor-Leste | 0.514 | 145 (92–195) | 21.13 (13.99–28.48) | 211 (138–286) | 24.23 (15.76–32.56) | 0.15 (–0.08–0.43) | 37 (24–57) | 10.70 (7.09–16.08) |
| Low SDI | | | | | | | | |
| Afghanistan | 0.343 | 3166 (1784–4811) | 24.93 (15.1–37.14) | 4229 (2421–6523) | 24.18 (15.22–35.44) | –0.03 (–0.21–0.22) | 766 (464–1282) | 12.65 (7.56–20.82) |
| Nepal | 0.422 | 3324 (2549–4373) | 16.40 (12.9–21.24) | 4680 (3430–6331) | 18.69 (13.92–25.09) | 0.14 (–0.11–0.4) | 977 (629–1373) | 10.25 (6.67–14.29) |
| Pakistan | 0.449 | 38,327 (31,722–45,824) | 33.09 (27.77–39.04) | 49,409 (39,271–60,858) | 32.29 (26.35–39.3) | –0.02 (–0.22–0.22) | 14,613 (11,327–18,156) | 25.49 (19.77–31.67) |
| Yemen | 0.412 | 1567 (1089–2159) | 13.17 (9.46–17.8) | 2359 (1630–3283) | 14.19 (10.12–19.22) | 0.08 (–0.13–0.32) | 508 (346–757) | 8.37 (5.72–12.42) |

this time trend was determined based on geographic region and SDI and compared with global data. The results showed that from 2010 to 2019, the number of new cases of thyroid cancer increased 1.28 times, the number of deaths increased 1.26 times, and the prevalence of thyroid cancer increased 1.39 times. In contrast, thyroid cancer's DALY increased 1.2 times. Also, from 2010 to 2019, ASIR increased by 5%, ASDR decreased by 6%, ASPR increased by 16%, and Dalys ASR of ThC cancer decreased by 4%.

The results showed that in 2019, more than 54% of ThC cases occurred in Asian countries. In 2019, more than 31.5% of new ThC cases occurred in men, and more than 68.5% of new cases occurred in Asian women. From 2010 to 2019, the number of new cases increased by 1.25 times in women and men by 1.38. In the investigated Asian countries, from 2010 to 2019, ASIR of ThC increased by 5%. This increase was higher in men than in women (5% vs. 3%). In this period, ASIR of ThC increased globally and in Africa, but in America and Europe, it decreased.

According to the results, in 2019, the newest cases of ThC were reported in men and women +85. In the same year, the highest ASIR of ThC was generally observed in high-income Asia-Pacific countries. Also, ASIR of ThC was higher in males than females in Maldives and more elevated in females than males in other countries.

The incidence of thyroid cancer varies significantly based on geographic location, especially in women.¹⁸ The highest incidence is observed in high-income countries such as the Republic of Korea, Canada, Italy, France, Israel, Croatia, Austria, the United States, and some middle-to-high-income countries such as Turkey, Brazil, Costa Rica, and China.^{18,19} It is high in some countries and island regions, including Cyprus, Cape Verde, French Polynesia, New Caledonia, and Puerto Rico.¹⁸ This variation appears to be mainly attributable to geographic differences in access to care and diagnostic procedures, although environmental exposures may also play a role.²⁰

Many exogenous factors are related to the development of thyroid cancer, the most important of which are iodine deficiency and radiation, but other factors may also play a role in the development of this disease, including diet, exposure to endocrine-disrupting chemicals (EDCs) or xenobiotics, or other related influences from volcanic areas.²¹

The best-studied risk factor for differentiated thyroid carcinomas is radiation exposure, which increases the risk of thyroid malignancy from 5% to 50%.^{17,22} Other risk factors include estrogen,²³ smoking,²⁴ diabetes,²⁵ insulin resistance,²⁶ obesity,²⁷ metabolic syndrome,²⁸ insulin resistance,²³ and physical activity.²⁹ In a

