Supplementary Material

Supplementary Table 1. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** (n=22612) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 2. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall solid cancer incidence** (n=20805) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 3. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** (n=22560) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 4. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **cutaneous squamous cell carcinoma incidence** (n=2792) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 5. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **melanoma incidence** (n=1198) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 6. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** (n=9252) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 7. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+)** (n=5905) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 8. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER−)** (n=1521) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 9. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (PR+)** (n=4826) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 10. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (PR−)** (n=2379) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 11. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+/PR+)** (n=4634) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 12. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+/PR-)** (n=1086) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 13. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER-/PR-)** (n=1287) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 14. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** (n=1215) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 15. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **colorectal cancer incidence** (n=2394) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 16. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **bladder cancer incidence** (n=596) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 17. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **kidney cancer incidence** (n=477) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 18. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **lung cancer incidence** (n=2623) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 19. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **brain cancer incidence** (n=277) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 20. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall hematopoietic cancer incidence** (n=1807) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 21. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall non-Hodgkin lymphoma incidence** (n=1277) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 22. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **T-cell lymphoma incidence** (n=51) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 23. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **diffuse large B-cell lymphoma incidence** (n=190) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 24. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **follicular lymphoma incidence** (n=204) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 25. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **chronic lymphocytic leukemia/small lymphocytic lymphoma incidence** (n=272) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 26. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **Hodgkin lymphoma incidence** (n=70) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 27. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **multiple myeloma incidence** (n=274) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 28. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **myeloid leukemias incidence** (n=170) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 29. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **cancer-related death** (n=4860) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Supplementary Table 30. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 31. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 32. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 33. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 34. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 35. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 36. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 37. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Supplementary Table 38. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Supplementary Table 39. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Supplementary Table 40. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Supplementary Table 41. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Supplementary Table 42. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Supplementary Figure 10. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (PR−) incidence

Supplementary Figure 11. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER+/PR+) incidence

Supplementary Figure 12. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER+/PR−) incidence

Supplementary Figure 13. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER−/PR−) incidence

Supplementary Figure 14. Dose-response relationship between cumulative dose of personal permanent hair dye use and ovarian cancer incidence

Supplementary Figure 15. Dose-response relationship between cumulative dose of personal permanent hair dye use and colorectal cancer incidence

Supplementary Figure 16. Dose-response relationship between cumulative dose of personal permanent hair dye use and bladder cancer incidence

Supplementary Figure 17. Dose-response relationship between cumulative dose of personal permanent hair dye use and kidney cancer incidence

Supplementary Figure 18. Dose-response relationship between cumulative dose of personal permanent hair dye use and lung cancer incidence

Supplementary Figure 19. Dose-response relationship between cumulative dose of personal permanent hair dye use and brain cancer incidence

Supplementary Figure 20. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall hematopoietic cancer incidence

Supplementary Figure 21. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall non-Hodgkin lymphoma incidence

Supplementary Figure 22. Dose-response relationship between cumulative dose of personal permanent hair dye use and T-cell lymphoma incidence

Supplementary Figure 23. Dose-response relationship between cumulative dose of personal permanent hair dye use and diffuse large B-cell lymphoma incidence

Supplementary Figure 24. Dose-response relationship between cumulative dose of personal permanent hair dye use and follicular lymphoma incidence

Supplementary Figure 25. Dose-response relationship between cumulative dose of personal permanent hair dye use and chronic lymphocytic leukemia/small lymphocytic lymphoma incidence

Supplementary Table 1. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** (n=22612) * among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

All cancers *	Any hair color [a] (n=22612)			Dark hair color [b,d] (n=8389)			Light hair color [c,d] (n=9417)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
Ever-user	9367	1.01 (0.99-1.04)	0.98 (0.96-1.01)	3322	1.02 (0.98-1.07)	1.00 (0.96-1.05)	4283	1.00 (0.96-1.04)	0.98 (0.94-1.02)
Duration of use									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
<5 years	3626	1.01 (0.97-1.04)	0.98 (0.94-1.02)	1351	1.03 (0.97-1.10)	1.01 (0.95-1.08)	1539	0.98 (0.93-1.04)	0.96 (0.91-1.02)
5-9 years	2254	1.04 (1.00-1.09)	1.01 (0.97-1.06)	869	1.04 (0.96-1.11)	1.02 (0.95-1.09)	963	1.01 (0.94-1.09)	1.00 (0.93-1.07)
≥10 years	3487	1.01 (0.97-1.05)	0.97 (0.94-1.01)	1102	1.00 (0.94-1.07)	0.98 (0.91-1.04)	1781	1.01 (0.95-1.06)	0.99 (0.93-1.04)
P-value for trend		.45	.30		.84	.57		.70	.78
Frequency of use									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
Every ≥5 weeks	4102	1.03 (0.99-1.07)	0.98 (0.95-1.02)	1515	1.04 (0.99-1.11)	1.02 (0.96-1.08)	2052	1.00 (0.95-1.06)	0.98 (0.93-1.03)
Every 1-4 weeks	5265	1.00 (0.97-1.04)	0.98 (0.95-1.02)	1807	1.00 (0.95-1.06)	0.99 (0.94-1.04)	2231	1.00 (0.95-1.05)	0.98 (0.93-1.03)
P-value for trend		.79	.34		.81	.71		.87	.42
Cumulative dose [g]									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
1-99 times	4492	1.01 (0.98-1.05)	0.98 (0.94-1.01)	1678	1.05 (0.99-1.11)	1.02 (0.96-1.08)	1988	0.97 (0.92-1.02)	0.95 (0.90-1.00)
100-199 times	2393	1.01 (0.97-1.06)	0.98 (0.94-1.03)	904	1.01 (0.94-1.09)	0.99 (0.92-1.06)	1109	0.99 (0.93-1.06)	0.98 (0.92-1.05)
≥200 times	2482	1.02 (0.98-1.07)	1.00 (0.96-1.05)	740	0.98 (0.91-1.06)	0.97 (0.90-1.05)	1186	1.05 (0.99-1.12)	1.03 (0.97-1.10)
P-value for trend [h]		.34	.94		.81	.47		.14	.36
Per 50-time increment		1.00 (1.00-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (1.00-1.01)
P-value for trend [i]		.84	.74		.66	.44		.31	.59
Age at first use									

