

Chapter 15

New Malignancies Following Cancer of the Thyroid and Other Endocrine Glands

Cécile M. Ronckers, Peter McCarron, Eric A. Engels, Elaine Ron

Synopsis

The risk of subsequent primary cancers was evaluated in 31,230 survivors of cancers of the thyroid and other endocrine glands, diagnosed between 1973 and 2000. We found an 11% increased risk of subsequent cancers among 29,456 survivors of thyroid cancer ($O/E=1.11$, $O=2,214$, $EAR=8$ per 10,000 person-years). For up to 15 years after initial diagnosis, thyroid cancer patients were at increased risk of developing a subsequent thyroid cancer as well as a variety of other malignancies—including cancers of the salivary glands, trachea, female breast, prostate, scrotum, kidney parenchyma, adrenal glands, brain and central nervous system, and hematopoietic malignancies. Although some new cancers (e.g., leukemia) may be associated with radiotherapy, the pattern for others suggests the role of increased medical surveillance, shared risk factors, and/or genetic susceptibility. The overall risk of subsequent malignancy in 811 survivors of adrenal gland cancer (excluding neuroblastoma) was increased almost 2-fold ($O/E=1.76$, $O=57$, $EAR=71$), with excesses observed for cancers of the lung, prostate, and bladder. Also seen was a pronounced excess of subsequent cancers that are characteristic of Li-Fraumeni syndrome among young patients with adrenal carcinoma. Following pheochromocytoma, only kidney cancer risk was elevated, with no overall increase in cancer risk. Among 963 survivors of thymus cancer, the overall risk of subsequent malignancy was elevated ($O/E=1.53$, $O=91$, $EAR=60$), with increased risks observed for cancers of the salivary glands and digestive system, soft tissue sarcoma, and non-Hodgkin lymphoma. The latter may have been related to altered immunity associated with thymoma or to misclassified thymoma.

Thyroid Cancer

Currently, thyroid cancer accounts for 1.9% of the estimated new cancer cases in the U.S., with rates increasing in recent decades (Howe et al, 2001; Jemal et al, 2005). Three in 4 patients are female, 83% are white, 5% are black, and 9% are of Asian descent. Most thyroid malignancies are papillary (78%) or follicular (15%) adenocarcinomas. The median age at thyroid cancer

diagnosis in our survey was 43.3 years, which is young compared with other malignancies, but age at diagnosis varies by histology. Treatment for differentiated thyroid cancer typically consists of surgery followed by iodine-131 (^{131}I) ablation and sometimes includes subsequent external beam radiotherapy (Gimm, 2001). According to a 1996 survey, more than 50% of U.S. patients with differentiated thyroid cancer received treatment with ^{131}I , whereas more than 70% of the relatively few patients with undifferentiated (primarily anaplastic) thyroid cancer received external beam radiotherapy (Hundahl et al, 2000). The overall 5- and 10-year relative survival rates are both close to 95%, although anaplastic thyroid cancer is among the most aggressive and fatal cancers, with a median survival of less than 6 months (Gimm, 2001).

Childhood radiation exposure to the head and neck area is a well-established risk factor for both papillary thyroid cancer and, to a lesser extent, follicular thyroid cancer (Ron et al, 1995). A history of benign thyroid nodules is associated with increased risk of papillary and follicular thyroid cancer (Franceschi et al, 1999). In women, there are weak associations with late menarche, late age at first birth (Negri et al, 1999), and oral contraceptive use (LaVecchia et al, 1999). Smoking is associated with a decreased risk (Mack et al, 2003). Papillary thyroid cancer has been associated with specific rearrangements of the *RET* proto-oncogene (Segev et al, 2003). Familial occurrences of non-medullary thyroid cancer have been described, although the role of genetic predisposition is unclear except for a few genetic syndromes, such as Cowden disease and familial adenomatous polyposis (Eng, 2000a).

Sparsely available epidemiologic data suggest that medullary thyroid cancer is associated with prior medical conditions such as thyroid nodules, hypertension, gallbladder disease, and allergies (Negri et al, 2002). Approximately 20% of medullary thyroid cancers show a familial tendency as part of the genetic syndrome

Abbreviations: O=observed number of subsequent (2nd, 3rd, etc.) primary cancers; O/E=ratio of observed to expected cancers; CI=confidence interval; PYR=person-years at risk; EAR=excess absolute risk (excess cancers per 10,000 person-years, calculated as $[(O-E)/PYR] \times 10,000$).

Author affiliations: Cécile M. Ronckers, Eric A. Engels, Elaine Ron, Division of Cancer Epidemiology and Genetics, NCI, NIH, DHHS; Peter McCarron, Division of Cancer Control and Population Sciences, NCI, NIH, DHHS. Present address for Dr. McCarron: Department of Epidemiology and Public Health, Queen's University Belfast, Royal Victoria Hospital, Belfast, United Kingdom. Dr. McCarron is supported by a career scientist award funded by the Research and Development Office for Health and Personal Social Services in Northern Ireland. Present address for Dr. Ronckers: Department of Pediatric Oncology, Academic Medical Center/Emma Children's Hospital, Amsterdam, The Netherlands.

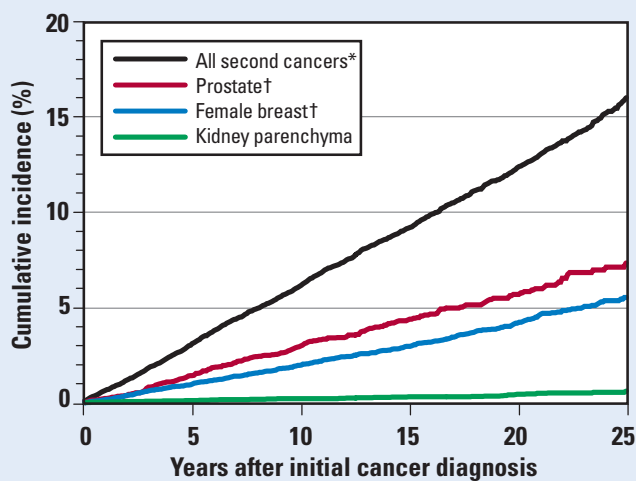
multiple endocrine neoplasia (MEN) type 2, caused by germline mutations of *RET* (Eng, 2000b).

Results and Discussion

Of 29,456 thyroid cancer patients surviving 2 months or more, 95% were treated with surgery, and slightly more than one-third received radiotherapy. We observed a small overall increased risk of subsequent cancers (O/E=1.11, O=2,214, 95% CI=1.06-1.15, EAR=8 per 10,000 person-years). The cumulative incidence of developing any second cancer following thyroid cancer, adjusted for the competing risk of death from other causes, was 15.9% at 25 years (95% CI=15.0%-16.8%) (Figure 15.1). Risk varied by time since thyroid cancer diagnosis, with the highest risk (26%) seen in the first year, mainly for subsequent thyroid and stomach cancers. Increased medical surveillance may explain the elevated risks in the early years but not the persistent elevation throughout the follow-up period. Patients younger than 40 years of age at thyroid cancer diagnosis had a 39% increased risk of subsequent cancer, whereas the average increase was only 6% among thyroid patients 40 years or older (Figure 15.2). The relative risk for all malignancies combined was similar for males and females, but the excess absolute risk was 12 for males and 6 for females. There were no major differences in risk by race. The overall risks of subsequent cancer following papillary and follicular thyroid cancer were similar, whereas no increased risk was observed following medullary thyroid cancer. A total of 50 patients developed a new primary thyroid cancer according to the SEER registry coding definitions. In clinical practice, however, the majority of these new cases would be considered recurrences, except for the 5 cases that had clearly different histologies for the first and subsequent thyroid malignancies. Thus the risk estimate for subsequent thyroid cancer was likely inflated due to misdiagnosis of recurrent cancers as new primary cancers. When we repeated our analyses of subsequent cancer risk excluding all individuals with a second thyroid cancer, the overall result was similar (O/E=1.10).

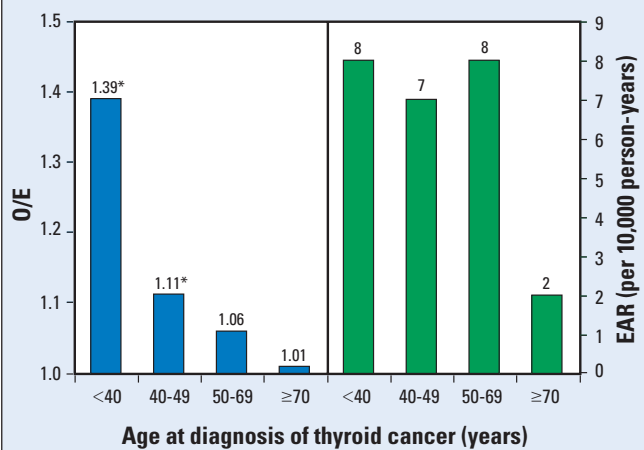
Breast cancer accounted for 36% of all cancers following thyroid cancer in females and constituted the highest absolute excess risk among women (EAR=4). The significantly elevated risk (O/E=1.21) was in agreement with some studies (Vassilopoulou-Sellin et al, 1999; Simon et al, 2002; Adjadj et al, 2003), but not all (Hall et al, 1990; Hemminki and Jiang, 2001; Sadetzki et al, 2003). Risk was elevated throughout the follow-up period, but it was most pronounced 1 to 5 years following thyroid cancer diagnosis. The reciprocal risk of thyroid cancer among breast cancer survivors was elevated 30%. The 1.4-fold increase in risk of developing breast cancer among women who were less than 40 years of age at thyroid cancer diagnosis suggests an influence of hormonal or genetic factors or both. This mechanism would be consistent with the elevated risk of endocrine-dependent cancers reported among first-degree relatives of patients with non-medullary thyroid cancer (Pal et al, 2001). Although Cowden disease features both breast

Figure 15.1: Cumulative incidence of developing a second cancer among patients with cancer of the thyroid, both sexes, SEER 1973-2000.



* Cumulative incidence for all second cancers at 25 years is 20.3% for males and 14.2% for females.
 † Prostate and female breast cancer curves are based on male and female thyroid cancer patients, respectively.

Figure 15.2: Observed-to-expected ratio (O/E) and excess absolute risk (EAR) of subsequent primary cancers after thyroid cancer, both sexes, SEER 1973-2000.



*P <0.05.
 Notes: EAR = Excess number of subsequent cancers per 10,000 person-years. Observed number of subsequent cancers are 397, 423, 1,084 and 310, for age groups <40, 40-49, 50-69 and ≥70 years, respectively.

and follicular thyroid cancer (Eng, 2000b), the excess risk of subsequent breast cancer was similar following papillary or follicular thyroid cancer in our survey.

Among males, the highest absolute risk following thyroid cancer was observed for prostate cancer (EAR=9). The excess risk was restricted to the first 10 years after diagnosis of papillary thyroid cancer, which may reflect increased surveillance and detection of otherwise indolent prostate tumors. An increased risk of thyroid cancer following prostate cancer was also observed; however, the elevation in risk was concentrated in the first year following prostate cancer diagnosis.

In agreement with 2 other large studies (Hemminki and Jiang, 2001; Rubino et al, 2003), we found a more-than-2-fold increase in risk for kidney parenchyma cancer following papillary and follicular thyroid cancer. In addition, consistent with the findings of Hall et al (1990), we noted a 2-fold increase in risk of renal pelvis cancer, which appeared to be higher in males and in those with follicular thyroid cancer. Survivors of kidney parenchyma cancer had an almost 3-fold increased risk of thyroid cancer. The mechanisms underlying the complex of thyroid and kidney cancers are unclear but may reflect a heritable cancer syndrome, such as that described for the combination of papillary thyroid cancer and papillary renal neoplasia (Eng, 2000b). In our series, we could not evaluate risk for the renal papillary histologic type separately, because most of these tumors were registered under the more general category of renal cell carcinoma. On rare occasions, renal cancers may metastasize to the thyroid and may be hard to distinguish from primary thyroid cancer (Heffess et al, 2002).

Unlike most other malignancies, the predominant form of radiotherapy for thyroid cancer consists of ^{131}I treatment rather than external beam radiation. Information on type of radiotherapy has been reported in SEER since 1988. Of 17,055 thyroid cancer patients diagnosed between 1988 and 2000, 6,745 (40%) were treated with ^{131}I , 614 (4%) with beam radiation, and 185 (1%) with a combination of modalities, which suggests underreporting of ^{131}I treatment. The thyroid receives the highest dose of iodine by far, but ^{131}I also concentrates in other organs, such as the salivary glands, stomach, small intestine, and bladder (ICRP, 1987; Ron, 1997). Although the dose to the bone marrow is lower, leukemia has been reported following ^{131}I therapy (Ron, 1997). However, bone marrow is known to be very sensitive to external radiation (Preston et al, 1994). Following ^{131}I treatment, we found increased risks of stomach cancer (O/E=2.41, O=8) and non-chronic lymphocytic leukemia (O/E=3.69, O=11). For the combined group of non-chronic lymphocytic leukemia and cancers of the salivary glands, stomach, small intestine, and bladder, we found an almost 2-fold increased risk among patients treated with ^{131}I (O/E=1.92, O=29). A pooled study of 4,225 European patients with thyroid cancer treated with ^{131}I also showed increased risks for leukemia and salivary gland malignancies (Rubino et al, 2003).