| 2019 | | | Female | | 2019 | | | F/M Ratio |
|-----------------|-------------------|--------------------|-----------------|-------------------|-----------------|-------------------|--------------------|-----------|
| Number | ASR per 1,000,000 | % change 2010–2019 | Number | ASR per 1,000,000 | Number | ASR per 1,000,000 | % change 2010–2019 | |
| 43 | 23.34 | 0.00 | 13 | 13.82 | 17 | 12.30 | -0.11 | 0.53 |
| (34–55) | (18.26–29.8) | (-0.22–0.26) | (10–16) | (10.22–16.56) | (13–22) | (9.15–15.31) | (-0.29–0.11) | |
| 189 | 14.26 | -0.05 | 156 | 17.80 | 201 | 15.17 | -0.15 | 1.06 |
| (87–264) | (6.32–19.77) | (-0.31–0.27) | (65–207) | (6.11–23.91) | (86–285) | (5.75–21.36) | (-0.36–0.15) | |
| 3836 | 17.24 | 0.00 | 7889 | 36.58 | 8769 | 32.00 | -0.13 | 1.86 |
| (2815–4998) | (12.72–22.5) | (-0.23–0.31) | (4791–10,399) | (22.61–47.56) | (5710–11,425) | (20.98–41.44) | (-0.32–0.1) | |
| 121 | 9.02 | 0.05 | 194 | 19.22 | 323 | 23.53 | 0.22 | 2.61 |
| (95–148) | (7.11–10.95) | (-0.17–0.31) | (159–232) | (15.58–22.7) | (204–408) | (14.81–29.53) | (-0.13–0.56) | |
| 144 | 5.28 | 0.04 | 110 | 5.46 | 146 | 5.39 | -0.01 | 1.02 |
| (102–185) | (3.37–6.77) | (-0.2–0.37) | (79–131) | (3.31–6.7) | (107–187) | (3.37–6.94) | (-0.24–0.26) | |
| 60 | 13.57 | 0.27 | 107 | 31.74 | 151 | 34.93 | 0.10 | 2.57 |
| (38–85) | (8.88–19.33) | (-0.03–0.67) | (64–150) | (19.19–43.86) | (89–212) | (21.06–48.81) | (-0.14–0.4) | |
| 1110 | 12.90 | 0.02 | 2400 | 36.33 | 3119 | 34.89 | -0.04 | 2.70 |
| (706–1742) | (8.22–19.93) | (-0.21–0.34) | (1081–3947) | (17.9–58.19) | (1471–5216) | (18.18–54.8) | (-0.24–0.22) | |
| 1498 | 13.04 | 0.27 | 2347 | 22.20 | 3182 | 23.57 | 0.06 | 1.81 |
| (918–2188) | (7.97–19.06) | (-0.05–0.64) | (1765–3257) | (17.29–30.19) | (2296–4500) | (17.28–32.79) | (-0.19–0.35) | |
| 19,078 | 25.34 | -0.01 | 23,714 | 41.17 | 30,331 | 39.53 | -0.04 | 1.56 |
| (13,760–25,597) | (18.18–33.71) | (-0.28–0.39) | (17,633–30,706) | (31.77–51.25) | (21,162–42,069) | (28.81–53.19) | (-0.3–0.33) | |
| 752 | 9.04 | 0.08 | 1059 | 18.00 | 1606 | 19.23 | 0.07 | 2.13 |
| (490–1169) | (5.92–14.05) | (-0.18–0.39) | (693–1573) | (12.3–25.24) | (1029–2365) | (12.92–27.26) | (-0.15–0.36) | |

population-based cohort study conducted in Korea, smoking and alcohol were shown to be inversely associated with thyroid cancer, with a significant interaction between these variables.³⁰

The results showed that in 2019, more than 59% of ThC deaths occurred in Asian countries. The number of ThC deaths in 2019 increased by 1.26 times, but the ASDR of ThC decreased by 6%. From 2010 to 2019, the number of deaths in men increased by 1.29 times and women by 1.24 times. In the investigated Asian countries, from 2010 to 2019, the ASDR of ThC decreased by 6%. This decrease was more significant in women than men (8% vs. 2%). ThCs ASDR declined in America, Europe, and globally during this period, while it has been stable in Africa. Death from thyroid cancer is related to age, gender, and stage of the disease. Age is an important risk factor for death.³¹ According to the results of this study, most cases of ThC death were reported in women and men aged 85 and older. Also, in most age groups, death cases of ThC were higher in women than in men. Males have been shown to have more prolonged survival than females.³¹ Also, in most studies, age has been reported as one of the most critical and influential risk factors for disease survival in ThC patients.³² It should be noted that the 5-year survival rate of ThC is generally 98.1%.³³ Fortunately, the 5-year survival of ThC is high, so if the prevalence of thyroid cancer is high, it can be due to the increase in new cases or the high survival rate of thyroid cancer.