Non-user	13245			5067			5134		
<30 years	4930	1 [Reference]	1 [Reference]	1819	1 [Reference]	1 [Reference]	2103	1 [Reference]	1 [Reference]
≥30 years	4437	1.01 (0.97-1.06)	1.00 (0.96-1.05)	1503	1.02 (0.94-1.10)	1.02 (0.95-1.11)	2180	0.95 (0.89-1.02)	0.95 (0.88-1.01)
Time since first use									
Non-user	13245			5067			5134		
<30 years	3662	1 [Reference]	1 [Reference]	1166	1 [Reference]	1 [Reference]	1818	1 [Reference]	1 [Reference]
≥30 years	5705	0.98 (0.93-1.03)	0.99 (0.94-1.04)	2156	1.02 (0.94-1.12)	1.05 (0.96-1.14)	2465	0.90 (0.84-0.97)	0.92 (0.85-0.99)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 2. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall solid cancer incidence** (n=20805) * among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

All solid cancers *	Any hair color [a] (n=20805)			Dark hair color [b,d] (n=7648)			Light hair color [c,d] (n=8708)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	12178	1 [Reference]	1 [Reference]	4630	1 [Reference]	1 [Reference]	4732	1 [Reference]	1 [Reference]
Ever-user	8627	1.02 (0.99-1.04)	0.98 (0.96-1.01)	3018	1.02 (0.97-1.06)	0.99 (0.95-1.04)	3976	1.00 (0.96-1.05)	0.98 (0.94-1.02)
Duration of use									
Non-user	12178	1 [Reference]	1 [Reference]	4630	1 [Reference]	1 [Reference]	4732	1 [Reference]	1 [Reference]
<5 years	3349	1.01 (0.97-1.05)	0.98 (0.94-1.02)	1229	1.03 (0.96-1.09)	1.01 (0.94-1.07)	1431	0.99 (0.93-1.05)	0.96 (0.91-1.02)
5-9 years	2068	1.04 (0.99-1.09)	1.01 (0.96-1.06)	789	1.03 (0.95-1.11)	1.01 (0.93-1.09)	887	1.01 (0.94-1.09)	0.99 (0.92-1.07)
≥10 years	3210	1.01 (0.97-1.05)	0.97 (0.94-1.01)	1000	0.99 (0.93-1.06)	0.97 (0.90-1.04)	1658	1.02 (0.96-1.07)	0.99 (0.94-1.05)
P-value for trend		.44	.27		1.00	.41		.53	.91
Frequency of use									
Non-user	12178	1 [Reference]	1 [Reference]	4630	1 [Reference]	1 [Reference]	4732	1 [Reference]	1 [Reference]
Every ≥5 weeks	3767	1.03 (0.99-1.07)	0.98 (0.94-1.02)	1371	1.03 (0.97-1.10)	1.01 (0.95-1.07)	1904	1.01 (0.95-1.06)	0.98 (0.93-1.03)
Every 1-4 weeks	4860	1.01 (0.97-1.04)	0.99 (0.95-1.02)	1647	1.00 (0.95-1.06)	0.98 (0.93-1.04)	2072	1.00 (0.95-1.06)	0.98 (0.93-1.04)
P-value for trend		.64	.40		.93	.58		.93	.53
Cumulative dose [g]									
Non-user	12178	1 [Reference]	1 [Reference]	4630	1 [Reference]	1 [Reference]	4732	1 [Reference]	1 [Reference]
1-99 times	4123	1.01 (0.97-1.05)	0.97 (0.94-1.01)	1512	1.03 (0.97-1.09)	1.00 (0.95-1.06)	1846	0.98 (0.93-1.03)	0.95 (0.90-1.00)
100-199 times	2221	1.02 (0.98-1.07)	0.99 (0.95-1.04)	841	1.03 (0.95-1.11)	1.01 (0.93-1.08)	1020	0.99 (0.92-1.06)	0.97 (0.91-1.04)
≥200 times	2283	1.02 (0.98-1.07)	1.00 (0.96-1.05)	665	0.97 (0.89-1.05)	0.96 (0.88-1.04)	1110	1.07 (1.00-1.14)	1.05 (0.98-1.12)
P-value for trend [h]		.26	.99		.72	.38		.08	.25
Per 50-time increment		1.00 (1.00-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (1.00-1.01)
P-value for trend [i]		.86	.64		.62	.39		.27	.59
Age at first use									