The lower-than-expected rates of lung and bronchus carcinoma in survivors of thyroid cancer compared to the general U.S. population may reflect a low prevalence of smoking among thyroid cancer patients relative to the general population. Thyroid cancer is one of the few cancers reported to be inversely associated with smoking (Mack et al, 2003). Decreased O/E ratios were observed for most other smoking-related cancers, including cancers of the buccal cavity (excluding the salivary glands), larynx, esophagus, pancreas, cervix, and bladder, although not all risks were statistically significant. In contrast, based on 5 cases, a 14-fold increased risk of tracheal cancer was observed, possibly related to diag-

nostic misclassification of metastatic thyroid cancer presenting as endotracheal nodules (Datta and Lahiri, 2002).

An increased risk of adrenal cancer was seen (O/E=4.72, O=4), in particular following medullary thyroid cancer (O/E=70.42, O=2), consistent with MEN type 2, which features pheochromocytoma in addition to medullary thyroid cancer. In addition, an 8-fold increased risk for scrotal cancer was observed (O/E=11.58, O=3), as well as an increased reciprocal risk, but the reasons are unclear. In addition, female thyroid cancer patients had a 1.6-fold increased risk for brain cancer (O/E=1.64, O=24), although no clear pattern by brain tumor histologic subtype was observed. Finally, salivary gland cancers occurred in excess (O/E=2.78, O=13), but this did not appear to be a radiation effect.

Cancer of the Adrenal Glands

Malignant neoplasms of the adrenal glands are extremely rare and heterogeneous tumors (Correa and Chen, 1995), accounting for less than 0.05% of cancers in the U.S. (We have excluded childhood neuroblastomas, which are discussed elsewhere in this volume.) Adrenal gland cancers occur almost as frequently in men as in women, and the median age at diagnosis is 54.6 years. The most common histologic subtypes for adults are adrenocortical carcinoma and pheochromocytoma, which arises in the medulla. The 5-year relative survival rate is 47.9%. The mainstay of treatment is surgical resection, often supplemented with adjuvant chemotherapy (Kopf et al, 2001).

The etiology of adrenocortical cancers is largely unknown, but there is limited evidence that cigarette smoking and oral contraceptive use increase risk (Hsing et al, 1996). Most cases are sporadic, except for a familial tendency for childhood cases, often arising in combination with other tumors constituting Li-Fraumeni syndrome (Li et al, 1988). Approximately 90% of pheochromocytomas are sporadic tumors, with the remaining 10% arising as a component of the genetic syndrome MEN type 2 (Klingler et al, 2001).

Results and Discussion

Of 811 individuals with adrenal cancer who survived at least 2 months, 81% were diagnosed with carcinomas. Malignant pheochromocytoma occurred in 14%, and the remaining 5% presented with other histologic types. Overall, patients with adrenal gland cancers were at elevated risk of subsequent malignancies (O/E=1.76, O=57, 95% CI=1.33-2.27, EAR=71), with a 2-fold excess for men. The cumulative incidence of any second cancer following adrenal cancer was 8.3% at 15 years (95% CI=6.1%-10.8%). Increased risks were found for lung and bladder cancers for both sexes combined, and for prostate cancers among men. Together these cancers accounted for almost half of the subsequent malignancies. Among women, an elevated risk was observed only for melanoma (O/E=8.10, O=3), but the excess was found only in the first year following adrenal cancer diagnosis.

Analysis by histology highlighted differences in the risk of subsequent primary cancers. Among patients with adrenal carcinoma, there was a 2-fold overall increased risk of subsequent cancer (O/E=2.04, O=48), particularly in the first year after diagnosis. Increased risks were observed for smoking-related cancers, including lung (O/E=2.70) and bladder (O/E=5.50), which is consistent with the association reported between adrenal carcinoma and smoking (Hsing et al, 1996). There also was an elevated risk of prostate cancer (O/E=2.58), especially in the first year, suggesting an effect of increased medical surveillance. Patients younger than 45 years of age at adrenal carcinoma diagnosis had a particularly high risk of subsequent cancer (O/E=5.32, O=10), whereas among those 45 years and older the risk was lower (O/E=1.76, O=38). In particular, young patients had a 10-fold increased risk (O/E=10.89, O=5) for the combined group of tumors characteristic of Li-Fraumeni syndrome, notably adrenocortical cancer, breast cancer, bone and soft tissue sarcoma, brain tumor, and acute leukemia (Nichols et al, 2001).

Following pheochromocytoma, the overall risk of subsequent cancers was not elevated. However, based on only 2 cases, a significant excess risk was found for kidney parenchyma cancer (O/E=12.6), consistent with recent population-based findings (Hemminki and Jiang, 2001) and possibly related to the von Hippel-Lindau syndrome, which genetically predisposes to renal adenocarcinomas as well as pheochromocytoma.

Cancer of the Thymus

The thymus is the site of maturation for T lymphocytes, which play a central role in adaptive immunity. The thymus is large in childhood and begins to atrophy in adolescence, although it maintains some activity throughout life (Douek et al, 1998). Malignant neoplasms of the thymus are rare (0.3 incident cases per 100,000 person-years) and occur slightly more often in men than women (Ries et al, 2004). The median age at diagnosis is 55.3 years. The most common histologic type is thymoma (85% of cases), a tumor of thymic epithelial cells frequently accompanied by a rich infiltrate of T lymphocytes. Although these tumors can be benign, SEER identifies only malignant thymomas (Engels and Pfeiffer, 2003). Carcinoid tumors make up another 4% of thymic malignancies, while no other histologic type constitutes more than 1% of cases. The mainstay of therapy for thymoma is surgery, with radiotherapy often given as adjuvant therapy or given alone when surgical resection is not possible (Hejna et al, 1999). Adjuvant chemotherapy is sometimes administered (Hejna et al, 1999). Overall survival is poor, with a relative 5-year survival rate of only 65.3%. Although the causes of thymic neoplasms are unknown, thymoma is frequently associated with autoimmune diseases, most notably myasthenia gravis and pure red cell aplasia (Müller-Hermelink and Marx, 2000).

Results and Discussion

For 963 individuals surviving at least 2 months with a thymic malignancy, the overall risk of subsequent cancer was significantly elevated (O/E=1.53, O=91, 95% CI=1.23-1.88, EAR=60). Restricting analysis to the 815 patients with thymoma did not change the relative risk (O/E=1.54), which was similar in males and females. The cumulative incidence of any second cancer following thymus cancer was 12.7% at 15 years (95% CI=10.0%-15.7%).

Among all subjects, the risk for non-Hodgkin lymphoma (NHL) was elevated (O/E=4.81, O=10), consistent with previous surveys (Souadjan et al, 1968; Welsh et al, 2000), but a reciprocal relationship (O/E=0.64) was not seen. Altered immune function associated with thymoma may predispose to NHL, or the lymphoma excess may artifactually result from initial misclassification of thymoma (Ritter and Wick, 1999). Although all cases of NHL arose in patients treated with radiotherapy, the relevance of this finding is not clear.

A modest increase in cancers of the digestive tract was noted (O/E=1.84, O=24). However, no specific site entirely accounted for this finding, which also has been suggested in clinical surveys (Souadjan et al, 1968; Welsh et al, 2000; Pan et al, 2001). Risks for cancer of the liver and biliary tract were also increased (O/E=3.73). All 4 cases occurred in males (O/E=5.65), and 3 of them were hepatocellular carcinomas, which have been described previously as a new malignancy following thymoma (Welsh et al, 2000; Pan et al, 2001). Risk of soft tissue sarcoma was also elevated among individuals with thymoma (O/E=9.00), based on 2 cases (malignant fibrous histiocytoma and liposarcoma) at sites distant from the thymus. It is noteworthy that an elevated risk for malignant fibrous histiocytoma following thymoma has been described previously (Masaoka et al, 1994); the increased occurrence is possibly the result of shared susceptibility factors or perhaps chemotherapy (Zahm et al, 1996). Although the overall risk of subsequent cancers was elevated only among the 68% of patients receiving radiotherapy (O/E=1.72), there was no apparent radiotherapy effect for malignancies of tissues receiving substantial radiation doses (bone marrow, lung, and esophagus) (Travis et al, 2003).

References

- Adjad E, Rubino C, Shamsaldim A, et al. 2003. The risk of multiple primary breast and thyroid carcinomas. *Cancer* 98(6):1309-1317.
- Correa P, Chen VW. 1995. Endocrine gland cancer. *Cancer* 75(1 Suppl):338-352.
- Datta D, Lahiri B. 2002. Recurrent thyroid carcinoma presenting as an endotracheal nodule. *Conn Med* 66(10):585-587.
- Douek DC, McFarland RD, Keiser PH, et al. 1998. Changes in thymic function with age and during the treatment of HIV infection. *Nature* 396(6712):690-695.

- Eng C. 2000a. Will the real Cowden syndrome please stand up: revised diagnostic criteria. *J Med Genet* 37(11):828-830.
- Eng C. 2000b. Familial papillary thyroid cancer—many syndromes, too many genes? *J Clin Endocrinol Metab* 85(5):1755-1757.
- Engels EA, Pfeiffer RM. 2003. Malignant thymoma in the United States: demographic patterns in incidence and associations with subsequent malignancies. *Int J Cancer* 105(4):546-551.
- Franceschi S, Preston-Martin S, Dal Maso L, et al. 1999. A pooled analysis of case-control studies of thyroid cancer. IV. Benign thyroid diseases. *Cancer Causes Control* 10(6):583-595.
- Gimm O. 2001. Thyroid cancer. *Cancer Lett* 163(2):143-156.
- Hall P, Holm LE, Lundell G. 1990. Second primary tumors following thyroid cancer. A Swedish record-linkage study. *Acta Oncol* 29(7):869-873.
- Heffess CS, Wenig BM, Thompson LD. 2002. Metastatic renal cell carcinoma to the thyroid gland: a clinicopathologic study of 36 cases. *Cancer* 95(9):1869-1878.
- Hejna M, Haberl I, Raderer M. 1999. Nonsurgical management of malignant thymoma. *Cancer* 85(9):1871-1884.
- Hemminki K, Jiang Y. 2001. Second primary neoplasms after 19281 endocrine gland tumours: aetiological links? *Eur J Cancer* 37(15):1886-1894.
- Howe HL, Wingo PA, Thun MJ, et al. 2001. Annual report to the nation on the status of cancer (1973 through 1998), featuring cancers with recent increasing trends. *J Natl Cancer Inst* 93(11):824-842.
- Hsing AW, Nam JM, Co Chien HT, et al. 1996. Risk factors for adrenal cancer: an exploratory study. *Int J Cancer* 65(4):432-436.
- Hundahl SA, Cady B, Cunningham MP, et al. 2000. Initial results from a prospective cohort study of 5,583 cases of thyroid carcinoma treated in the United States during 1996. U.S. and German Thyroid Cancer Study Group. An American College of Surgeons Commission on Cancer Patient Care Evaluation study. *Cancer* 89(1):202-217.
- International Commission on Radiological Protection (ICRP). 1987. Radiation Dose to Patients from Radiopharmaceuticals. ICRP publication 53. Oxford, Pergamon Press.
- Jemal A, Murray T, Ward E, et al. 2005. Cancer statistics, 2005. *CA Cancer J Clin* 55(1):10-30.
- Klingler HC, Klingler PJ, Martin JK Jr, et al. 2001. Pheochromocytoma. *Urology* 57(6):1025-1032.
- Kopf D, Goretzki PE, Lehnert H. 2001. Clinical management of malignant adrenal tumors. *J Cancer Res Clin Oncol* 127(3):143-155.
- La Vecchia C, Ron E, Franceschi S, et al. 1999. A pooled analysis of case-control studies of thyroid cancer. III. Oral contraceptives, menopausal replacement therapy and other female hormones. *Cancer Causes Control* 10(2):157-166.
- Li FP, Fraumeni JF Jr, Mulvihill JJ, et al. 1988. A cancer family syndrome in twenty-four kindreds. *Cancer Res* 48(18):5358-5362.
- Mack WJ, Preston-Martin S, Dal Maso L, et al. 2003. A pooled analysis of case-control studies of thyroid cancer: cigarette smoking and consumption of alcohol, coffee, and tea. *Cancer Causes Control* 14(8):773-785.
- Masaoka A, Yamakawa Y, Niwa H, et al. 1994. Thymectomy and malignancy. *Eur J Cardiothorac Surg* 8(5):251-253.
- Müller-Hermelink HK, Marx A. 2000. Thymoma. *Curr Opin Oncol* 12(5):426-433.
- Negri E, Dal Maso L, Ron E, et al. 1999. A pooled analysis of case-control studies of thyroid cancer. II. Menstrual and reproductive factors. *Cancer Causes Control* 10(2):143-155.
- Negri E, Ron E, Franceschi S, et al. 2002. Risk factors for medullary thyroid carcinoma: a pooled analysis. *Cancer Causes Control* 13(4):365-372.
- Nichols KE, Malkin D, Garber JE, et al. 2001. Germ-line p53 mutations predispose to a wide spectrum of early-onset cancers. *Cancer Epidemiol Biomarkers Prev* 10(2):83-87.
- Pal T, Vogl FD, Chappuis PO, et al. 2001. Increased risk for nonmedullary thyroid cancer in the first degree relatives of prevalent cases of nonmedullary thyroid cancer: a hospital-based study. *J Clin Endocrinol Metab* 86(11):5307-5312.
- Pan CC, Chen PC, Wang LS, et al. 2001. Thymoma is associated with an increased risk of second malignancy. *Cancer* 92(9):2406-2411.
- Preston DL, Kusumi S, Tomonaga M, et al. 1994. Cancer incidence in atomic bomb survivors. Part III. Leukemia, lymphoma and multiple myeloma, 1950-1987. *Radiat Res* 137(2 Suppl):S68-S97.
- Ries LG, Eisner MP, Kosary CL, et al (eds). 2004. SEER Cancer Statistics Review, 1975-2001. Bethesda, MD, National Cancer Institute. Available at http://seer.cancer.gov/csr/1975_2001/.
- Ritter JH, Wick MR. 1999. Primary carcinomas of the thymus gland. *Semin Diagn Pathol* 16(1):18-31.
- Ron E, Lubin JH, Shore RE, et al. 1995. Thyroid cancer after exposure to external radiation: a pooled analysis of seven studies. *Radiat Res* 141(3):259-277.
- Ron E. 1997. Cancer risk following radioactive iodine-131 exposures in medicine. Proceedings of the National Council on Radiation Protection and Measurements 32nd Annual Meeting, April 3-4, 1996.
- Rubino C, de Vathaire F, Dottorini ME, et al. 2003. Second primary malignancies in thyroid cancer patients. *Br J Cancer* 89(9):1638-1644.
- Sadetzki S, Calderon-Margalit R, Peretz C, et al. 2003. Second primary breast and thyroid cancers (Israel). *Cancer Causes Control* 14(4):367-375.
- Segev DL, Umbricht C, Zeiger MA. 2003. Molecular pathogenesis of thyroid cancer. *Surg Oncol* 12(2):69-90.
- Simon MS, Tang MT, Bernstein L, et al. 2002. Do thyroid disorders increase the risk of breast cancer? *Cancer Epidemiol Biomarkers Prev* 11(12):1574-1578.
- Souadjan JV, Silverstein MN, Titus JL. 1968. Thymoma and cancer. *Cancer* 22(6):1221-1225.

