

Table S1: Factors included in variable selection procedure for relative risk models.

Variable	Type	Which models	Cohort only
Gender	Categorical	M1,M2,M3	No
Race (White, Other)	Categorical	M1,M2,M3	Yes
Body mass index	Continuous	M1,M2,M3	Yes
Type of first cancer (9 types)	Categorical	M1,M2,M3	No
Birth year after 1970	Categorical	M1,M2,M3	No
Age at FPC diagnosis <15	Categorical	M1,M2,M3	No
Medical visits	Continuous	M1,M2,M3	Yes
Smoking status	Categorical	M1,M2,M3	Yes
Thyroid medication	Categorical	M1,M2,M3	Yes
Thyroid conditions (4 types)	Categorical	M1,M2,M3	Yes
Thyroid nodules	Categorical	M1,M2,M3	Yes
Hormonal conditions (3 types)	Categorical	M1,M2,M3	Yes
Reproductive conditions (3 types)	Categorical	M1,M2,M3	Yes
Family history of cancer (4 types)	Categorical	M1,M2,M3	Yes
Radiation for FPC	Categorical	M2,M3	No
Body regions irradiated in treating FPC (11 regions)	Categorical	M2, M3	Yes
Chemotherapy for FPC (6 types)	Categorical	M2,M3	No
Reconstructed radiation dose to thyroid in treating FPC	Continuous	M3	No

FPC, first primary cancer

Table S2: Number (%) of differentiated subtypes of second primary thyroid cancer.

Subtype	CCSS (n=124)	LESG (n=22)	Nordic (n=13)	CCSS-France (n=39)
Papillary	103 (83)	19 (86)	9 (69)	34 (87)
Follicular	13 (10.5)	3 (14)	3 (23)	2 (5)
Unspecified	7 (5.6)	0	0	0
Other	1 (0.9)	0	1 (8)	3 (8)

Table S3: Multivariable-adjusted relative risks (95% CI) for second primary thyroid cancer competing events (minimum time to other second primary cancer, thyroid removal, or death) [n=12150, event=2483].

Risk factor	M1	M2	M3
Birth year after 1970	0.70 (0.61, 0.76)	0.74 (0.66, 0.82)	0.73 (0.66, 0.82)
Age at FPC < 15 years	0.84 (0.76, 0.95)	0.81 (0.73, 0.90)	0.81 (0.73, 0.90)
Hodgkin lymphoma FPC	1.74 (1.57, 1.92)		
Female	0.99 (0.93, 1.09)	1.04 (0.96, 1.13)	1.04 (0.96, 1.13)
Thyroid nodules (in lifetime) ^a	1.69 (1.33, 2.15)	1.44 (1.13, 1.83)	1.45 (1.14, 1.85)
Any alkylating agent for FPC ^b		1.60 (1.48, 1.74)	1.65 (1.52, 1.80)
Any radiation for FPC ^b		2.06 (1.82, 2.32)	2.27 (2.02, 2.54)
Radiation to neck ^b		1.77 (1.62, 1.94)	
Radiation > 20 Gray			1.62 (1.47, 1.78)

FPC, first primary cancer

a Self-reported 'Yes'; 12-month incident nodule diagnoses excluded

b Within 10 years of FPC

Table S4: Pooled multivariable-adjusted relative risk estimates (95% CI) for M1 with multiple imputation for missing data[†] compared to estimated in the CCSS cohort only.