From 2010 to 2019, according to the results, the number of cases living with ThC increased by 1.3 times. In 2019, more than 53% of ThC prevalence occurred in Asian countries. The number of patients who lived with ThC has risen 1.39 times in men and 1.25 times in women. Also, the ASPR of ThC increased by 8% in the period under review. ASPR of ThC increased in Asian men and women from 2010 to 2019, but this increase was more tremendous in men than in women, with a 16% increase in men and a 5% increase in women. ThC ASDR increased globally and in Africa during this period, but this amount decreased in America and Europe. The highest age-specific prevalence of cases of ThC were reported in men aged 55 to 59 and women aged 60 to 64. Also, in all age groups, the prevalence of cases of ThC was higher in women than in men.

In this review, ThC DALYs were also evaluated. The results showed that ThC DALYs increased 1.2 times from 2010 to 2019. Also, in 2019, about 61% of ThC DALYs occurred in Asian countries. During this period, Dalys ASR of ThC decreased by 4%. DALY ASR of ThC decreased in men and women, although this reduction was greater in women than in men, so it decreased by 6% in women and 2% in men. This amount decreased globally and in Europe, while it increased in America and Africa. Also, DALY cases of ThC in most age groups (except 80–84 years old and 85 years old and above) were more in women than in men.

The relationships between gender, obesity, and ThC have been widely investigated.³⁴ Worldwide, obesity and ThC are more common in women than men.^{23,35} The results of a meta-analysis showed that obesity is associated with ThC.³⁶ It has also been shown that the body mass index is higher in women than men.³⁷⁻⁴⁰ On the other hand, hyperinsulinemia, as a result of insulin resistance, is associated with obesity and has been suggested as a link between obesity and cancer development.⁴¹⁻⁴³ The prevalence of diabetes is also higher in women than in men.³⁷⁻⁴⁰ Therefore, it can be said that obesity and diabetes are related to the higher prevalence of ThC in women.

In this study, also we have conducted further analysis, specifically focusing on the differentiation between the elderly and non-elderly groups. The results showed that 48.13% of new cases of ThC was in elderly aged ≥ 70 years in Asia. Also, 55.61% of ThC deaths, 40.24% of ThC patients, and 55.87% of the burden caused by ThC were recorded in the elderly aged ≥ 70 years in Asia. It should be noted that ThC is the only malignancy in which age increase is considered a prognostic indicator in the majority of staging systems.⁴⁴ Although the mortality rate starts to climb at age 45, the rate of recurrence is even higher starting at age 60.⁴⁴

A higher cancer recurrence rate has been demonstrated in children and young adults aged over 20, but with a better survival rate over the evaluable time period.⁴⁵ In another study, it was found that participants who were 70 years or older were more likely to die from thyroid cancer and that the proportion of death increased by years.⁴⁶ The decrease in death among other age groups may be due to improved treatment and aging of the population.⁴⁷

The responsiveness to radioactive iodine (RAI) is related to better survival in young individuals.^{48,49} According to another study, the 5-year survival rate for younger, older, and super-elders was 90.3%, 76.8%, and 57.8%, respectively.⁵⁰ Alternatively, elderly patients have a tendency to present at advanced stages and have more aggressive histology.⁵¹ So, ThC death in this age group is higher than other groups.

Age is associated with changes in thyroid physiology, including a rise in thyroid-stimulating hormone (TSH) and a drop in the rate of thyrocyte proliferation. Aging has a negative impact on both normal thyroid tissue and thyroid cancer, and those older than 45 have a worse prognosis.⁵²

Again, ThC stands out from other malignancies in that age is a significant predictor in most staging systems. Preventing premature death is greatly assisted by early detection and screening.