Travis LB, Boice JD Jr, Travis WD. 2003. Second primary cancers after thymoma. *Int J Cancer* 107(5):868-870.

Vassilopoulou-Sellin R, Palmer L, Taylor S, et al. 1999. Incidence of breast carcinoma in women with thyroid carcinoma. *Cancer* 85(3):696-705.

Welsh JS, Wilkins KB, Green R, et al. 2000. Association between thymoma and second neoplasms. *JAMA* 283(9):1142-1143.

Zahm SH, Tucker MA, Fraumeni JF Jr. 1996. Soft tissue sarcomas. *In* Schottenfeld D, Fraumeni JF Jr (eds): *Cancer Epidemiology and Prevention*, 2nd ed. New York, Oxford University Press, pp. 984-999.

Table 15.1.1: Characteristics of patients with an initial cancer of the thyroid, both sexes, SEER 1973-2000.

Characteristics	Males		Females		Total	
	No.	%	No.	%	No.	%
Number of patients with 1st primary cancer						
Total	7,406	100.0	22,050	100.0	29,456	100.0
Initial treatment						
Any radiation	3,196	43.2	8,022	36.4	11,218	38.1
With surgery	3,010	40.6	7,776	35.3	10,786	36.6
Without surgery	186	2.5	246	1.1	432	1.5
No radiation	4,210	56.8	14,028	63.6	18,238	61.9
With surgery	3,945	53.3	13,392	60.7	17,337	58.9
Without surgery	265	3.6	636	2.9	901	3.1
Race						
White	6,364	85.9	18,214	82.6	24,578	83.4
Black	311	4.2	1,225	5.6	1,536	5.2
Other	683	9.2	2,433	11.0	3,116	10.6
Unknown	48	0.6	178	0.8	226	0.8
Age at 1st primary cancer diagnosis, years						
< 30	1,020	13.8	4,601	20.9	5,621	19.1
30–49	3,033	41.0	10,021	45.4	13,054	44.3
50–69	2,574	34.8	5,391	24.4	7,965	27.0
70–79	603	8.1	1,439	6.5	2,042	6.9
≥ 80	176	2.4	598	2.7	774	2.6
Number of patients with one or more primary cancers						
One primary cancer only	6,737	91.0	20,717	94.0	27,454	93.2
1st and 2nd cancers	604	8.2	1,213	5.5	1,817	6.2
1st, 2nd, and 3rd cancers	53	0.7	105	0.5	158	0.5
1st, 2nd, 3rd, and additional cancers	12	0.2	15	0.1	27	0.1
Other statistics						
Median age at 1st cancer diagnosis	47.6	—	42.0	—	43.3	—
Median year of 1st cancer diagnosis	1990.0	—	1990.4	—	1990.3	—
Median person-years at risk	7.4	—	8.0	—	7.9	—
Percent histologically confirmed*						
Both 1st and 2nd cancers	—	97.5	—	98.3	—	98.0
1st, 2nd, and additional cancers	—	96.4	—	98.0	—	97.5
1st cancer only	—	2.1	—	1.2	—	1.5

*Percent histologically confirmed among patients who developed a subsequent primary cancer.

Thyroid Both Sexes

Table 15.1.2: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis													
	<1 year		1-4 years		5-9 years		≥10 years		Total					
	Number starting interval	Person-years in interval	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR		
All subsequent cancers	29,456	23,251	160	1.26*	619	1.17*	590	1.11*	845	1.04	2,214	1,999.67	1.11*	7.64
All excluding same site			141	1.13	611	1.18*	584	1.12*	828	1.03	2,164	1,969.87	1.10*	6.92
Buccal cavity, pharynx			2	0.65	9	0.71	9	0.74	17	0.99	37	45.08	0.82	-0.29
Lip			0	0.00	0	0.00	0	0.00	1	0.60	1	4.50	0.22	-0.12
Tongue			2	3.07	0	0.00	2	0.76	1	0.26	5	9.82	0.51	-0.17
Salivary gland			0	0.00	4	3.09	3	2.41	6	3.29*	13	4.68	2.78*	0.30
Mouth			0	0.00	2	0.58	3	0.90	4	0.85	9	12.34	0.73	-0.12
Nasopharynx			0	0.00	0	0.00	0	0.00	3	3.07	3	2.71	1.11	0.01
Tonsil			0	0.00	1	0.79	0	0.00	1	0.58	2	4.52	0.44	-0.09
Oropharynx			0	0.00	1	3.03	0	0.00	0	0.00	1	1.18	0.84	-0.01
Hypopharynx			0	0.00	1	0.91	1	0.95	1	0.69	3	3.86	0.78	-0.03
Digestive system			30	1.24	97	0.97	104	1.03	143	0.92	374	380.23	0.98	-0.22
Esophagus			2	1.93	2	0.47	2	0.47	3	0.46	9	16.02	0.56	-0.25
Stomach			7	2.91*	11	1.12	13	1.36	12	0.87	43	35.54	1.21	0.27
Small intestine			1	2.61	4	2.49	2	1.22	2	0.74	9	6.34	1.42	0.09
Colon			9	0.84	51	1.14	56	1.24	66	0.94	182	171.05	1.06	0.39
Rectum, rectosigmoid junction			6	1.39	11	0.62	14	0.80	31	1.19	62	65.57	0.95	-0.13
Anus, anal canal			1	3.10	2	1.47	1	0.72	0	0.00	4	5.27	0.76	-0.05
Liver			0	0.00	5	1.40	4	1.11	5	0.85	14	13.91	1.01	0.00
Gallbladder			0	0.00	1	0.60	1	0.60	1	0.40	3	6.24	0.48	-0.12
Bile ducts, other biliary			2	3.86	0	0.00	2	0.89	4	1.06	8	8.71	0.92	-0.03
Pancreas			2	0.69	9	0.75	8	0.65	17	0.88	36	46.59	0.77	-0.38
Respiratory system			17	0.94	66	0.87	64	0.83	109	0.89	256	293.36	0.87*	-1.33
Nose, nasal cavity, ear			0	0.00	0	0.00	0	0.00	3	2.66	3	2.88	1.04	0.00
Larynx			1	0.89	5	1.09	1	0.23	3	0.48	10	16.32	0.61	-0.23
Lung, bronchus			15	0.90	60	0.85	62	0.86	101	0.88	238	273.33	0.87*	-1.26
Female breast			27	1.01	156	1.38*	140	1.21*	207	1.14	530	437.35	1.21*	4.36
Female genital system			12	0.96	43	0.84	53	1.06	57	0.78	165	186.45	0.88	-1.01
Cervix uteri			1	0.41	7	0.72	5	0.58	8	0.79	21	30.99	0.68	-0.47
Corpus uteri			3	0.54	16	0.69	29	1.27	25	0.71	73	86.60	0.84	-0.64
Ovary			5	1.39	18	1.20	17	1.14	15	0.67	55	55.82	0.99	-0.04
Vagina			1	6.76	0	0.00	0	0.00	1	1.07	2	2.30	0.87	-0.01
Vulva			1	2.37	1	0.57	1	0.55	3	1.03	6	6.93	0.87	-0.04
Male genital system			17	1.37	81	1.57*	74	1.42*	97	1.15	269	200.86	1.34*	10.02
Prostate			16	1.34	74	1.48*	74	1.46*	93	1.12	257	195.83	1.31*	9.00
Testis			0	0.00	4	2.98	0	0.00	3	3.09	7	3.73	1.88	0.48
Urinary system			10	1.35	41	1.34	42	1.35	66	1.35*	159	118.15	1.35*	1.46
Urinary bladder			4	0.86	16	0.83	16	0.83	26	0.85	62	73.64	0.84	-0.41
Kidney parenchyma			5	2.19	23	2.40*	21	2.16*	35	2.24*	84	37.22	2.26*	1.67
Renal pelvis, other urinary			1	2.13	2	1.03	5	2.59	5	1.70	13	7.29	1.78	0.20
Ureter			1	6.73	0	0.00	0	0.00	2	2.16	3	2.30	1.31	0.03
Bone, joints			0	0.00	2	2.76	0	0.00	4	4.72*	6	2.40	2.50	0.13
Soft tissue including heart			1	1.59	5	1.96	3	1.23	4	1.12	13	9.20	1.41	0.14
Kaposi sarcoma			1	2.81	0	0.00	0	0.00	0	0.00	1	4.60	0.22	-0.13
Melanoma of skin			8	1.91	25	1.43	19	1.12	26	1.07	78	62.98	1.24	0.54
Eye, orbit			0	0.00	1	1.20	2	2.52	0	0.00	3	2.99	1.00	0.00
Brain, central nervous system			2	1.21	12	1.77	12	1.85	11	1.21	37	24.00	1.54*	0.46
Thyroid			19	8.37*	8	0.88	6	0.74	17	1.65	50	29.80	1.68*	0.72
Lymphatic, hematopoietic			10	1.06	56	1.44*	50	1.29	63	1.05	179	146.86	1.22*	1.15
Hodgkin lymphoma			2	2.69	6	2.12	4	1.74	2	0.80	14	8.36	1.67	0.20
Non-Hodgkin lymphoma			6	1.36	14	0.76	19	1.01	32	1.06	71	71.83	0.99	-0.03
Myeloma			2	1.46	13	2.27*	9	1.55	8	0.86	32	22.21	1.44	0.35
Leukemia			0	0.00	23	1.93*	18	1.53	21	1.18	62	44.45	1.39*	0.63
Acute lymphocytic			0	0.00	0	0.00	4	7.72*	0	0.00	4	1.90	2.10	0.07
Chronic lymphocytic			0	0.00	3	0.73	8	1.93	8	1.24	19	15.71	1.21	0.12
Acute non-lymphocytic			0	0.00	15	3.43*	3	0.70	2	0.30	20	16.31	1.23	0.13
Chronic myeloid			0	0.00	2	1.12	2	1.15	5	1.94	9	6.53	1.38	0.09

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 212,594 PYR and for male cancers on 67,987 PYR.