Risk factor	Pooled (CCSS, LESG, Nordic) [§]	CCSS only
Birth year after 1970	1.54 (1.00, 2.37)	1.50 (0.98, 2.30)
Age at FPC < 15 years	2.78 (1.53, 5.06)	2.93 (1.49, 5.41)
Hodgkin lymphoma FPC	2.58 (1.71, 3.91)	2.52 (1.62, 3.92)
Female	1.99 (1.39, 2.86)	2.11 (1.43, 3.12)
Thyroid nodules (in lifetime) ^a	10.81 (6.51, 17.98)	11.06 (6.79, 18.01)

FPC, first primary cancer

† Thyroid nodules, neck radiation, and birth year (LESG only)

§ Mean and 95% CIs were based on 100 imputed datasets

a Self-reported 'Yes'; 12-month incident nodule diagnoses excluded

Table S5: Pooled multivariable-adjusted relative risk estimates (95% CI) for M2 with multiple imputation for missing data[†] compared to estimated in the CCSS cohort only.

Risk factor	Pooled (CCSS, LESG, Nordic) [§]	CCSS only
Birth year after 1970	1.67 (1.05, 2.64)	1.69 (1.12, 2.56)
Age at FPC < 15 years	3.17 (1.63, 6.16)	3.05 (1.66, 5.59)
Female	2.28 (1.56, 3.32)	2.32 (1.57, 3.42)
Thyroid nodules (in lifetime) ^a	6.83 (4.06, 11.48)	7.05 (4.39, 11.33)
Any alkylating agent for FPC ^b	1.56 (1.07, 2.28)	1.63 (1.11, 2.38)
Any radiation for FPC ^b	1.92 (0.92, 4.02)	1.39 (0.70, 2.79)
Radiation to neck ^b	5.57 (3.33, 9.33)	6.03 (3.76, 9.68)

FPC, first primary cancer

† Thyroid nodules, neck radiation, and birth year (LESG only)

§ Mean and 95% CIs were based on 100 imputed datasets

a Self-reported 'Yes'; 12-month incident nodule diagnoses excluded

b Within 10 years of FPC

Table S6: Pooled multivariable-adjusted relative risk estimates for (95% CI) M3 with multiple imputation for missing data[†] compared to estimated in the CCSS cohort only.

Risk factor	Pooled (CCSS, LESG, Nordic) [§]	CCSS only
Birth year after 1970	1.77 (1.08, 2.90)	1.68 (1.07, 2.63)
Female	2.12 (1.34, 3.37)	2.26 (1.60, 3.19)
Thyroid nodules (in lifetime) ^a	8.22 (4.59, 14.74)	7.89 (4.77, 13.03)
Any alkylating agent for FPC ^b	1.49 (1.08, 2.06)	1.56 (1.01, 2.39)
Radiation dose (linear term)		
By age at FPC		
< 5 years	1.58 (0.58, 4.32)	1.57 (0.70, 3.59)
5-9 years	1.66 (0.85, 3.26)	1.44 (0.54, 3.87)
10-14 years	2.33 (1.10, 4.94)	1.97 (0.87, 4.46)
≥ 15 years	0.87 (0.34, 2.22)	0.48 (0.22, 1.05)
Radiation dose (exp. term)	-0.060 (-0.043, -0.085)	-0.054 (-0.041, -0.072)

FPC, first primary cancer

[†] Thyroid nodules, neck radiation, and birth year (LESG only)

[§] Mean and 95% CIs were based on 100 imputed datasets

^a Self-reported ‘Yes’; 12-month incident nodule diagnoses excluded

^b Within 10 years of FPC

Table S7: Distribution, No. (%), of reconstructed radiation absorbed dose to thyroid gland in model development (n=12150) and validation (n=2966) data sets.

Exposure group	Model development (CCSS, LESG, Nordic)	Validation CCSS-France
None	4020 (33.1)	881 (29.7)
Dose ^a , Gy		
< 0.5	2098 (17.3)	892 (30.1)
0.5-4.99	2894 (23.8)	645 (21.7)
5 - 9.99	252 (2.1)	143 (4.8)
10 - 19.99	785 (6.5)	174 (5.9)
20 - 39.99	1372 (11.3)	188 (6.3)
40+	729 (6.0)	43 (1.4)

^a a Wilcoxon test p-value of difference between groups < 0.001