Non-user	12178			4630			4732	
<30 years	4518	1 [Reference]	1 [Reference]	1642	1 [Reference]	1 [Reference]	1945	1 [Reference]	1 [Reference]
≥30 years	4109	1.02 (0.98-1.07)	1.01 (0.96-1.06)	1376	1.03 (0.95-1.12)	1.04 (0.96-1.13)	2031	0.96 (0.89-1.03)	0.95 (0.89-1.02)
Time since first use								
Non-user	12178			4630			4732	
<30 years	3342	1 [Reference]	1 [Reference]	1040	1 [Reference]	1 [Reference]	1684	1 [Reference]	1 [Reference]
≥30 years	5285	0.97 (0.92-1.03)	0.99 (0.94-1.05)	1978	1.03 (0.94-1.13)	1.05 (0.96-1.15)	2292	0.89 (0.83-0.96)	0.91 (0.84-0.98)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 3. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** (n=22560) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Basal cell carcinoma	Any hair color [a] (n=22560)			Dark hair color [b,d] (n=7737)			Light hair color [c,d] (n=11334)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
Ever-user	10024	1.15 (1.12-1.18)	1.05 (1.02-1.08)	3199	1.10 (1.05-1.15)	1.01 (0.96-1.06)	5443	1.11 (1.07-1.15)	1.06 (1.02-1.11)
Duration of use									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
<5 years	3842	1.12 (1.08-1.16)	1.05 (1.01-1.09)	1275	1.07 (1.01-1.14)	1.01 (0.95-1.08)	1972	1.09 (1.04-1.15)	1.06 (1.01-1.12)
5-9 years	2257	1.10 (1.05-1.15)	1.01 (0.97-1.06)	781	1.03 (0.96-1.12)	0.96 (0.89-1.04)	1201	1.10 (1.03-1.17)	1.05 (0.98-1.12)
≥10 years	3925	1.21 (1.16-1.25)	1.07 (1.03-1.11)	1143	1.17 (1.09-1.25)	1.05 (0.98-1.12)	2270	1.14 (1.08-1.19)	1.07 (1.02-1.13)
P-value for trend		<0.001	.003		<0.001	.37		<0.001	.008
Frequency of use									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
Every ≥5 weeks	4517	1.19 (1.15-1.23)	1.06 (1.02-1.10)	1401	1.07 (1.01-1.14)	0.99 (0.93-1.06)	2688	1.14 (1.09-1.20)	1.10 (1.04-1.15)
Every 1-4 weeks	5507	1.11 (1.08-1.15)	1.04 (1.01-1.08)	1798	1.11 (1.05-1.18)	1.02 (0.97-1.08)	2755	1.08 (1.03-1.13)	1.04 (0.99-1.09)
P-value for trend		<0.001	.01		<0.001	.45		<0.001	.14
Cumulative dose [g]									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
1-99 times	4808	1.14 (1.10-1.18)	1.05 (1.02-1.09)	1526	1.05 (0.99-1.11)	0.98 (0.93-1.05)	2645	1.13 (1.08-1.18)	1.09 (1.04-1.15)
100-199 times	2605	1.16 (1.11-1.21)	1.04 (1.00-1.09)	895	1.12 (1.04-1.20)	1.03 (0.96-1.11)	1387	1.09 (1.03-1.16)	1.03 (0.97-1.10)
≥200 times	2611	1.15 (1.10-1.20)	1.05 (1.00-1.09)	778	1.17 (1.09-1.27)	1.04 (0.96-1.13)	1411	1.11 (1.04-1.17)	1.04 (0.98-1.11)
P-value for trend [h]		<0.001	.03		<0.001	.25		<0.001	.23
Per 50-time increment		1.01 (1.01-1.01)	1.00 (1.00-1.01)		1.01 (1.01-1.02)	1.00 (1.00-1.01)		1.01 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		<0.001	.40		<0.001	.29		.07	.96
Age at first use									

Non-user	12536			4538			5891		
<30 years	5155	1 [Reference]	1 [Reference]	1806	1 [Reference]	1 [Reference]	2596	1 [Reference]	1 [Reference]
≥30 years	4869	1.04 (0.99-1.09)	0.98 (0.93-1.03)	1393	0.93 (0.86-1.01)	0.92 (0.84-0.99)	2847	1.01 (0.95-1.08)	0.99 (0.93-1.05)
Time since first use									
Non-user	12536			4538			5891		
<30 years	3885	1 [Reference]	1 [Reference]	1141	1 [Reference]	1 [Reference]	2153	1 [Reference]	1 [Reference]
≥30 years	6139	0.97 (0.92-1.02)	0.98 (0.93-1.04)	2058	0.94 (0.86-1.03)	0.99 (0.91-1.09)	3290	0.97 (0.91-1.04)	1.00 (0.93-1.06)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index; UV: ultraviolet