Table 15.1.3: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, long-term follow-up, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<10 years		10-14 years		15-19 years		≥20 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	1,369	1.16*	417	1.06	256	0.97	172	1.10	2,214	1,999.67	1.11*	7.64
All excluding same site	1,336	1.15*	411	1.06	247	0.94	170	1.10	2,164	1,969.87	1.10*	6.92
Buccal cavity, pharynx	20	0.72	9	1.05	5	0.91	3	0.97	37	45.08	0.82	-0.29
Lip	0	0.00	1	1.21	0	0.00	0	0.00	1	4.50	0.22	-0.12
Tongue	4	0.67	0	0.00	1	0.81	0	0.00	5	9.82	0.51	-0.17
Salivary gland	7	2.45	3	3.34	2	3.42	1	2.92	13	4.68	2.78*	0.30
Mouth	5	0.66	3	1.27	0	0.00	1	1.18	9	12.34	0.73	-0.12
Nasopharynx	0	0.00	1	1.97	1	3.27	1	6.15	3	2.71	1.11	0.01
Tonsil	1	0.36	0	0.00	1	1.79	0	0.00	2	4.52	0.44	-0.09
Oropharynx	1	1.37	0	0.00	0	0.00	0	0.00	1	1.18	0.84	-0.01
Hypopharynx	2	0.83	1	1.36	0	0.00	0	0.00	3	3.86	0.78	-0.03
Digestive system	231	1.03	77	1.03	37	0.74	29	0.95	374	380.23	0.98	-0.22
Esophagus	6	0.63	2	0.64	0	0.00	1	0.77	9	16.02	0.56	-0.25
Stomach	31	1.42	8	1.17	1	0.23	3	1.16	43	35.54	1.21	0.27
Small intestine	7	1.92	1	0.79	0	0.00	1	1.80	9	6.34	1.42	0.09
Colon	116	1.15	30	0.89	22	0.97	14	1.01	182	171.05	1.06	0.39
Rectum, rectosigmoid junction	31	0.78	18	1.41	8	0.96	5	1.01	62	65.57	0.95	-0.13
Anus, anal canal	4	1.30	0	0.00	0	0.00	0	0.00	4	5.27	0.76	-0.05
Liver	9	1.12	5	1.82	0	0.00	0	0.00	14	13.91	1.01	0.00
Gallbladder	2	0.53	0	0.00	1	1.25	0	0.00	3	6.24	0.48	-0.12
Bile ducts, other biliary	4	0.81	2	1.14	1	0.81	1	1.27	8	8.71	0.92	-0.03
Pancreas	19	0.70	10	1.09	3	0.48	4	1.03	36	46.59	0.77	-0.38
Respiratory system	147	0.86	53	0.91	31	0.78	25	1.03	256	293.36	0.87*	-1.33
Nose, nasal cavity, ear	0	0.00	3	5.34*	0	0.00	0	0.00	3	2.88	1.04	0.00
Larynx	7	0.69	0	0.00	1	0.50	2	1.80	10	16.32	0.61	-0.23
Lung, bronchus	137	0.86	49	0.90	29	0.78	23	1.01	238	273.33	0.87*	-1.26
Female breast	323	1.26*	96	1.08	68	1.16	43	1.28	530	437.35	1.21*	4.36
Female genital system	108	0.95	32	0.88	16	0.68	9	0.69	165	186.45	0.88	-1.01
Cervix uteri	13	0.62	4	0.71	2	0.65	2	1.43	21	30.99	0.68	-0.47
Corpus uteri	48	0.93	17	1.00	5	0.44	3	0.45	73	86.60	0.84	-0.64
Ovary	40	1.19	6	0.54	6	0.83	3	0.75	55	55.82	0.99	-0.04
Vagina	1	0.73	1	2.19	0	0.00	0	0.00	2	2.30	0.87	-0.01
Vulva	3	0.75	1	0.72	1	1.05	1	1.74	6	6.93	0.87	-0.04
Male genital system	172	1.48*	49	1.25	29	1.01	19	1.12	269	200.86	1.34*	10.02
Prostate	164	1.46*	46	1.20	28	0.99	19	1.13	257	195.83	1.31*	9.00
Testis	4	1.45	2	3.42	1	3.59	0	0.00	7	3.73	1.88	0.48
Urinary system	93	1.35*	30	1.29	17	1.06	19	1.93*	159	118.15	1.35*	1.46
Urinary bladder	36	0.83	15	1.04	7	0.71	4	0.65	62	73.64	0.84	-0.41
Kidney parenchyma	49	2.27*	14	1.89*	8	1.56	13	4.20*	84	37.22	2.26*	1.67
Renal pelvis, other urinary	8	1.84	1	0.71	2	2.11	2	3.38	13	7.29	1.78	0.20
Ureter	1	0.73	0	0.00	1	3.36	1	5.36	3	2.30	1.31	0.03
Bone, joints	2	1.29	2	4.63	2	7.47	0	0.00	6	2.40	2.50	0.13
Soft tissue including heart	9	1.60	2	1.14	1	0.87	1	1.49	13	9.20	1.41	0.14
Kaposi sarcoma	1	0.32	0	0.00	0	0.00	0	0.00	1	4.60	0.22	-0.13
Melanoma of skin	52	1.35*	13	1.08	10	1.28	3	0.66	78	62.98	1.24	0.54
Eye, orbit	3	1.64	0	0.00	0	0.00	0	0.00	3	2.99	1.00	0.00
Brain, central nervous system	26	1.74*	3	0.66	3	1.03	5	3.07	37	24.00	1.54*	0.46
Thyroid	33	1.69*	6	1.10	9	2.79*	2	1.21	50	29.80	1.68*	0.72
Lymphatic, hematopoietic	116	1.33*	29	1.01	22	1.14	12	1.03	179	146.86	1.22*	1.15
Hodgkin lymphoma	12	2.04*	0	0.00	0	0.00	2	5.45	14	8.36	1.67	0.20
Non-Hodgkin lymphoma	39	0.93	15	1.05	9	0.92	8	1.34	71	71.83	0.99	-0.03
Myeloma	24	1.86*	5	1.13	2	0.66	1	0.54	32	22.21	1.44	0.35
Leukemia	41	1.54*	9	1.04	11	1.91	1	0.29	62	44.45	1.39*	0.63
Acute lymphocytic	4	3.28	0	0.00	0	0.00	0	0.00	4	1.90	2.10	0.07
Chronic lymphocytic	11	1.19	2	0.64	6	2.85*	0	0.00	19	15.71	1.21	0.12
Acute non-lymphocytic	18	1.85*	0	0.00	1	0.47	1	0.77	20	16.31	1.23	0.13
Chronic myeloid	4	1.01	3	2.36	2	2.42	0	0.00	9	6.53	1.38	0.09

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 212,594 PYR and for male cancers on 67,987 PYR.

Table 15.1.4: Risk of subsequent primary cancers after cancer of the thyroid, females, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	107	1.29*	408	1.18*	389	1.10	564	1.02	1,468	1,337.02	1.10*	6.16
All excluding same site	91	1.13	402	1.18*	384	1.11*	552	1.01	1,429	1,311.00	1.09*	5.55
Buccal cavity, pharynx	0	0.00	6	0.96	4	0.64	12	1.30	22	23.20	0.95	-0.06
Lip	0	0.00	0	0.00	0	0.00	1	1.83	1	1.29	0.77	-0.01
Tongue	0	0.00	0	0.00	1	0.71	0	0.00	1	5.26	0.19	-0.20
Salivary gland	0	0.00	2	2.44	1	1.27	5	4.32*	8	2.96	2.70*	0.24
Mouth	0	0.00	1	0.51	2	1.02	4	1.36	7	7.32	0.96	-0.02
Nasopharynx	0	0.00	0	0.00	0	0.00	2	3.73	2	1.46	1.37	0.03
Tonsil	0	0.00	1	1.72	0	0.00	0	0.00	1	2.12	0.47	-0.05
Oropharynx	0	0.00	1	6.75	0	0.00	0	0.00	1	0.56	1.80	0.02
Hypopharynx	0	0.00	1	2.47	0	0.00	0	0.00	1	1.50	0.67	-0.02
Digestive system	18	1.21	59	0.95	68	1.06	96	0.93	241	243.69	0.99	-0.13
Esophagus	0	0.00	2	1.16	2	1.13	0	0.00	4	6.81	0.59	-0.13
Stomach	5	3.95*	6	1.15	9	1.72	4	0.50	24	19.68	1.22	0.20
Small intestine	1	4.12	2	1.94	1	0.93	2	1.09	6	4.19	1.43	0.09
Colon	5	0.71	33	1.12	35	1.15	46	0.94	119	115.98	1.03	0.14
Rectum, rectosigmoid junction	3	1.19	6	0.57	8	0.75	24	1.46	41	40.21	1.02	0.04
Rectum	2	1.20	5	0.72	5	0.71	19	1.73*	31	26.58	1.17	0.21
Anus, anal canal	0	0.00	2	1.94	0	0.00	0	0.00	2	4.09	0.49	-0.10
Liver	0	0.00	2	1.21	1	0.58	4	1.35	7	6.74	1.04	0.01
Gallbladder	0	0.00	0	0.00	1	0.72	1	0.48	2	5.17	0.39	-0.15
Bile ducts, other biliary	2	6.22	0	0.00	2	1.38	3	1.19	7	5.64	1.24	0.06
Pancreas	2	1.08	5	0.64	8	0.98	10	0.74	25	31.28	0.80	-0.30
Respiratory system	12	1.28	34	0.84	33	0.76	67	0.90	146	168.34	0.87	-1.05
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	2	2.80	2	1.77	1.13	0.01
Larynx	1	2.82	2	1.33	0	0.00	0	0.00	3	5.76	0.52	-0.13
Lung, bronchus	10	1.12	31	0.81	33	0.80	64	0.89	138	160.33	0.86	-1.05
Female breast	27	1.01	156	1.38*	140	1.21*	207	1.14	530	437.35	1.21*	4.36
Female genital system	12	0.96	43	0.84	53	1.06	57	0.78	165	186.45	0.88	-1.01
Cervix uteri	1	0.41	7	0.72	5	0.58	8	0.79	21	30.99	0.68	-0.47
Corpus uteri	3	0.54	16	0.69	29	1.27	25	0.71	73	86.60	0.84	-0.64
Ovary	5	1.39	18	1.20	17	1.14	15	0.67	55	55.82	0.99	-0.04
Vagina	1	6.76	0	0.00	0	0.00	1	1.07	2	2.30	0.87	-0.01
Vulva	1	2.37	1	0.57	1	0.55	3	1.03	6	6.93	0.87	-0.04
Urinary system	5	1.55	23	1.69*	20	1.40	32	1.33	80	55.16	1.45*	1.17
Urinary bladder	3	1.69	8	1.07	6	0.77	11	0.84	28	30.25	0.93	-0.11
Kidney parenchyma	2	1.66	15	2.92*	11	2.03*	20	2.19*	48	20.89	2.30*	1.28
Renal pelvis, other urinary	0	0.00	0	0.00	3	2.84	1	0.58	4	4.03	0.99	0.00
Ureter	0	0.00	0	0.00	0	0.00	1	1.93	1	1.21	0.82	-0.01
Bone, joints	0	0.00	0	0.00	0	0.00	3	5.07*	3	1.64	1.83	0.06
Soft tissue including heart	0	0.00	3	1.79	2	1.23	3	1.24	8	6.12	1.31	0.09
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.36	0.00	-0.02
Melanoma of skin	6	2.18	16	1.39	11	0.98	15	0.95	48	41.20	1.17	0.32
Eye, orbit	0	0.00	1	1.89	2	3.89	0	0.00	3	1.94	1.55	0.05
Brain, central nervous system	0	0.00	11	2.55*	8	1.90	8	1.32	27	15.62	1.73*	0.54
Thyroid	16	8.08*	6	0.75	5	0.70	12	1.34	39	26.02	1.50*	0.61
Lymphatic, hematopoietic	9	1.54	37	1.52*	36	1.46*	34	0.86	116	94.17	1.23*	1.03
Hodgkin lymphoma	2	3.93	3	1.55	4	2.57	1	0.60	10	5.67	1.76	0.20
Non-Hodgkin lymphoma	6	2.18	12	1.03	12	0.98	20	0.99	50	46.94	1.07	0.14
Myeloma	1	1.17	8	2.23	6	1.60	5	0.81	20	14.36	1.39	0.27
Leukemia	0	0.00	14	1.98*	14	1.96*	8	0.71	36	27.20	1.32	0.41
Acute lymphocytic	0	0.00	0	0.00	4	11.72*	0	0.00	4	1.26	3.18	0.13
Chronic lymphocytic	0	0.00	3	1.32	5	2.10	3	0.77	11	9.11	1.21	0.09
Acute non-lymphocytic	0	0.00	9	3.26*	3	1.09	0	0.00*	12	10.52	1.14	0.07
Chronic myeloid	0	0.00	1	0.91	2	1.84	3	1.83	6	4.09	1.47	0.09

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000.