It should be considered that timely interventions are necessary to prevent ThC, especially in women and people at risk. On the other hand, the effect of ThC screening should be considered. However, there are no direct studies on whether screening causes overdiagnosis; ecological and cross-sectional data suggest that ThC screening leads to an increase in disease incidence without a change in mortality.⁵³ The conclusion of a systematic review in the United States showed that the incidence of ThC is increasing over time without changing the mortality rate.⁵⁴ Finally, it should be kept in mind that

although the survival of ThC is high, ThC is the most common endocrine cancer in the world, leading to a significant burden of this disease.

5 | CONCLUSION

More than half of the burden of ThC is imposed on the residents of the Asian continent. Although the incidence and prevalence of this cancer in Asian countries is lower than that of the world, America, and Europe, the highest rate of death from ThC occurs in Asia and they witness the highest burden of the disease. Therefore, it seems that implementing early detection strategies and increasing access to treatment facilities in Asia is one of the necessities of ThC control in its residents.

6 | LIMITATION

Given the difficulties of using online databases, including the quality of data reported by low-income countries, the results of this study should be interpreted with caution.

AUTHOR CONTRIBUTIONS

AM, HS, FR, and LA designed and conceived the study. AM and ZP collected the data. LA, AM, HS, and ZP analyzed the data. AM, SD, FR, LA, and ZP drafted the manuscript. HS and AM provided administrative support. FR and AM provided oversight. All authors contributed to the article and approved the submitted version.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data presented in this study are available on request from the corresponding author.

ETHICS STATEMENT

The study was approved by the ethics committee of the Jahrom University of Medical Sciences (ethics committee approval code IR.JUMS.REC.1401.094). As we used routinely collected anonymized electronic data, patient consent was not required. All procedures were performed by the relevant guidelines and regulations.