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 4. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **cutaneous squamous cell carcinoma incidence** (n=2792) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Cutaneous squamous cell carcinoma	Any hair color [a] (n=2792)			Dark hair color [b,d] (n=959)			Light hair color [c,d] (n=1375)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	1581	1 [Reference]	1 [Reference]	558	1 [Reference]	1 [Reference]	747	1 [Reference]	1 [Reference]
Ever-user	1211	1.10 (1.02-1.18)	1.00 (0.93-1.09)	401	1.11 (0.98-1.27)	1.02 (0.89-1.16)	628	1.01 (0.90-1.12)	0.95 (0.85-1.06)
Duration of use									
Non-user	1581	1 [Reference]	1 [Reference]	558	1 [Reference]	1 [Reference]	747	1 [Reference]	1 [Reference]
<5 years	475	1.09 (0.99-1.21)	1.02 (0.91-1.13)	156	1.07 (0.90-1.28)	0.99 (0.82-1.19)	240	1.04 (0.90-1.21)	1.01 (0.86-1.17)
5-9 years	277	1.05 (0.93-1.20)	0.99 (0.86-1.13)	95	0.99 (0.80-1.24)	0.94 (0.75-1.17)	154	1.10 (0.92-1.31)	1.01 (0.84-1.21)
≥10 years	459	1.13 (1.02-1.26)	1.00 (0.89-1.12)	150	1.26 (1.05-1.51)	1.11 (0.92-1.34)	234	0.92 (0.79-1.07)	0.87 (0.75-1.01)
P-value for trend		.02	.94		.03	.40		.39	.09
Frequency of use									
Non-user	1581	1 [Reference]	1 [Reference]	558	1 [Reference]	1 [Reference]	747	1 [Reference]	1 [Reference]
Every ≥5 weeks	534	1.11 (1.00-1.22)	0.98 (0.88-1.08)	166	1.02 (0.85-1.21)	0.93 (0.78-1.12)	313	1.03 (0.91-1.18)	0.96 (0.84-1.10)
Every 1-4 weeks	677	1.09 (1.00-1.19)	1.03 (0.93-1.13)	235	1.19 (1.02-1.39)	1.08 (0.92-1.27)	315	0.98 (0.86-1.12)	0.94 (0.82-1.08)
P-value for trend		.05	.62		.03	.34		.76	.38
Cumulative dose [g]									
Non-user	1581	1 [Reference]	1 [Reference]	558	1 [Reference]	1 [Reference]	747	1 [Reference]	1 [Reference]
1-99 times	588	1.10 (1.00-1.21)	1.00 (0.90-1.11)	191	1.06 (0.89-1.25)	0.98 (0.82-1.16)	308	1.02 (0.89-1.17)	0.97 (0.85-1.12)
100-199 times	312	1.10 (0.97-1.24)	1.03 (0.91-1.17)	111	1.12 (0.91-1.38)	1.04 (0.84-1.28)	169	1.05 (0.89-1.24)	1.00 (0.84-1.19)
≥200 times	311	1.10 (0.97-1.24)	0.98 (0.86-1.12)	99	1.23 (0.99-1.53)	1.07 (0.86-1.34)	151	0.93 (0.78-1.11)	0.86 (0.72-1.03)
P-value for trend [h]		.08	.92		.04	.51		.61	.15
Per 50-time increment		1.01 (1.00-1.02)	1.00 (0.99-1.01)		1.01 (1.00-1.03)	1.01 (0.99-1.03)		0.99 (0.97-1.01)	0.98 (0.96-1.00)
P-value for trend [i]		.21	.96		.05	.36		.35	.09
Age at first use									

	N			N cases			N cases		
Non-user	1581			558			747		
<30 years	605	1 [Reference]	1 [Reference]	214	1 [Reference]	1 [Reference]	300	1 [Reference]	1 [Reference]
≥30 years	606	1.12 (0.99-1.27)	1.03 (0.90-1.17)	187	1.07 (0.86-1.34)	1.07 (0.85-1.34)	328	1.04 (0.87-1.24)	0.99 (0.82-1.18)
Time since first use									
Non-user	1581			558			747		
<30 years	605	1 [Reference]	1 [Reference]	199	1 [Reference]	1 [Reference]	302	1 [Reference]	1 [Reference]
≥30 years	606	1.03 (0.91-1.18)	1.06 (0.92-1.21)	202	0.93 (0.74-1.17)	0.98 (0.77-1.24)	326	1.11 (0.93-1.32)	1.16 (0.96-1.39)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index; UV: ultraviolet

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 5. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **melanoma incidence** (n=1198) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Melanoma	Any hair color [a] (n=1198)			Dark hair color [b,d] (n=386)			Light hair color [c,d] (n=580)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	703	1 [Reference]	1 [Reference]	244	1 [Reference]	1 [Reference]	316	1 [Reference]	1 [Reference]
Ever-user	495	1.02 (0.91-1.14)	1.01 (0.89-1.14)	142	0.92 (0.75-1.14)	0.93 (0.75-1.16)	264	0.98 (0.83-1.16)	1.00 (0.84-1.19)
Duration of use									
Non-user	703	1 [Reference]	1 [Reference]	244	1 [Reference]	1 [Reference]	316	1 [Reference]	1 [Reference]
<5 years	214	1.09 (0.94-1.27)	1.11 (0.94-1.31)	60	0.93 (0.70-1.23)	0.92 (0.68-1.24)	115	1.15 (0.92-1.42)	1.20 (0.96-1.51)
5-9 years	113	0.98 (0.80-1.20)	0.94 (0.76-1.17)	35	0.89 (0.62-1.27)	0.91 (0.63-1.31)	55	0.90 (0.67-1.20)	0.90 (0.66-1.22)
≥10 years	168	0.95 (0.81-1.13)	0.94 (0.78-1.13)	47	0.94 (0.69-1.30)	0.96 (0.69-1.33)	94	0.88 (0.70-1.11)	0.87 (0.68-1.10)
P-value for trend		.54	.38		.62	.73		.18	.14
Frequency of use									
Non-user	703	1 [Reference]	1 [Reference]	244	1 [Reference]	1 [Reference]	316	1 [Reference]	1 [Reference]
Every ≥5 weeks	222	1.04 (0.89-1.21)	1.03 (0.87-1.21)	65	0.92 (0.70-1.21)	0.95 (0.71-1.26)	131	1.01 (0.82-1.24)	1.03 (0.83-1.28)
Every 1-4 weeks	273	1.00 (0.87-1.15)	0.99 (0.85-1.16)	77	0.93 (0.71-1.20)	0.91 (0.70-1.20)	133	0.96 (0.78-1.18)	0.97 (0.78-1.20)
P-value for trend		.99	.93		.53	.50		.70	.78
Cumulative dose [g]									
Non-user	703	1 [Reference]	1 [Reference]	244	1 [Reference]	1 [Reference]	316	1 [Reference]	1 [Reference]
1-99 times	256	1.06 (0.92-1.23)	1.03 (0.88-1.20)	73	0.93 (0.71-1.21)	0.92 (0.70-1.21)	136	1.04 (0.85-1.27)	1.07 (0.86-1.32)
100-199 times	119	0.96 (0.79-1.17)	0.95 (0.77-1.17)	37	0.91 (0.64-1.29)	0.90 (0.63-1.29)	63	0.90 (0.68-1.18)	0.90 (0.68-1.20)
≥200 times	120	0.98 (0.81-1.19)	1.02 (0.83-1.26)	32	0.93 (0.64-1.36)	0.99 (0.67-1.44)	65	0.97 (0.74-1.27)	0.96 (0.73-1.28)
P-value for trend [h]		.75	.99		.60	.79		.62	.60
Per 50-time increment		0.99 (0.97-1.01)	0.99 (0.97-1.02)		0.99 (0.95-1.03)	1.00 (0.96-1.04)		0.99 (0.96-1.02)	0.99 (0.96-1.02)
P-value for trend [i]		.37	.59		.74	.93		.43	.42
Age at first use									