Table 15.1.5: Risk of subsequent primary cancers after cancer of the thyroid, males, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	53	1.20	211	1.17*	201	1.14	281	1.07	746	662.65	1.13*	12.26
All excluding same site	50	1.14	209	1.16*	200	1.14	276	1.06	735	658.87	1.12*	11.20
Buccal cavity, pharynx	2	1.25	3	0.47	5	0.84	5	0.63	15	21.88	0.69	-1.01
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	3.21	0.00	-0.47
Tongue	2	6.21	0	0.00	1	0.82	1	0.59	4	4.56	0.88	-0.08
Salivary gland	0	0.00	2	4.21	2	4.40	1	1.50	5	1.72	2.91	0.48
Mouth	0	0.00	1	0.67	1	0.73	0	0.00	2	5.02	0.40	-0.44
Nasopharynx	0	0.00	0	0.00	0	0.00	1	2.27	1	1.26	0.80	-0.04
Tonsil	0	0.00	0	0.00	0	0.00	1	1.12	1	2.39	0.42	-0.20
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.63	0.00	-0.09
Hypopharynx	0	0.00	0	0.00	1	1.55	1	1.18	2	2.36	0.85	-0.05
Digestive system	12	1.28	38	1.00	36	0.98	47	0.90	133	136.54	0.97	-0.52
Esophagus	2	3.20	0	0.00	0	0.00	3	0.83	5	9.22	0.54	-0.62
Stomach	2	1.76	5	1.09	4	0.93	8	1.37	19	15.87	1.20	0.46
Small intestine	0	0.00	2	3.46	1	1.77	0	0.00	3	2.15	1.40	0.13
Colon	4	1.08	18	1.18	21	1.42	20	0.94	63	55.07	1.14	1.17
Rectum, rectosigmoid junction	3	1.68	5	0.70	6	0.88	7	0.73	21	25.36	0.83	-0.64
Anus, anal canal	1	12.39	0	0.00	1	3.20	0	0.00	2	1.18	1.70	0.12
Liver	0	0.00	3	1.56	3	1.59	1	0.35	7	7.17	0.98	-0.02
Gallbladder	0	0.00	1	3.30	0	0.00	0	0.00	1	1.06	0.94	-0.01
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	1	0.80	1	3.08	0.33	-0.31
Pancreas	0	0.00	4	0.93	0	0.00*	7	1.19	11	15.32	0.72	-0.63
Respiratory system	5	0.58	32	0.91	31	0.92	42	0.89	110	125.02	0.88	-2.21
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	1	2.41	1	1.11	0.90	-0.02
Larynx	0	0.00	3	0.97	1	0.35	3	0.78	7	10.56	0.66	-0.52
Lung, bronchus	5	0.64	29	0.91	29	0.95	37	0.86	100	112.99	0.89	-1.91
Male breast	0	0.00	1	2.88	0	0.00	1	1.97	2	1.28	1.57	0.11
Male genital system	17	1.37	81	1.57*	74	1.42*	97	1.15	269	200.86	1.34*	10.02
Prostate	16	1.34	74	1.48*	74	1.46*	93	1.12	257	195.83	1.31*	9.00
Testis	0	0.00	4	2.98	0	0.00	3	3.09	7	3.73	1.88	0.48
Urinary system	5	1.20	18	1.06	22	1.32	34	1.36	79	62.98	1.25	2.36
Urinary bladder	1	0.35	8	0.68	10	0.87	15	0.87	34	43.39	0.78	-1.38
Kidney parenchyma	3	2.78	8	1.80	10	2.31*	15	2.31*	36	16.33	2.20*	2.89
Renal pelvis, other urinary	1	4.40	2	2.17	2	2.28	4	3.23	9	3.26	2.76*	0.84
Ureter	1	13.25	0	0.00	0	0.00	1	2.44	2	1.08	1.85	0.13
Bone, joints	0	0.00	2	8.47	0	0.00	1	3.89	3	0.76	3.96	0.33
Soft tissue including heart	1	4.56	2	2.27	1	1.22	1	0.86	5	3.08	1.62	0.28
Kaposi sarcoma	1	3.00	0	0.00	0	0.00	0	0.00	1	4.24	0.24	-0.48
Melanoma of skin	2	1.39	9	1.52	8	1.39	11	1.27	30	21.78	1.38	1.21
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	1.05	0.00	-0.15
Brain, central nervous system	2	3.27	1	0.41	4	1.76	3	0.98	10	8.39	1.19	0.24
Thyroid	3	10.30*	2	1.76	1	0.99	5	3.71*	11	3.78	2.91*	1.06
Lymphatic, hematopoietic	1	0.28	19	1.30	14	0.99	29	1.42	63	52.68	1.20	1.52
Hodgkin lymphoma	0	0.00	3	3.37	0	0.00	1	1.22	4	2.69	1.49	0.19
Non-Hodgkin lymphoma	0	0.00	2	0.29	7	1.06	12	1.22	21	24.89	0.84	-0.57
Myeloma	1	1.91	5	2.34	3	1.44	3	0.96	12	7.85	1.53	0.61
Leukemia	0	0.00	9	1.87	4	0.86	13	1.97*	26	17.25	1.51	1.29
Acute lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.65	0.00	-0.09
Chronic lymphocytic	0	0.00	0	0.00	3	1.69	5	1.95	8	6.60	1.21	0.21
Acute non-lymphocytic	0	0.00	6	3.72*	0	0.00	2	0.89	8	5.80	1.38	0.32
Chronic myeloid	0	0.00	1	1.45	0	0.00	2	2.14	3	2.45	1.23	0.08

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000.

Thyroid Both Sexes, <40 Years of Age

Table 15.1.6: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, <40 years of age, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	28	3.06*	70	1.49*	85	1.33*	214	1.29*	397	286.20	1.39*	8.16
All excluding same site	18	2.18*	67	1.55*	82	1.37*	202	1.26*	369	272.05	1.36*	7.14
Buccal cavity, pharynx	0	0.00	1	1.15	2	1.54	8	2.13	11	6.09	1.81	0.36
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.46	0.00	-0.03
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	1.43	0.00	-0.11
Salivary gland	0	0.00	1	4.47	1	4.00	4	8.34*	6	1.00	5.99*	0.37
Mouth	0	0.00	0	0.00	1	3.71	3	3.36	4	1.35	2.97	0.20
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.62	0.00	-0.05
Tonsil	0	0.00	0	0.00	0	0.00	1	2.04	1	0.70	1.42	0.02
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.01
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.30	0.00	-0.02
Digestive system	1	1.79	6	1.86	6	1.14	28	1.48	41	28.02	1.46*	0.96
Esophagus	0	0.00	0	0.00	0	0.00	0	0.00	0	1.04	0.00	-0.08
Stomach	1	14.60	1	2.59	2	3.48	3	1.86	7	2.64	2.65*	0.32
Small intestine	0	0.00	0	0.00	0	0.00	1	1.91	1	0.82	1.21	0.01
Colon	0	0.00	3	2.36	3	1.48	13	1.77	19	10.87	1.75*	0.60
Rectum, rectosigmoid junction	0	0.00	0	0.00	1	0.91	7	1.75	8	5.85	1.37	0.16
Anus, anal canal	0	0.00	0	0.00	0	0.00	0	0.00	0	0.88	0.00	-0.06
Liver	0	0.00	2	12.78*	0	0.00	0	0.00	2	1.36	1.47	0.05
Gallbladder	0	0.00	0	0.00	0	0.00	0	0.00	0	0.35	0.00	-0.03
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	1	2.40	1	0.61	1.65	0.03
Pancreas	0	0.00	0	0.00	0	0.00	3	1.43	3	2.90	1.03	0.01
Respiratory system	2	7.13	1	0.55	3	0.85	17	1.07	23	21.46	1.07	0.11
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	1	4.31	1	0.42	2.38	0.04
Larynx	1	46.10	0	0.00	0	0.00	1	0.93	2	1.51	1.33	0.04
Lung, bronchus	1	4.31	1	0.64	3	0.96	15	1.04	20	19.35	1.03	0.05
Female breast	5	2.16	17	1.23	36	1.64*	77	1.35*	135	94.96	1.42*	3.76
Female genital system	3	1.90	11	1.42	7	0.72	15	0.69	36	40.58	0.89	-0.43
Cervix uteri	0	0.00	4	1.09	4	1.04	4	0.76	12	13.58	0.88	-0.15
Corpus uteri	0	0.00	3	2.12	2	0.85	5	0.60	10	12.34	0.81	-0.22
Ovary	2	4.48	4	1.80	1	0.34	4	0.59	11	12.33	0.89	-0.13
Vagina	1	82.39*	0	0.00	0	0.00	0	0.00	1	0.34	2.91	0.06
Vulva	0	0.00	0	0.00	0	0.00	1	1.53	1	1.20	0.83	-0.02
Male genital system	1	4.40	3	3.06	3	2.64	11	1.56	18	9.38	1.92*	2.96
Prostate	0	0.00	0	0.00	3	9.91*	9	1.46	12	6.53	1.84	1.88
Testis	0	0.00	3	3.30	0	0.00	2	2.50	5	2.74	1.83	0.78
Urinary system	1	4.86	1	0.84	3	1.56	13	1.89*	18	10.18	1.77*	0.58
Urinary bladder	0	0.00	0	0.00	2	2.23	4	1.18	6	4.95	1.21	0.08
Kidney parenchyma	1	9.89	1	1.69	1	1.04	9	2.81*	12	4.86	2.47*	0.53
Renal pelvis, other urinary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.37	0.00	-0.03
Ureter	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.01
Bone, joints	0	0.00	0	0.00	0	0.00	2	6.14	2	0.85	2.35	0.08
Soft tissue including heart	0	0.00	1	1.81	0	0.00	1	0.96	2	2.30	0.87	-0.02
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	3.05	0.00	-0.22
Melanoma of skin	3	2.82	7	1.40	5	0.88	12	1.23	27	21.45	1.26	0.41
Eye, orbit	0	0.00	0	0.00	1	7.70	0	0.00	1	0.55	1.81	0.03
Brain, central nervous system	1	3.33	6	4.44*	4	2.74	5	1.89	16	5.75	2.78*	0.75
Thyroid	10	11.42*	3	0.78	3	0.79	12	2.13*	28	14.15	1.98*	1.02
Lymphatic, hematopoietic	1	0.94	12	2.50*	11	2.04*	11	0.94	35	22.94	1.53*	0.89
Hodgkin lymphoma	1	2.54	4	2.64	2	1.66	2	1.63	9	4.33	2.08	0.34
Non-Hodgkin lymphoma	0	0.00	3	1.51	6	2.32	6	0.96	15	11.22	1.34	0.28
Myeloma	0	0.00	0	0.00	0	0.00	1	0.84	1	1.62	0.62	-0.05
Leukemia	0	0.00	5	4.31*	3	2.25	2	0.66	10	5.76	1.74	0.31
Acute lymphocytic	0	0.00	0	0.00	1	5.93	0	0.00	1	0.64	1.56	0.03
Chronic lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.99	0.00	-0.07
Acute non-lymphocytic	0	0.00	4	7.15*	1	1.64	0	0.00	5	2.49	2.00	0.18
Chronic myeloid	0	0.00	0	0.00	1	3.53	1	1.81	2	1.15	1.74	0.06

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 106,643 PYR and for male cancers on 29,113 PYR.