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REFERENCES

- Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2018;68(6):394-424.
- Pellegriti G, Frasca F, Regalbuto C, Squatrito S, Vigneri R. Worldwide increasing incidence of thyroid cancer: update on epidemiology and risk factors. *J Cancer Epidemiol*. 2013;2013:1-10.
- Fitzmaurice C, Dicker D, Pain A, et al. The global burden of cancer 2013. *JAMA Oncol*. 2015;1(4):505-527.
- Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin*. 2021;71(3):209-249.
- Bonnefond S, Davies TF. Thyroid cancer—risks and causes. *Oncol Hematol Rev*. 2014;10:144-151.
- Horvatic Herceg G, Herceg D, Kralik M, et al. Urokinase plasminogen activator and its inhibitor type-1 as prognostic factors in differentiated thyroid carcinoma patients. *Otolaryngol Head Neck Surg*. 2013;149(4):533-540.
- Kitahara CM, Sosa JA. The changing incidence of thyroid cancer. *Nat Rev Endocrinol*. 2016;12(11):646-653.
- Hiasa Y, Kitahori Y, Kitamura M, et al. Relationships between serum thyroid stimulating hormone levels and development of thyroid tumors in rats treated with N-bis-(2-hydroxypropyl) nitrosamine. *Carcinogenesis*. 1991;12(5):873-877.
- Cherrat L, Espina L, Bakkali M, García-Gonzalo D, Pagán R, Laglaoui A. Chemical composition and antioxidant properties of *Laurus nobilis* L. and *Myrtus communis* L. essential oils from Morocco and evaluation of their antimicrobial activity acting alone or in combined processes for food preservation. *J Sci Food Agric*. 2014;94(6):1197-1204.
- Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet*. 2008;371(9612):569-578.
- Choi WJ, Kim J. Dietary factors and the risk of thyroid cancer: a review. *Clin Nutr Res*. 2014;3(2):75-88.
- La Vecchia C, Malvezzi M, Bosetti C, et al. Thyroid cancer mortality and incidence: a global overview. *Int J Cancer*. 2015;136(9):2187-2195.
- Allahqoli L, Mazidimoradi A, Momenimovahed Z, et al. The global incidence, mortality, and burden of breast cancer in 2019: correlation with smoking, drinking, and drug use. *Front Oncol*. 2022;12:921015.
- Momenimovahed Z, Mazidimoradi A, Amiri S, Nooraie Z, Allahgholi L, Salehiniya H. Temporal trends of cervical cancer between 1990 and 2019, in Asian countries by geographical region and socio-demographic index, and comparison with global data. *Oncologie*. 2023;25(2):119-148.
- Momenimovahed Z, Mazidimoradi A, Banakar N, Allahqoli L, Salehiniya H. Temporal trends of ovarian cancer between 1990 and 2019, in Asian countries by geographical region and SDI, comparison with global data. *Indian J Gynecol Oncol*. 2023;21(2):38.
- Rezaei F, Mazidimoradi A, Rayatinejad A, Allahqoli L, Salehiniya H. Temporal trends of tracheal, bronchus, and lung cancer between 2010 and 2019, in Asian countries by geographical region and sociodemographic index, comparison with global data. *Thorac Cancer*. 2023;14:1668-1706.
- Mazidimoradi A, Ghavidel F, Momenimovahed Z, Allahqoli L, Salehiniya H. Global incidence, mortality, and burden of esophageal cancer, and its correlation with SDI, metabolic risks, fasting plasma glucose, LDL cholesterol, and body mass index: An ecological study. *Health Sci Rep*. 2023;6(6):e1342.
- Ferlay J, Ervik M, Lam F, et al. *Global Cancer Observatory: Cancer Today*. International Agency for Research on Cancer; 2018.
- Lortet-Tieulent J, Franceschi S, Dal Maso L, Vaccarella S. Thyroid cancer “epidemic” also occurs in low-and middle-income countries. *Int J Cancer*. 2019;144(9):2082-2087.
- Pizzato M, Li M, Vignat J, et al. The epidemiological landscape of thyroid cancer worldwide: GLOBOCAN estimates for incidence and mortality rates in 2020. *Lancet Diabetes Endocrinol*. 2022;10(4):264-272.
- Nettore IC, Colao A, Macchia PE. Nutritional and environmental factors in thyroid carcinogenesis. *Int J Environ Res Public Health*. 2018;15(8):1735.
- Iglesias ML, Schmidt A, Ghuzlan AA, et al. Radiation exposure and thyroid cancer: a review. *Arch Endocrinol Metab*. 2017;61:180-187.
- Derwahl M, Nicula D. Estrogen and its role in thyroid cancer. *Endocr Relat Cancer*. 2014;21(5):T273-T283.
- Cho YA, Kim J. Thyroid cancer risk and smoking status: a meta-analysis. *Cancer Causes Control*. 2014;25:1187-1195.
- Yeo Y, Ma S-H, Hwang Y, et al. Diabetes mellitus and risk of thyroid cancer: a meta-analysis. *PLoS One*. 2014;9(6):e98135.
- Xu N, Liu H, Wang Y, Xue Y. Relationship between insulin resistance and thyroid cancer in Chinese euthyroid subjects without conditions affecting insulin resistance. *BMC Endocr Disord*. 2022;22(1):58.
- Burrage LC, McLeod DS, Jordan SJ. Obesity and thyroid cancer risk. *Curr Opin Endocrinol Diabetes Obes*. 2023;30(5):244-251.
- Park JH, Cho HS, Yoon JH. Thyroid cancer in patients with metabolic syndrome or its components: a nationwide population-based cohort study. *Cancer*. 2022;14(17):4106.
- Bui AQ, Gunathilake M, Lee J, Lee EK, Kim J. Relationship between physical activity levels and thyroid cancer risk: a prospective cohort study in Korea. *Thyroid*. 2022;32(11):1402-1410.
- Yeo Y, Shin DW, Han K, et al. Smoking, alcohol consumption, and the risk of thyroid cancer: a population-based Korean cohort study of 10 million people. *Thyroid*. 2022;32(4):440-448.
- Amri A, Soltanian AR, Borzouei S. Survival rates and prognostic factors of thyroid cancer: a retrospective cohort study. *J Parathyroid Dis*. 2022;10(1):e11162.
- Kaliszewski K, Diakowska D, Nowak Ł, Wojtczak B, Rudnicki J. The age threshold of the 8th edition AJCC classification is useful for indicating patients with aggressive papillary thyroid cancer in clinical practice. *BMC Cancer*. 2020;20(1):1-11.
- Bibbins-Domingo K, Grossman DC, Curry SJ, et al. Screening for thyroid cancer: US preventive services task force recommendation statement. *JAMA*. 2017;317(18):1882-1887.
- Pappa T, Alevizaki M. Obesity and thyroid cancer: a clinical update. *Thyroid*. 2014;24(2):190-199.
- Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. *Endocr Rev*. 2016;37(3):278-316.
- Ma J, Huang M, Wang L, Ye W, Tong Y, Wang H. Obesity and risk of thyroid cancer: evidence from a meta-analysis of 21 observational studies. *Med Sci Monit*. 2015;21:283-291.
- Rezaei F, Seif M, Gandomkar A, Fattahi MR, Hasanzadeh J. Agreement between laboratory-based and non-laboratory-based Framingham risk score in southern Iran. *Sci Rep*. 2021;11(1):10767.
- Rezaei F, Seif M, Gandomkar A, et al. Comparison of laboratory-based and non-laboratory-based WHO cardiovascular disease risk charts: a population-based study. *J Transl Med*. 2022;20(1):1-9.
- Jahangiry L, Dehghan A, Farjam M, Aune D, Rezaei F. Laboratory-based and office-based Globorisk scores to predict 10-year risk of cardiovascular diseases among Iranians: results from the Fasa PERSIAN cohort. *BMC Med Res Methodol*. 2022;22(1):305.
- Dehghan A, Rayatinejad A, Khezri R, Aune D, Rezaei F. Laboratory-based versus non-laboratory-based World Health Organization risk equations for assessment of cardiovascular disease risk. *BMC Med Res Methodol*. 2023;23(1):1-12.