Non-user	703			244			316		
<30 years	213	1 [Reference]	1 [Reference]	70	1 [Reference]	1 [Reference]	103	1 [Reference]	1 [Reference]
≥30 years	282	1.21 (0.99-1.48)	1.13 (0.91-1.40)	72	1.09 (0.75-1.57)	1.03 (0.71-1.51)	161	1.13 (0.85-1.50)	1.19 (0.88-1.59)
Time since first use									
Non-user	703			244			316		
<30 years	179	1 [Reference]	1 [Reference]	46	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
≥30 years	316	0.97 (0.77-1.23)	0.97 (0.76-1.24)	96	0.81 (0.51-1.28)	0.76 (0.48-1.22)	167	1.06 (0.77-1.44)	1.12 (0.81-1.54)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index; UV: ultraviolet

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 6. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** (n=9252) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer	Any hair color [a] (n=9252)			Dark hair color [b,d] (n=3565)			Light hair color [c,d] (n=3902)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
Ever-user	3920	1.06 (1.01-1.10)	1.02 (0.98-1.07)	1448	1.08 (1.01-1.15)	1.06 (0.99-1.13)	1818	1.04 (0.98-1.11)	1.02 (0.96-1.09)
Duration of use									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
<5 years	1530	1.04 (0.98-1.10)	1.01 (0.95-1.07)	595	1.08 (0.98-1.18)	1.07 (0.97-1.17)	638	0.98 (0.90-1.08)	0.96 (0.87-1.05)
5-9 years	933	1.07 (1.00-1.15)	1.04 (0.97-1.12)	383	1.09 (0.98-1.22)	1.08 (0.97-1.21)	414	1.08 (0.97-1.20)	1.07 (0.96-1.19)
≥10 years	1457	1.07 (1.01-1.13)	1.03 (0.97-1.09)	470	1.06 (0.96-1.17)	1.03 (0.93-1.14)	766	1.08 (0.99-1.17)	1.06 (0.97-1.15)
P-value for trend		.01	.28		.15	.42		.04	.10
Frequency of use									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
Every ≥5 weeks	1711	1.06 (1.00-1.12)	1.02 (0.96-1.08)	657	1.08 (0.99-1.18)	1.07 (0.98-1.17)	855	1.02 (0.94-1.11)	1.00 (0.92-1.09)
Every 1-4 weeks	2209	1.05 (1.00-1.11)	1.03 (0.98-1.08)	791	1.07 (0.98-1.16)	1.05 (0.96-1.14)	963	1.06 (0.99-1.15)	1.04 (0.96-1.13)
P-value for trend		.03	.25		.10	.24		.11	.33
Cumulative dose [g]									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
1-99 times	1884	1.04 (0.98-1.09)	1.01 (0.96-1.06)	741	1.09 (1.00-1.18)	1.08 (0.99-1.18)	833	0.99 (0.91-1.07)	0.97 (0.89-1.05)
100-199 times	972	1.03 (0.96-1.10)	0.99 (0.92-1.06)	384	1.04 (0.93-1.16)	1.02 (0.91-1.14)	447	1.00 (0.90-1.11)	0.99 (0.89-1.10)
≥200 times	1064	1.12 (1.04-1.19)	1.09 (1.02-1.16)	323	1.09 (0.97-1.23)	1.05 (0.93-1.18)	538	1.19 (1.08-1.31)	1.16 (1.05-1.28)
P-value for trend [h]		.002	.04		.14	.44		.001	.006
Per 50-time increment		1.01 (1.00-1.01)	1.00 (1.00-1.01)		1.01 (1.00-1.02)	1.01 (0.99-1.02)		1.01 (1.00-1.02)	1.01 (1.00-1.02)
P-value for trend [i]		.05	.17		.14	.39		.006	.02
Age at first use									