Table 15.1.7: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, 40-49 years of age, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	16	1.03	99	1.33*	107	1.19	201	1.00	423	381.73	1.11*	6.96
All excluding same site	13	0.87	97	1.34*	105	1.19	198	0.99	413	374.87	1.10	6.43
Buccal cavity, pharynx	1	2.63	2	1.03	1	0.41	2	0.42	6	9.48	0.63	-0.59
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.71	0.00	-0.12
Tongue	1	12.11	0	0.00	1	1.82	1	0.91	3	2.15	1.40	0.14
Salivary gland	0	0.00	1	4.65	0	0.00	0	0.00	1	0.93	1.08	0.01
Mouth	0	0.00	1	2.02	0	0.00	0	0.00	1	2.54	0.39	-0.26
Nasopharynx	0	0.00	0	0.00	0	0.00	1	3.55	1	0.69	1.45	0.05
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	1.12	0.00	-0.19
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.25	0.00	-0.04
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.80	0.00	-0.14
Digestive system	2	1.19	15	1.67	11	0.88	26	0.76	54	57.25	0.94	-0.55
Esophagus	0	0.00	1	2.66	1	1.74	0	0.00	2	2.69	0.74	-0.12
Stomach	1	5.70	1	1.15	2	1.82	0	0.00	4	4.95	0.81	-0.16
Small intestine	0	0.00	1	4.29	1	3.46	0	0.00	2	1.23	1.62	0.13
Colon	1	1.54	7	1.99	2	0.40	12	0.82	22	23.80	0.92	-0.30
Rectum, rectosigmoid junction	0	0.00	4	2.12	2	0.76	5	0.79	11	11.21	0.98	-0.04
Anus, anal canal	0	0.00	1	4.11	0	0.00	0	0.00	1	1.14	0.88	-0.02
Liver	0	0.00	0	0.00	1	1.92	2	1.39	3	2.44	1.23	0.09
Gallbladder	0	0.00	0	0.00	0	0.00	1	1.92	1	0.86	1.16	0.02
Bile ducts, other biliary	0	0.00	0	0.00	1	3.99	1	1.33	2	1.22	1.64	0.13
Pancreas	0	0.00	0	0.00	1	0.69	4	0.96	5	6.78	0.74	-0.30
Respiratory system	1	0.75	8	1.05	13	1.11	19	0.57*	41	54.01	0.76	-2.19
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	0	0.00	0	0.55	0.00	-0.09
Larynx	0	0.00	1	1.74	0	0.00	1	0.52	2	3.42	0.58	-0.24
Lung, bronchus	1	0.84	7	1.01	13	1.22	18	0.58*	39	49.89	0.78	-1.84
Female breast	3	0.51	37	1.38	31	1.08	59	1.21	130	109.94	1.18	4.47
Female genital system	3	1.38	9	0.88	11	0.96	17	0.85	40	43.78	0.91	-0.84
Cervix uteri	1	1.64	1	0.42	0	0.00	1	0.45	3	7.19	0.42	-0.93
Corpus uteri	0	0.00	4	0.98	6	1.13	11	1.04	21	20.77	1.01	0.05
Ovary	1	1.47	3	0.94	4	1.14	3	0.50	11	13.34	0.82	-0.52
Vagina	0	0.00	0	0.00	0	0.00	0	0.00	0	0.43	0.00	-0.10
Vulva	1	15.68	0	0.00	1	3.39	0	0.00	2	1.23	1.62	0.17
Male genital system	0	0.00	3	1.77	3	0.86	17	0.86	23	25.20	0.91	-1.53
Prostate	0	0.00	3	2.16	3	0.91	16	0.82	22	24.40	0.90	-1.67
Testis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.60	0.00	-0.42
Urinary system	1	1.74	4	1.32	10	2.37*	23	1.99*	38	19.39	1.96*	3.14
Urinary bladder	0	0.00	1	0.66	1	0.45	10	1.49	12	10.75	1.12	0.21
Kidney parenchyma	1	3.66	3	2.16	8	4.44*	12	2.85*	24	7.68	3.12*	2.75
Renal pelvis, other urinary	0	0.00	0	0.00	1	5.18	1	1.62	2	0.96	2.08	0.18
Ureter	0	0.00	0	0.00	0	0.00	1	5.32	1	0.27	3.74	0.12
Bone, joints	0	0.00	0	0.00	0	0.00	1	5.28	1	0.46	2.16	0.09
Soft tissue including heart	0	0.00	0	0.00	3	6.65*	2	2.44	5	1.81	2.77	0.54
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.77	0.00	-0.13
Melanoma of skin	1	1.11	8	2.12	8	2.21	4	0.70	21	13.99	1.50	1.18
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.61	0.00	-0.10
Brain, central nervous system	0	0.00	3	2.61	6	4.79*	3	1.33	12	4.92	2.44*	1.19
Thyroid	3	5.46*	2	0.92	2	1.07	3	1.32	10	6.86	1.46	0.53
Lymphatic, hematopoietic	1	0.97	6	1.23	6	1.03	16	1.19	29	25.13	1.15	0.65
Hodgkin lymphoma	1	9.61	1	2.51	1	2.91	0	0.00	3	1.32	2.28	0.28
Non-Hodgkin lymphoma	0	0.00	0	0.00	3	0.97	9	1.29	12	13.22	0.91	-0.21
Myeloma	0	0.00	3	5.60*	0	0.00	1	0.47	4	3.55	1.13	0.08
Leukemia	0	0.00	2	1.49	2	1.23	6	1.58	10	7.04	1.42	0.50
Acute lymphocytic	0	0.00	0	0.00	1	10.62	0	0.00	1	0.36	2.75	0.11
Chronic lymphocytic	0	0.00	0	0.00	0	0.00	3	2.08	3	2.36	1.27	0.11
Acute non-lymphocytic	0	0.00	2	3.79	1	1.68	0	0.00	3	2.59	1.16	0.07
Chronic myeloid	0	0.00	0	0.00	0	0.00	2	3.75	2	1.12	1.79	0.15

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 44,929 PYR and for male cancers on 14,394 PYR.

Thyroid Both Sexes, 50-69 Years of Age

Table 15.1.8: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, 50-69 years of age, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	64	1.05	323	1.20*	308	1.07	389	0.96	1,084	1,024.08	1.06	8.41
All excluding same site	60	0.99	320	1.20*	307	1.07	387	0.96	1,074	1,016.62	1.06	8.05
Buccal cavity, pharynx	1	0.57	4	0.55	4	0.58	7	0.88	16	23.93	0.67	-1.11
Lip	0	0.00	0	0.00	0	0.00	1	1.08	1	2.50	0.40	-0.21
Tongue	1	2.66	0	0.00	1	0.68	0	0.00	2	5.11	0.39	-0.44
Salivary gland	0	0.00	2	3.47	1	1.73	2	2.48	5	2.10	2.39	0.41
Mouth	0	0.00	1	0.49	1	0.52	1	0.44	3	6.74	0.45	-0.52
Nasopharynx	0	0.00	0	0.00	0	0.00	2	5.58	2	1.20	1.66	0.11
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	2.34	0.00	-0.33
Oropharynx	0	0.00	1	4.61	0	0.00	0	0.00	1	0.69	1.44	0.04
Hypopharynx	0	0.00	0	0.00	1	1.41	1	1.36	2	2.37	0.84	-0.05
Digestive system	15	1.33	43	0.83	62	1.07	80	0.90	200	209.93	0.95	-1.39
Esophagus	2	3.36	0	0.00	0	0.00	3	0.82	5	9.63	0.52	-0.65
Stomach	3	2.82	4	0.83	8	1.49	7	0.87	22	19.31	1.14	0.38
Small intestine	1	5.30	3	3.59	0	0.00	1	0.74	5	3.28	1.52	0.24
Colon	3	0.63	22	0.99	38	1.47*	35	0.84	98	94.38	1.04	0.51
Rectum, rectosigmoid junction	4	1.82	5	0.51	8	0.78	19	1.36	36	36.20	0.99	-0.03
Anus, anal canal	1	6.23	1	1.43	0	0.00	0	0.00	2	2.54	0.79	-0.08
Liver	0	0.00	1	0.51	1	0.46	3	0.94	5	7.74	0.65	-0.38
Gallbladder	0	0.00	0	0.00	1	1.06	0	0.00	1	3.37	0.30	-0.33
Bile ducts, other biliary	1	4.50	0	0.00	1	0.81	2	0.90	4	4.71	0.85	-0.10
Pancreas	0	0.00	7	1.11	5	0.69	9	0.79	21	26.29	0.80	-0.74
Respiratory system	8	0.77	50	1.07	37	0.73	66	0.97	161	175.79	0.92	-2.07
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	2	3.59	2	1.46	1.37	0.08
Larynx	0	0.00	4	1.31	1	0.35	1	0.33	6	9.74	0.62	-0.52
Lung, bronchus	8	0.84	45	1.04	35	0.74	61	0.95	149	164.19	0.91	-2.13
Female breast	9	0.72	77	1.46*	57	1.09	66	0.97	209	185.74	1.13	4.63
Female genital system	4	0.67	19	0.77	30	1.28	23	0.81	76	82.41	0.92	-1.28
Cervix uteri	0	0.00	2	0.69	1	0.42	3	1.28	6	8.37	0.72	-0.47
Corpus uteri	2	0.61	6	0.45*	17	1.34	7	0.47*	32	44.26	0.72	-2.44
Ovary	2	1.20	10	1.44	11	1.62	8	0.93	31	24.03	1.29	1.39
Vagina	0	0.00	0	0.00	0	0.00	1	2.24	1	1.09	0.92	-0.02
Vulva	0	0.00	1	1.44	0	0.00	2	1.45	3	3.03	0.99	-0.01
Male genital system	8	1.25	46	1.49*	53	1.41*	61	1.11	168	129.68	1.30*	18.18
Prostate	8	1.27	44	1.44*	53	1.42*	60	1.10	165	128.59	1.28*	17.27
Testis	0	0.00	1	6.84	0	0.00	1	14.73	2	0.35	5.71	0.78
Urinary system	3	0.81	30	1.78*	24	1.29	28	1.01	85	66.76	1.27*	2.56
Urinary bladder	1	0.44	13	1.25	11	0.93	10	0.55	35	42.73	0.82	-1.08
Kidney parenchyma	2	1.62	15	2.80*	10	1.79	14	1.85*	41	19.71	2.08*	2.99
Renal pelvis, other urinary	0	0.00	2	1.91	3	2.49	4	2.16	9	4.32	2.08	0.66
Ureter	0	0.00	0	0.00	0	0.00	1	1.65	1	1.40	0.71	-0.06
Bone, joints	0	0.00	2	7.91	0	0.00	0	0.00	2	0.86	2.33	0.16
Soft tissue including heart	1	4.03	2	1.91	0	0.00	1	0.66	4	3.86	1.04	0.02
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.54	0.00	-0.08
Melanoma of skin	4	2.54	7	1.09	5	0.81	7	0.85	23	22.39	1.03	0.09
Eye, orbit	0	0.00	1	2.40	1	2.48	0	0.00	2	1.44	1.39	0.08
Brain, central nervous system	1	1.35	2	0.64	1	0.33	3	0.77	7	10.83	0.65	-0.54
Thyroid	4	6.13*	3	1.21	1	0.48	2	0.89	10	7.46	1.34	0.36
Lymphatic, hematopoietic	4	0.98	27	1.49	25	1.25	34	1.11	90	73.03	1.23	2.38
Hodgkin lymphoma	0	0.00	0	0.00	1	1.65	0	0.00	1	2.16	0.46	-0.16
Non-Hodgkin lymphoma	3	1.51	6	0.68	8	0.82	16	1.06	33	35.77	0.92	-0.39
Myeloma	1	1.48	7	2.28	8	2.30	5	0.94	21	12.55	1.67*	1.19
Leukemia	0	0.00	14	2.52*	8	1.30	13	1.35	35	22.55	1.55*	1.75
Acute lymphocytic	0	0.00	0	0.00	2	10.44*	0	0.00	2	0.68	2.94	0.19
Chronic lymphocytic	0	0.00	3	1.35	4	1.61	5	1.34	12	8.90	1.35	0.43
Acute non-lymphocytic	0	0.00	7	3.64*	0	0.00	2	0.57	9	8.02	1.12	0.14
Chronic myeloid	0	0.00	2	2.65	1	1.24	2	1.57	5	3.02	1.66	0.28

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 50,185 PYR and for male cancers on 21,081 PYR.

Table 15.1.9: Risk of subsequent primary cancers after cancer of the thyroid, both sexes, ≥70 years of age, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	52	1.27	127	0.93	90	1.03	41	0.96	310	307.67	1.01	1.64
All excluding same site	50	1.22	127	0.94	90	1.03	41	0.96	308	306.34	1.01	1.17
Buccal cavity, pharynx	0	0.00	2	0.79	2	1.31	0	0.00	4	5.57	0.72	-1.11
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.83	0.00	-0.59
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	1.12	0.00	-0.79
Salivary gland	0	0.00	0	0.00	1	5.31	0	0.00	1	0.65	1.53	0.24
Mouth	0	0.00	0	0.00	1	2.10	0	0.00	1	1.72	0.58	-0.50
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.20	0.00	-0.14
Tonsil	0	0.00	1	5.83	0	0.00	0	0.00	1	0.35	2.86	0.46
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.09
Hypopharynx	0	0.00	1	5.04	0	0.00	0	0.00	1	0.39	2.55	0.43
Digestive system	12	1.12	33	0.91	25	1.01	9	0.67	79	85.03	0.93	-4.23
Esophagus	0	0.00	1	0.84	1	1.34	0	0.00	2	2.66	0.75	-0.46
Stomach	2	1.82	5	1.35	1	0.40	2	1.52	10	8.64	1.16	0.95
Small intestine	0	0.00	0	0.00	1	3.49	0	0.00	1	1.00	1.00	0.00
Colon	5	0.98	19	1.08	13	1.05	6	0.87	43	42.00	1.02	0.71
Rectum, rectosigmoid junction	2	1.21	2	0.37	3	0.86	0	0.00	7	12.31	0.57	-3.73
Anus, anal canal	0	0.00	0	0.00	1	5.04	0	0.00	1	0.71	1.41	0.20
Liver	0	0.00	2	1.88	2	2.95	0	0.00	4	2.37	1.69	1.14
Gallbladder	0	0.00	1	1.41	0	0.00	0	0.00	1	1.66	0.60	-0.46
Bile ducts, other biliary	1	3.99	0	0.00	0	0.00	0	0.00	1	2.18	0.46	-0.83
Pancreas	2	1.51	2	0.45	2	0.65	1	0.58	7	10.62	0.66	-2.55
Respiratory system	6	0.99	7	0.36*	11	0.95	7	1.46	31	42.11	0.74	-7.80
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	0	0.00	0	0.45	0.00	-0.32
Larynx	0	0.00	0	0.00	0	0.00	0	0.00	0	1.65	0.00	-1.16
Lung, bronchus	5	0.87	7	0.38*	11	1.00	7	1.53	30	39.90	0.75	-6.95
Female breast	10	1.64	25	1.24	16	1.21	5	0.70	56	46.71	1.20	8.57
Female genital system	2	0.75	4	0.46	5	0.92	2	0.69	13	19.68	0.66	-6.17
Cervix uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	1.85	0.00	-1.71
Corpus uteri	1	0.75	3	0.71	4	1.61	2	1.68	10	9.23	1.08	0.71
Ovary	0	0.00	1	0.38	1	0.58	0	0.00	2	6.12	0.33	-3.80
Vagina	0	0.00	0	0.00	0	0.00	0	0.00	0	0.44	0.00	-0.40
Vulva	0	0.00	0	0.00	0	0.00	0	0.00	0	1.47	0.00	-1.35
Male genital system	8	1.45	29	1.61*	15	1.50	8	2.60*	60	36.59	1.64*	68.88
Prostate	8	1.46	27	1.51	15	1.51	8	2.63*	58	36.31	1.60*	63.82
Testis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.04	0.00	-0.10
Urinary system	5	1.73	6	0.62	5	0.80	2	0.67	18	21.81	0.83	-2.68
Urinary bladder	3	1.50	2	0.30	2	0.45	2	0.95	9	15.22	0.59	-4.37
Kidney parenchyma	1	1.48	4	1.79	2	1.43	0	0.00	7	4.96	1.41	1.43
Renal pelvis, other urinary	1	4.59	0	0.00	1	2.14	0	0.00	2	1.64	1.22	0.26
Ureter	1	13.48	0	0.00	0	0.00	0	0.00	1	0.55	1.82	0.32
Bone, joints	0	0.00	0	0.00	0	0.00	1	32.20	1	0.23	4.39	0.54
Soft tissue including heart	0	0.00	2	3.83	0	0.00	0	0.00	2	1.23	1.62	0.54
Kaposi sarcoma	1	38.28	0	0.00	0	0.00	0	0.00	1	0.24	4.22	0.54
Melanoma of skin	0	0.00	3	1.36	1	0.67	3	3.83	7	5.14	1.36	1.31
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.39	0.00	-0.27
Brain, central nervous system	0	0.00	1	0.87	1	1.45	0	0.00	2	2.50	0.80	-0.35
Thyroid	2	10.28*	0	0.00	0	0.00	0	0.00	2	1.33	1.50	0.47
Lymphatic, hematopoietic	4	1.23	11	0.99	8	1.07	2	0.51	25	25.75	0.97	-0.53
Hodgkin lymphoma	0	0.00	1	3.99	0	0.00	0	0.00	1	0.55	1.83	0.32
Non-Hodgkin lymphoma	3	2.05	5	1.00	2	0.59	1	0.57	11	11.62	0.95	-0.43
Myeloma	1	1.72	3	1.53	1	0.77	1	1.54	6	4.49	1.34	1.06
Leukemia	0	0.00	2	0.52	5	1.88	0	0.00	7	9.10	0.77	-1.47
Acute lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.22	0.00	-0.15
Chronic lymphocytic	0	0.00	0	0.00	4	4.01*	0	0.00	4	3.45	1.16	0.38
Acute non-lymphocytic	0	0.00	2	1.47	1	1.07	0	0.00	3	3.20	0.94	-0.14
Chronic myeloid	0	0.00	0	0.00	0	0.00	0	0.00	0	1.25	0.00	-0.88