41. Noto H, Tsujimoto T, Sasazuki T, Noda M. Significantly increased risk of cancer in patients with diabetes mellitus: a systematic review and meta-analysis. *Endocr Pract.* 2011;17(4):616-628.
42. Garofalo C, Surmacz E. Leptin and cancer. *J Cell Physiol.* 2006;207(1):12-22.
43. Van Den Brandt PA, Spiegelman D, Yaun S-S, et al. Pooled analysis of prospective cohort studies on height, weight, and breast cancer risk. *Am J Epidemiol.* 2000;152(6):514-527.
44. Edge SB, Byrd D, Compton C, Fritz A, Greene F, Trotti A. American joint committee on Cancer cancer staging manual. *Ann Surg Oncol.* 2010;17:1471-1474.
45. Miccoli P, Minuto MN, Ugolini C, et al. Papillary thyroid cancer: pathological parameters as prognostic factors in different classes of age. *Otolaryngol Head Neck Surg.* 2008;138(2):200-203.
46. Deng Y, Li H, Wang M, et al. Global burden of thyroid cancer from 1990 to 2017. *JAMA Netw Open.* 2020;3(6):e208759-e.
47. Lee R, Mason A, Members of the NTA Network. Is low fertility really a problem? Population aging, dependency, and consumption. *Science.* 2014;346(6206):229-234.
48. Ronga G, Filesi M, Montesano T, et al. Lung metastases from differentiated thyroid carcinoma. *QJ Nucl Med Mol Imaging.* 2004;48:12-19.
49. Jarzab B, Handkiewicz-Junak D, Włoch J. Juvenile differentiated thyroid carcinoma and the role of radioiodine in its treatment: a qualitative review. *Endocr Relat Cancer.* 2005;12(4):773-803.
50. Sahli ZT, Canner JK, Zeiger MA, Mathur A. Association between age and disease specific mortality in medullary thyroid cancer. *Am J Surg.* 2021;221(2):478-484.
51. Biliotti G, Martini F, Vezzosi V, et al. Specific features of differentiated thyroid carcinoma in patients over 70 years of age. *J Surg Oncol.* 2006;93(3):194-198.
52. Haymart MR. Understanding the relationship between age and thyroid cancer. *Oncologist.* 2009;14(3):216-221.
53. Lin JS, Bowles EJA, Williams SB, Morrison CC. Screening for thyroid cancer: updated evidence report and systematic review for the US preventive services task force. *JAMA.* 2017;317(18):1888-1903.
54. Lin JS, Aiello Bowles EJ, Williams SB, Morrison CC. *Screening for Thyroid Cancer: A Systematic Evidence Review for the US Preventive Services Task Force.* Agency for Healthcare Research and Quality; 2017.

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