Non-user	5332			2117			2084		
<30 years	1990	1 [Reference]	1 [Reference]	760	1 [Reference]	1 [Reference]	868	1 [Reference]	1 [Reference]
≥30 years	1930	1.02 (0.95-1.09)	1.01 (0.94-1.09)	688	1.03 (0.92-1.16)	1.05 (0.93-1.18)	950	0.95 (0.85-1.05)	0.95 (0.85-1.06)
Time since first use									
Non-user	5332			2117			2084		
<30 years	1274	1 [Reference]	1 [Reference]	416	1 [Reference]	1 [Reference]	633	1 [Reference]	1 [Reference]
≥30 years	2646	1.05 (0.96-1.13)	1.04 (0.96-1.14)	1032	1.09 (0.95-1.26)	1.12 (0.97-1.29)	1185	0.98 (0.87-1.10)	0.97 (0.86-1.09)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 7. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+)*** (n=5905) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (ER+)	Any hair color [a] (n=5905)			Dark hair color [b,d] (n=2388)			Light hair color [c,d] (n=2595)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	3401	1 [Reference]	1 [Reference]	1425	1 [Reference]	1 [Reference]	1393	1 [Reference]	1 [Reference]
Ever-user	2504	1.06 (1.00-1.11)	1.00 (0.95-1.05)	963	1.06 (0.98-1.16)	1.01 (0.93-1.10)	1202	1.03 (0.96-1.12)	1.01 (0.93-1.09)
Duration of use									
Non-user	3401	1 [Reference]	1 [Reference]	1425	1 [Reference]	1 [Reference]	1393	1 [Reference]	1 [Reference]
<5 years	990	1.04 (0.97-1.12)	1.00 (0.93-1.08)	399	1.07 (0.95-1.19)	1.04 (0.93-1.17)	432	0.99 (0.89-1.11)	0.96 (0.85-1.07)
5-9 years	598	1.08 (0.99-1.18)	1.01 (0.93-1.11)	252	1.07 (0.94-1.23)	1.02 (0.89-1.17)	280	1.10 (0.97-1.26)	1.08 (0.95-1.24)
≥10 years	916	1.06 (0.98-1.14)	0.99 (0.91-1.06)	312	1.05 (0.93-1.19)	0.97 (0.86-1.11)	490	1.03 (0.93-1.15)	1.01 (0.91-1.13)
P-value for trend		.08	.78		.31	.74		.34	.55
Frequency of use									
Non-user	3401	1 [Reference]	1 [Reference]	1425	1 [Reference]	1 [Reference]	1393	1 [Reference]	1 [Reference]
Every ≥5 weeks	1101	1.07 (1.00-1.14)	0.99 (0.92-1.06)	425	1.04 (0.94-1.16)	1.00 (0.90-1.12)	566	1.01 (0.92-1.12)	0.99 (0.89-1.09)
Every 1-4 weeks	1403	1.05 (0.98-1.12)	1.01 (0.95-1.07)	538	1.08 (0.98-1.19)	1.02 (0.92-1.14)	636	1.05 (0.96-1.16)	1.02 (0.93-1.13)
P-value for trend		.12	.82		.13	.65		.27	.63
Cumulative dose [g]									
Non-user	3401	1 [Reference]	1 [Reference]	1425	1 [Reference]	1 [Reference]	1393	1 [Reference]	1 [Reference]
1-99 times	1214	1.04 (0.98-1.12)	0.99 (0.92-1.06)	488	1.06 (0.96-1.18)	1.03 (0.93-1.15)	557	0.99 (0.89-1.09)	0.95 (0.86-1.06)
100-199 times	649	1.08 (0.99-1.17)	1.00 (0.92-1.09)	258	1.05 (0.91-1.20)	0.99 (0.86-1.14)	313	1.05 (0.93-1.19)	1.03 (0.91-1.17)
≥200 times	641	1.06 (0.97-1.15)	1.02 (0.93-1.11)	217	1.10 (0.95-1.27)	1.00 (0.86-1.16)	332	1.11 (0.98-1.25)	1.08 (0.95-1.22)
P-value for trend [h]		.08	.73		.19	.96		.08	.17
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.01 (1.00-1.02)	1.00 (0.99-1.02)		1.01 (0.99-1.02)	1.00 (0.99-1.02)
P-value for trend [i]		.69	.86		.14	.57		.31	.50
Age at first use									

Non-user	3401			1425			1393		
<30 years	1257	1 [Reference]	1 [Reference]	461	1 [Reference]	1 [Reference]	640	1 [Reference]	1 [Reference]
≥30 years	1247	1.06 (1.00-1.13)	1.01 (0.95-1.08)	502	1.08 (0.97-1.20)	1.07 (0.96-1.19)	562	1.00 (0.92-1.10)	0.99 (0.90-1.09)
Time since first use									
Non-user	3401			1425			1393		
<30 years	1644	1 [Reference]	1 [Reference]	668	1 [Reference]	1 [Reference]	762	1 [Reference]	1 [Reference]
≥30 years	860	1.09 (1.03-1.16)	1.03 (0.97-1.09)	295	1.08 (0.98-1.18)	1.05 (0.96-1.16)	440	1.05 (0.96-1.15)	1.02 (0.93-1.12)

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 8. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER−)*** (n=1521) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (ER−)	Any hair color [a] (n=1521)			Dark hair color [b,d] (n=610)			Light hair color [c,d] (n=649)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	878	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]
Ever-user	643	1.05 (0.94-1.16)	1.02 (0.92-1.14)	257	1.13 (0.96-1.33)	1.16 (0.98-1.37)	296	1.00 (0.86-1.17)	1.00 (0.85-1.17)
Duration of use									
Non-user	878	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]
<5 years	259	1.06 (0.92-1.22)	1.05 (0.91-1.21)	111	1.20 (0.97-1.49)	1.20 (0.96-1.50)	107	0.98 (0.79-1.22)	0.99 (0.79-1.23)
5-9 years	145	1.00 (0.84-1.20)	0.97 (0.81-1.16)	64	1.08 (0.83-1.41)	1.12 (0.85-1.46)	61	0.91 (0.69-1.20)	0.89 (0.67-1.18)
≥10 years	239	1.06 (0.92-1.22)	1.03 (0.89-1.20)	82	1.09 (0.85-1.39)	1.13 (0.88-1.46)	128	1.08 (0.88-1.32)	1.07 (0.87-1.32)
P-value for trend		.49	.79		.47	.30		.58	.66
Frequency of use									
Non-user	878	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]
Every ≥5 weeks	255	0.95 (0.82-1.09)	0.91 (0.79-1.05)	108	1.04 (0.84-1.29)	1.07 (0.86-1.34)	122	0.86 (0.70-1.06)	0.85 (0.69-1.05)
Every 1-4 weeks	388	1.12 (1.00-1.27)	1.12 (0.99-1.26)	149	1.21 (1.00-1.47)	1.23 (1.01-1.50)	174	1.14 (0.95-1.37)	1.14 (0.94-1.37)
P-value for trend		.06	.08		.05	.04		.17	.18
Cumulative dose [g]									
Non-user	878	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]	353	1 [Reference]	1 [Reference]
1-99 times	307	1.02 (0.89-1.16)	0.99 (0.87-1.13)	138	1.20 (0.98-1.46)	1.22 (0.99-1.49)	131	0.92 (0.75-1.13)	0.91 (0.74-1.12)
100-199 times	148	0.94 (0.79-1.12)	0.91 (0.76-1.09)	64	1.03 (0.79-1.35)	1.05 (0.80-1.38)	65	0.84 (0.65-1.10)	0.85 (0.64-1.11)
≥200 times	188	1.21 (1.03-1.42)	1.20 (1.02-1.41)	55	1.11 (0.83-1.49)	1.16 (0.86-1.55)	100	1.31 (1.05-1.64)	1.31 (1.04-1.64)
P-value for trend [h]		.06	.09		.48	.35		.06	.07
Per 50-time increment		1.01 (1.00-1.03)	1.02 (1.00-1.03)		1.01 (0.98-1.03)	1.01 (0.98-1.04)		1.02 (1.00-1.04)	1.02 (1.00-1.04)
P-value for trend [i]		.05	.03		.65	.50		.04	.03
Age at first use									