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 10,837 PYR and for male cancers on 3,399 PYR.

Adrenal Gland Both Sexes

Table 15.2.1: Characteristics of patients with an initial cancer of the adrenal gland excluding neuroblastoma, both sexes, SEER 1973-2000.

Characteristics	Males		Females		Total	
	No.	%	No.	%	No.	%
Number of patients with 1st primary cancer						
Total	389	100.0	422	100.0	811	100.0
Initial treatment						
Any radiation	82	21.1	55	13.0	137	16.9
With surgery	41	10.5	37	8.8	78	9.6
Without surgery	41	10.5	18	4.3	59	7.3
No radiation	307	78.9	367	87.0	674	83.1
With surgery	221	56.8	286	67.8	507	62.5
Without surgery	86	22.1	81	19.2	167	20.6
Race						
White	334	85.9	359	85.1	693	85.5
Black	26	6.7	36	8.5	62	7.6
Other	28	7.2	27	6.4	55	6.8
Unknown	1	0.3	0	0.0	1	0.1
Age at 1st primary cancer diagnosis, years						
< 30	43	11.1	66	15.6	109	13.4
30–49	118	30.3	103	24.4	221	27.3
50–69	167	42.9	180	42.7	347	42.8
70–79	52	13.4	58	13.7	110	13.6
≥ 80	9	2.3	15	3.6	24	3.0
Number of patients with one or more primary cancers						
One primary cancer only	357	91.8	401	95.0	758	93.5
1st and 2nd cancers	28	7.2	21	5.0	49	6.0
1st, 2nd, and 3rd cancers	4	1.0	0	0.0	4	0.5
1st, 2nd, 3rd, and additional cancers	0	0.0	0	0.0	0	0.0
Other statistics						
Median age at 1st cancer diagnosis	55.4	—	54.3	—	54.6	—
Median year of 1st cancer diagnosis	1987.2	—	1989.0	—	1988.2	—
Median person-years at risk	1.1	—	1.7	—	1.6	—
Percent histologically confirmed*						
Both 1st and 2nd cancers	—	93.8	—	90.5	—	92.5
1st, 2nd, and additional cancers	—	93.8	—	90.5	—	92.5
1st cancer only	—	6.3	—	0.0	—	3.8

*Percent histologically confirmed among patients who developed a subsequent primary cancer.

Table 15.2.2: Risk of subsequent primary cancers after cancer of the adrenal gland excluding neuroblastoma, both sexes, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	12	3.01*	18	1.59	13	1.49	14	1.65	57	32.47	1.76*	71.36
All excluding same site	12	3.01*	18	1.59	12	1.38	14	1.66	56	32.46	1.73*	68.49
Buccal cavity, pharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.85	0.00	-2.46
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.10	0.00	-0.30
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	0.18	0.00	-0.52
Salivary gland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.21
Mouth	0	0.00	0	0.00	0	0.00	0	0.00	0	0.23	0.00	-0.66
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.04	0.00	-0.11
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.26
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.07
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.25
Digestive system	2	2.46	1	0.44	3	1.73	4	2.39	10	6.49	1.54	10.22
Esophagus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.34	0.00	-0.99
Stomach	0	0.00	1	4.62	0	0.00	0	0.00	1	0.61	1.64	1.14
Small intestine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.11	0.00	-0.31
Colon	0	0.00	0	0.00	1	1.28	2	2.66	3	2.89	1.04	0.31
Rectum, rectosigmoid junction	1	6.71	0	0.00	0	0.00	1	3.55	2	1.14	1.76	2.51
Anus, anal canal	0	0.00	0	0.00	1	49.39	0	0.00	1	0.08	13.05	2.69
Liver	0	0.00	0	0.00	0	0.00	0	0.00	0	0.23	0.00	-0.67
Gallbladder	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.25
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.14	0.00	-0.39
Pancreas	1	10.10	0	0.00	0	0.00	1	4.79	2	0.80	2.50	3.49
Respiratory system	2	2.87	7	3.57*	2	1.34	1	0.69	12	5.59	2.15*	18.65
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	1	81.24*	1	0.05	20.90	2.77
Larynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.37	0.00	-1.08
Lung, bronchus	2	3.13	7	3.88*	2	1.45	0	0.00	11	5.16	2.13*	17.00
Female breast	1	1.71	3	1.70	0	0.00	1	0.88	5	4.74	1.05	1.36
Female genital system	0	0.00	0	0.00	1	1.90	0	0.00	1	2.02	0.49	-5.40
Cervix uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	0.27	0.00	-1.41
Corpus uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	1.00	0.00	-5.30
Ovary	0	0.00	0	0.00	1	6.25	0	0.00	1	0.60	1.66	2.09
Vagina	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.14
Vulva	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.41
Male genital system	3	5.11*	4	2.43	1	0.68	3	1.91	11	5.27	2.09*	37.11
Prostate	3	5.24*	4	2.49	1	0.69	3	1.93	11	5.18	2.12*	37.71
Testis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.39
Urinary system	1	3.57	2	2.55	3	4.86	2	3.18	8	2.31	3.46*	16.56
Urinary bladder	1	5.50	2	3.97	2	4.96	1	2.41	6	1.50	3.99*	13.08
Kidney parenchyma	0	0.00	0	0.00	1	5.61	1	5.56	2	0.67	2.99	3.87
Renal pelvis, other urinary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.14	0.00	-0.40
Ureter	0	0.00	0	0.00	0	0.00	0	0.00	0	0.04	0.00	-0.13
Bone, joints	0	0.00	0	0.00	0	0.00	1	115.19*	1	0.04	28.56	2.81
Soft tissue including heart	0	0.00	0	0.00	0	0.00	0	0.00	0	0.14	0.00	-0.40
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.22
Melanoma of skin	2	19.37*	0	0.00	1	4.34	0	0.00	3	0.87	3.44	6.19
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.05	0.00	-0.14
Brain, central nervous system	1	19.91	0	0.00	0	0.00	0	0.00	1	0.38	2.64	1.81
Thyroid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.28	0.00	-0.82
Lymphatic, hematopoietic	0	0.00	1	1.20	1	1.55	2	3.14	4	2.41	1.66	4.63
Hodgkin lymphoma	0	0.00	0	0.00	0	0.00	1	39.86	1	0.11	9.33	2.60
Non-Hodgkin lymphoma	0	0.00	0	0.00	1	3.29	0	0.00	1	1.13	0.88	-0.39
Myeloma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.40	0.00	-1.16
Leukemia	0	0.00	1	3.75	0	0.00	1	5.03	2	0.77	2.61	3.59
Acute lymphocytic	0	0.00	0	0.00	0	0.00	1	131.92*	1	0.03	28.90	2.81
Chronic lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.30	0.00	-0.86
Acute non-lymphocytic	0	0.00	1	11.12	0	0.00	0	0.00	1	0.26	3.82	2.15
Chronic myeloid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.11	0.00	-0.31

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 1,894 PYR and for male cancers on 1,543 PYR.

Adrenal Gland Females

Table 15.2.3: Risk of subsequent primary cancers after cancer of the adrenal gland excluding neuroblastoma, females, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	4	2.14	6	1.07	5	1.22	6	1.62	21	15.27	1.37	30.23
All excluding same site	4	2.14	6	1.07	5	1.22	6	1.62	21	15.27	1.38	30.27
Buccal cavity, pharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.27	0.00	-1.41
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.08
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.32
Salivary gland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.16
Mouth	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.46
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.01	0.00	-0.07
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.13
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.01	0.00	-0.04
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.10
Digestive system	0	0.00	0	0.00	2	2.42	1	1.34	3	3.01	1.00	-0.05
Esophagus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.49
Stomach	0	0.00	0	0.00	0	0.00	0	0.00	0	0.22	0.00	-1.18
Small intestine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.05	0.00	-0.27
Colon	0	0.00	0	0.00	1	2.46	0	0.00	1	1.46	0.68	-2.45
Rectum, rectosigmoid junction	0	0.00	0	0.00	0	0.00	1	8.81	1	0.48	2.07	2.73
Rectum	0	0.00	0	0.00	0	0.00	1	13.14	1	0.32	3.16	3.61
Anus, anal canal	0	0.00	0	0.00	1	79.42*	0	0.00	1	0.05	21.33	5.03
Liver	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.39
Gallbladder	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.32
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.34
Pancreas	0	0.00	0	0.00	0	0.00	0	0.00	0	0.40	0.00	-2.12
Respiratory system	1	4.01	2	2.60	0	0.00	1	1.83	4	2.15	1.86	9.78
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	1	198.47*	1	0.02	49.64	5.17
Larynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.38
Lung, bronchus	1	4.22	2	2.73	0	0.00	0	0.00	3	2.05	1.46	5.02
Female breast	1	1.71	3	1.70	0	0.00	1	0.88	5	4.74	1.05	1.36
Female genital system	0	0.00	0	0.00	1	1.90	0	0.00	1	2.02	0.49	-5.40
Cervix uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	0.27	0.00	-1.41
Corpus uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	1.00	0.00	-5.30
Ovary	0	0.00	0	0.00	1	6.25	0	0.00	1	0.60	1.66	2.09
Vagina	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.14
Vulva	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.41
Urinary system	0	0.00	1	4.08	1	5.34	1	5.88	3	0.68	4.40	12.24
Urinary bladder	0	0.00	1	7.38	1	9.49	0	0.00	2	0.38	5.26	8.55
Kidney parenchyma	0	0.00	0	0.00	0	0.00	1	15.79	1	0.25	3.96	3.95
Renal pelvis, other urinary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.05	0.00	-0.26
Ureter	0	0.00	0	0.00	0	0.00	0	0.00	0	0.01	0.00	-0.08
Bone, joints	0	0.00	0	0.00	0	0.00	1	245.25*	1	0.02	59.50	5.19
Soft tissue including heart	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.35
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0.00	-0.02
Melanoma of skin	2	44.43*	0	0.00	1	9.98	0	0.00	3	0.37	8.10*	13.88
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.12
Brain, central nervous system	0	0.00	0	0.00	0	0.00	0	0.00	0	0.17	0.00	-0.90
Thyroid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.20	0.00	-1.06
Lymphatic, hematopoietic	0	0.00	0	0.00	0	0.00	1	3.64	1	1.11	0.90	-0.57
Hodgkin lymphoma	0	0.00	0	0.00	0	0.00	1	87.92*	1	0.05	20.95	5.03
Non-Hodgkin lymphoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.54	0.00	-2.87
Myeloma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.19	0.00	-1.01
Leukemia	0	0.00	0	0.00	0	0.00	0	0.00	0	0.33	0.00	-1.72
Acute lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.09
Chronic lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.62
Acute non-lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.63
Chronic myeloid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.05	0.00	-0.24

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000.

Table 15.2.4: Risk of subsequent primary cancers after cancer of the adrenal gland excluding neuroblastoma, males, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	8	3.78*	12	2.10*	8	1.74	8	1.68	36	17.20	2.09*	121.86
All excluding same site	8	3.78*	12	2.10*	7	1.52	8	1.68	35	17.19	2.04*	115.42
Buccal cavity, pharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.58	0.00	-3.76
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.57
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.77
Salivary gland	0	0.00	0	0.00	0	0.00	0	0.00	0	0.04	0.00	-0.27
Mouth	0	0.00	0	0.00	0	0.00	0	0.00	0	0.14	0.00	-0.90
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.16
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.41
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.12
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.42
Digestive system	2	4.44	1	0.84	1	1.11	3	3.22	7	3.48	2.01	22.82
Esophagus	0	0.00	0	0.00	0	0.00	0	0.00	0	0.25	0.00	-1.61
Stomach	0	0.00	1	7.29	0	0.00	0	0.00	1	0.39	2.59	3.98
Small intestine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.36
Colon	0	0.00	0	0.00	0	0.00	2	5.12	2	1.43	1.40	3.70
Rectum, rectosigmoid junction	1	11.42	0	0.00	0	0.00	0	0.00	1	0.65	1.53	2.25
Anus, anal canal	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.19
Liver	0	0.00	0	0.00	0	0.00	0	0.00	0	0.16	0.00	-1.01
Gallbladder	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.16
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.45
Pancreas	1	19.18	0	0.00	0	0.00	1	9.31	2	0.40	5.00	10.37
Respiratory system	1	2.23	5	4.20*	2	2.20	0	0.00	8	3.44	2.32*	29.53
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.18
Larynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.30	0.00	-1.94
Lung, bronchus	1	2.48	5	4.66*	2	2.43	0	0.00	8	3.11	2.58*	31.72
Male breast	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.22
Male genital system	3	5.11*	4	2.43	1	0.68	3	1.91	11	5.27	2.09*	37.11
Prostate	3	5.24*	4	2.49	1	0.69	3	1.93	11	5.18	2.12*	37.71
Testis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.39
Urinary system	1	5.01	1	1.86	2	4.65	1	2.18	5	1.63	3.07	21.86
Urinary bladder	1	7.29	1	2.71	1	3.35	1	3.12	4	1.12	3.56	18.64
Kidney parenchyma	0	0.00	0	0.00	1	9.10	0	0.00	1	0.42	2.40	3.78
Renal pelvis, other urinary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.56
Ureter	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.19
Bone, joints	0	0.00	0	0.00	0	0.00	0	0.00	0	0.02	0.00	-0.12
Soft tissue including heart	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.47
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.07	0.00	-0.47
Melanoma of skin	0	0.00	0	0.00	0	0.00	0	0.00	0	0.50	0.00	-3.25
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	0.00	-0.17
Brain, central nervous system	1	36.00	0	0.00	0	0.00	0	0.00	1	0.21	4.80	5.13
Thyroid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.52
Lymphatic, hematopoietic	0	0.00	1	2.29	1	2.93	1	2.77	3	1.30	2.30	11.01
Hodgkin lymphoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.39
Non-Hodgkin lymphoma	0	0.00	0	0.00	1	6.48	0	0.00	1	0.59	1.69	2.65
Myeloma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.21	0.00	-1.35
Leukemia	0	0.00	1	6.72	0	0.00	1	8.29	2	0.44	4.52	10.10
Acute lymphocytic	0	0.00	0	0.00	0	0.00	1	241.65*	1	0.02	54.45	6.36
Chronic lymphocytic	0	0.00	0	0.00	0	0.00	0	0.00	0	0.18	0.00	-1.15
Acute non-lymphocytic	0	0.00	1	20.95	0	0.00	0	0.00	1	0.14	6.99	5.55
Chronic myeloid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.39

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000.

Thymus Both Sexes

Table 15.3.1: Characteristics of patients with an initial cancer of the thymus, both sexes, SEER 1973-2000.

Characteristics	Males		Females		Total	
	No.	%	No.	%	No.	%
Number of patients with 1st primary cancer						
Total	545	100.0	418	100.0	963	100.0
Initial treatment						
Any radiation	372	68.3	286	68.4	658	68.3
With surgery	259	47.5	191	45.7	450	46.7
Without surgery	113	20.7	95	22.7	208	21.6
No radiation	173	31.7	132	31.6	305	31.7
With surgery	117	21.5	90	21.5	207	21.5
Without surgery	56	10.3	42	10.0	98	10.2
Race						
White	385	70.6	287	68.7	672	69.8
Black	63	11.6	64	15.3	127	13.2
Other	96	17.6	62	14.8	158	16.4
Unknown	1	0.2	5	1.2	6	0.6
Age at 1st primary cancer diagnosis, years						
< 30	47	8.6	30	7.2	77	8.0
30–49	181	33.2	116	27.8	297	30.8
50–69	236	43.3	176	42.1	412	42.8
70–79	65	11.9	72	17.2	137	14.2
≥ 80	16	2.9	24	5.7	40	4.2
Number of patients with one or more primary cancers						
One primary cancer only	496	91.0	386	92.3	882	91.6
1st and 2nd cancers	43	7.9	30	7.2	73	7.6
1st, 2nd, and 3rd cancers	5	0.9	1	0.2	6	0.6
1st, 2nd, 3rd, and additional cancers	1	0.2	1	0.2	2	0.2
Other statistics						
Median age at 1st cancer diagnosis	53.5	—	57.2	—	55.3	—
Median year of 1st cancer diagnosis	1990.0	—	1991.2	—	1990.5	—
Median person-years at risk	3.8	—	3.5	—	3.7	—
Percent histologically confirmed*						
Both 1st and 2nd cancers	—	100.0	—	96.9	—	98.8
1st, 2nd, and additional cancers	—	100.0	—	96.9	—	98.8
1st cancer only	—	0.0	—	0.0	—	0.0

*Percent histologically confirmed among patients who developed a subsequent primary cancer.

Table 15.3.2: Risk of subsequent primary cancers after cancer of the thymus, both sexes, SEER 1973-2000.

Subsequent primary cancer	Years after first primary cancer diagnosis											
	<1 year		1-4 years		5-9 years		≥10 years		Total			
	O	O/E	O	O/E	O	O/E	O	O/E	O	E	O/E	EAR
All subsequent cancers	9	1.30	34	1.45*	30	1.79*	18	1.46	91	59.55	1.53*	59.59
All excluding same site	9	1.30	34	1.45*	30	1.79*	18	1.46	91	59.52	1.53*	59.65
Buccal cavity, pharynx	0	0.00	0	0.00	2	4.47	0	0.00	2	1.62	1.23	0.72
Lip	0	0.00	0	0.00	0	0.00	0	0.00	0	0.19	0.00	-0.36
Tongue	0	0.00	0	0.00	0	0.00	0	0.00	0	0.33	0.00	-0.63
Salivary gland	0	0.00	0	0.00	2	54.22*	0	0.00	2	0.14	14.76*	3.53
Mouth	0	0.00	0	0.00	0	0.00	0	0.00	0	0.42	0.00	-0.79
Nasopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.11	0.00	-0.20
Tonsil	0	0.00	0	0.00	0	0.00	0	0.00	0	0.16	0.00	-0.31
Oropharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.05	0.00	-0.09
Hypopharynx	0	0.00	0	0.00	0	0.00	0	0.00	0	0.17	0.00	-0.33
Digestive system	2	1.31	8	1.55	8	2.18	6	2.23	24	13.04	1.84*	20.77
Esophagus	0	0.00	0	0.00	1	4.97	2	14.98*	3	0.71	4.23	4.34
Stomach	0	0.00	2	3.42	3	7.61*	0	0.00	5	1.43	3.50*	6.77
Small intestine	1	44.70	0	0.00	0	0.00	0	0.00	1	0.20	5.04	1.52
Colon	0	0.00	2	0.92	3	1.90	3	2.50	8	5.59	1.43	4.56
Rectum, rectosigmoid junction	0	0.00	3	3.38	0	0.00	0	0.00	3	2.21	1.36	1.50
Anus, anal canal	0	0.00	0	0.00	0	0.00	0	0.00	0	0.13	0.00	-0.25
Liver	0	0.00	1	4.10	1	5.84	1	8.47	3	0.60	4.97	4.54
Gallbladder	1	47.11	0	0.00	0	0.00	0	0.00	1	0.17	5.81	1.57
Bile ducts, other biliary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.30	0.00	-0.56
Pancreas	0	0.00	0	0.00	0	0.00	0	0.00	0	1.56	0.00	-2.96
Respiratory system	2	1.64	4	0.96	4	1.37	5	2.43	15	10.38	1.45	8.76
Nose, nasal cavity, ear	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.18
Larynx	0	0.00	1	3.39	1	5.10	0	0.00	2	0.70	2.86	2.46
Lung, bronchus	2	1.79	3	0.78	3	1.11	5	2.62	13	9.56	1.36	6.52
Female breast	1	1.22	4	1.50	1	0.53	0	0.00	6	6.69	0.90	-3.02
Female genital system	0	0.00	1	0.85	1	1.24	1	1.88	3	2.87	1.04	0.55
Cervix uteri	0	0.00	0	0.00	0	0.00	0	0.00	0	0.40	0.00	-1.73
Corpus uteri	0	0.00	0	0.00	1	2.54	1	3.81	2	1.40	1.43	2.60
Ovary	0	0.00	1	2.95	0	0.00	0	0.00	1	0.84	1.18	0.68
Vagina	0	0.00	0	0.00	0	0.00	0	0.00	0	0.04	0.00	-0.19
Vulva	0	0.00	0	0.00	0	0.00	0	0.00	0	0.12	0.00	-0.52
Male genital system	2	1.68	4	0.93	5	1.57	4	1.57	15	11.21	1.34	12.73
Prostate	2	1.71	4	0.95	5	1.60	4	1.59	15	11.03	1.36	13.34
Testis	0	0.00	0	0.00	0	0.00	0	0.00	0	0.11	0.00	-0.36
Urinary system	0	0.00	2	1.16	1	0.81	1	1.03	4	4.42	0.90	-0.80
Urinary bladder	0	0.00	1	0.89	1	1.23	1	1.52	3	2.92	1.03	0.16
Kidney parenchyma	0	0.00	1	2.03	0	0.00	0	0.00	1	1.24	0.81	-0.45
Renal pelvis, other urinary	0	0.00	0	0.00	0	0.00	0	0.00	0	0.27	0.00	-0.51
Ureter	0	0.00	0	0.00	0	0.00	0	0.00	0	0.09	0.00	-0.16
Bone, joints	0	0.00	0	0.00	0	0.00	0	0.00	0	0.06	0.00	-0.11
Soft tissue including heart	0	0.00	1	9.90	1	14.25	0	0.00	2	0.25	7.89	3.31
Kaposi sarcoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.14	0.00	-0.27
Melanoma of skin	0	0.00	1	1.85	1	2.64	0	0.00	2	1.39	1.44	1.15
Eye, orbit	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0.00	-0.15
Brain, central nervous system	0	0.00	0	0.00	1	5.75	0	0.00	1	0.63	1.58	0.69
Thyroid	0	0.00	2	10.58*	0	0.00	0	0.00	2	0.45	4.46	2.94
Lymphatic, hematopoietic	2	3.89	7	4.02*	5	4.02*	1	1.06	15	4.45	3.37*	20.00
Hodgkin lymphoma	0	0.00	0	0.00	0	0.00	0	0.00	0	0.17	0.00	-0.32
Non-Hodgkin lymphoma	2	8.42	3	3.72	4	6.86*	1	2.21	10	2.08	4.81*	15.01
Myeloma	0	0.00	1	3.32	0	0.00	0	0.00	1	0.77	1.30	0.44
Leukemia	0	0.00	3	5.36*	1	2.53	0	0.00	4	1.43	2.80	4.88
Acute lymphocytic	0	0.00	0	0.00	1	76.15	0	0.00	1	0.05	20.57	1.80
Chronic lymphocytic	0	0.00	1	4.79	0	0.00	0	0.00	1	0.54	1.87	0.88
Acute non-lymphocytic	0	0.00	2	10.20*	0	0.00	0	0.00	2	0.50	3.99	2.84
Chronic myeloid	0	0.00	0	0.00	0	0.00	0	0.00	0	0.20	0.00	-0.39

*P < 0.05. Notes: See Appendices for definitions of cancer sites and "all excluding same site." Abbreviations: O = observed number of subsequent (2nd, 3rd, etc.) primary cancers; E = expected number of subsequent primary cancers; O/E = ratio of observed to expected cancers; PYR = person-years at risk; EAR = excess absolute risk per 10,000 person-years = [(O-E)/PYR] × 10,000. EAR for female cancers is based on 2,302 PYR and for male cancers on 2,976 PYR.