Non-user	878			353			353		
<30 years	324	1 [Reference]	1 [Reference]	128	1 [Reference]	1 [Reference]	155	1 [Reference]	1 [Reference]
≥30 years	319	1.03 (0.91-1.17)	1.00 (0.88-1.14)	129	1.15 (0.94-1.40)	1.18 (0.96-1.45)	141	0.93 (0.77-1.12)	0.93 (0.77-1.13)
Time since first use									
Non-user	878			353			353		
<30 years	466	1 [Reference]	1 [Reference]	199	1 [Reference]	1 [Reference]	201	1 [Reference]	1 [Reference]
≥30 years	177	1.02 (0.91-1.14)	0.99 (0.88-1.11)	58	1.15 (0.96-1.37)	1.17 (0.98-1.40)	95	0.93 (0.78-1.10)	0.90 (0.75-1.07)

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 9. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (PR+)*** (n=4826) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (PR+)	Any hair color [a] (n=4826)			Dark hair color [b,d] (n=1933)			Light hair color [c,d] (n=2148)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	2805	1 [Reference]	1 [Reference]	1168	1 [Reference]	1 [Reference]	1175	1 [Reference]	1 [Reference]
Ever-user	2021	1.04 (0.98-1.10)	0.97 (0.92-1.03)	765	1.04 (0.95-1.14)	0.99 (0.90-1.08)	973	0.99 (0.91-1.08)	0.96 (0.88-1.05)
Duration of use									
Non-user	2805	1 [Reference]	1 [Reference]	1168	1 [Reference]	1 [Reference]	1175	1 [Reference]	1 [Reference]
<5 years	801	1.02 (0.94-1.10)	0.96 (0.89-1.05)	321	1.04 (0.92-1.18)	1.01 (0.89-1.15)	349	0.94 (0.83-1.06)	0.90 (0.79-1.02)
5-9 years	483	1.06 (0.96-1.17)	1.00 (0.90-1.10)	197	1.04 (0.89-1.21)	0.99 (0.85-1.15)	230	1.07 (0.93-1.23)	1.06 (0.91-1.22)
≥10 years	737	1.04 (0.96-1.13)	0.97 (0.89-1.05)	247	1.03 (0.90-1.19)	0.96 (0.83-1.10)	394	0.99 (0.88-1.11)	0.97 (0.86-1.09)
P-value for trend		.22	.49		.58	.54		.88	.93
Frequency of use									
Non-user	2805	1 [Reference]	1 [Reference]	1168	1 [Reference]	1 [Reference]	1175	1 [Reference]	1 [Reference]
Every ≥5 weeks	869	1.02 (0.94-1.10)	0.93 (0.86-1.01)	329	0.99 (0.87-1.12)	0.95 (0.83-1.07)	443	0.93 (0.84-1.04)	0.91 (0.82-1.02)
Every 1-4 weeks	1152	1.05 (0.98-1.12)	1.00 (0.94-1.08)	436	1.08 (0.96-1.20)	1.02 (0.91-1.14)	530	1.04 (0.94-1.15)	1.01 (0.91-1.12)
P-value for trend		.17	.95		.21	.79		.47	.88
Cumulative dose [g]									
Non-user	2805	1 [Reference]	1 [Reference]	1168	1 [Reference]	1 [Reference]	1175	1 [Reference]	1 [Reference]
1-99 times	969	1.00 (0.93-1.08)	0.94 (0.87-1.02)	389	1.03 (0.92-1.16)	1.00 (0.89-1.13)	441	0.92 (0.82-1.02)	0.88 (0.79-0.99)
100-199 times	526	1.07 (0.97-1.17)	0.99 (0.90-1.09)	207	1.03 (0.88-1.19)	0.98 (0.84-1.14)	254	1.01 (0.88-1.16)	1.00 (0.87-1.15)
≥200 times	526	1.07 (0.97-1.18)	1.02 (0.93-1.12)	169	1.06 (0.90-1.25)	0.97 (0.82-1.14)	278	1.10 (0.97-1.26)	1.07 (0.94-1.23)
P-value for trend [h]		.08	.71		.45	.64		.13	.25
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.01 (0.99-1.02)	1.00 (0.98-1.02)		1.01 (0.99-1.02)	1.01 (0.99-1.02)
P-value for trend [i]		.74	.81		.39	.98		.30	.47
Age at first use									

Non-user	2805			1168			1175		
<30 years	1021	1 [Reference]	1 [Reference]	365	1 [Reference]	1 [Reference]	529	1 [Reference]	1 [Reference]
≥30 years	1000	1.02 (0.95-1.10)	0.97 (0.90-1.04)	400	1.03 (0.92-1.16)	1.01 (0.90-1.14)	444	0.97 (0.87-1.07)	0.94 (0.85-1.05)
Time since first use									
Non-user	2805			1168			1175		
<30 years	1293	1 [Reference]	1 [Reference]	520	1 [Reference]	1 [Reference]	597	1 [Reference]	1 [Reference]
≥30 years	728	1.05 (0.98-1.12)	0.99 (0.92-1.05)	245	1.04 (0.93-1.15)	1.01 (0.91-1.13)	376	0.98 (0.89-1.08)	0.95 (0.86-1.05)

MV: multivariable; HR: hazard ratio; CI: confidence interval; PR: progesterone receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 10. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (PR−)*** (n=2379) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (PR−)	Any hair color [a] (n=2379)			Dark hair color [b,d] (n=977)			Light hair color [c,d] (n=1003)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	1353	1 [Reference]	1 [Reference]	565	1 [Reference]	1 [Reference]	523	1 [Reference]	1 [Reference]
Ever-user	1026	1.08 (1.00-1.17)	1.05 (0.97-1.15)	412	1.13 (1.00-1.29)	1.13 (0.99-1.29)	480	1.10 (0.97-1.25)	1.09 (0.96-1.24)
Duration of use									
Non-user	1353	1 [Reference]	1 [Reference]	565	1 [Reference]	1 [Reference]	523	1 [Reference]	1 [Reference]
<5 years	408	1.09 (0.98-1.22)	1.09 (0.97-1.21)	173	1.18 (0.99-1.40)	1.18 (0.99-1.41)	174	1.09 (0.92-1.30)	1.10 (0.92-1.31)
5-9 years	237	1.07 (0.93-1.22)	1.02 (0.88-1.17)	104	1.08 (0.87-1.33)	1.07 (0.86-1.33)	104	1.07 (0.86-1.32)	1.03 (0.83-1.29)
≥10 years	381	1.08 (0.97-1.21)	1.04 (0.93-1.17)	135	1.12 (0.92-1.35)	1.11 (0.91-1.34)	202	1.13 (0.96-1.33)	1.11 (0.94-1.31)
P-value for trend		.17	.55		.25	.32		.16	.26
Frequency of use									
Non-user	1353	1 [Reference]	1 [Reference]	565	1 [Reference]	1 [Reference]	523	1 [Reference]	1 [Reference]
Every ≥5 weeks	439	1.07 (0.96-1.19)	1.02 (0.91-1.14)	184	1.11 (0.94-1.32)	1.12 (0.94-1.33)	220	1.06 (0.90-1.24)	1.04 (0.88-1.22)
Every 1-4 weeks	587	1.09 (0.99-1.21)	1.08 (0.98-1.19)	228	1.15 (0.98-1.34)	1.14 (0.97-1.33)	260	1.14 (0.98-1.33)	1.13 (0.97-1.32)
P-value for trend		.07	.14		.07	.11		.08	.11
Cumulative dose [g]									
Non-user	1353	1 [Reference]	1 [Reference]	565	1 [Reference]	1 [Reference]	523	1 [Reference]	1 [Reference]
1-99 times	497	1.08 (0.98-1.20)	1.06 (0.95-1.17)	212	1.15 (0.98-1.35)	1.15 (0.98-1.36)	223	1.07 (0.92-1.26)	1.06 (0.90-1.25)
100-199 times	251	1.03 (0.90-1.18)	0.98 (0.86-1.13)	107	1.09 (0.88-1.34)	1.06 (0.86-1.32)	115	1.01 (0.82-1.24)	1.00 (0.81-1.23)
≥200 times	278	1.14 (1.00-1.29)	1.12 (0.98-1.28)	93	1.15 (0.92-1.44)	1.15 (0.91-1.44)	142	1.24 (1.03-1.50)	1.24 (1.02-1.49)
P-value for trend [h]		.07	.16		.17	.23		.04	.06
Per 50-time increment		1.01 (1.00-1.02)	1.01 (1.00-1.02)		1.01 (1.00-1.03)	1.01 (1.00-1.03)		1.02 (1.00-1.03)	1.02 (1.00-1.03)
P-value for trend [i]		.08	.06		.13	.12		.07	.07
Age at first use									

Non-user	1353			565			523		
<30 years	513	1 [Reference]	1 [Reference]	207	1 [Reference]	1 [Reference]	242	1 [Reference]	1 [Reference]
≥30 years	513	1.11 (1.00-1.22)	1.09 (0.98-1.20)	205	1.22 (1.04-1.43)	1.24 (1.05-1.45)	238	1.02 (0.88-1.18)	1.03 (0.88-1.20)
Time since first use									
Non-user	1353			565			523		
<30 years	726	1 [Reference]	1 [Reference]	307	1 [Reference]	1 [Reference]	326	1 [Reference]	1 [Reference]
≥30 years	300	1.11 (1.01-1.21)	1.07 (0.97-1.17)	105	1.16 (1.01-1.34)	1.17 (1.01-1.34)	154	1.09 (0.95-1.26)	1.06 (0.92-1.22)

MV: multivariable; HR: hazard ratio; CI: confidence interval; PR: progesterone receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 11. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+/PR+)*** (n=4634) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (ER+/PR+)	Any hair color [a] (n=4634)			Dark hair color [b,d] (n=1848)			Light hair color [c,d] (n=2079)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	2694	1 [Reference]	1 [Reference]	1120	1 [Reference]	1 [Reference]	1136	1 [Reference]	1 [Reference]
Ever-user	1940	1.04 (0.98-1.10)	0.97 (0.91-1.03)	728	1.03 (0.94-1.13)	0.98 (0.89-1.07)	943	0.99 (0.91-1.08)	0.96 (0.88-1.06)
Duration of use									
Non-user	2694	1 [Reference]	1 [Reference]	1120	1 [Reference]	1 [Reference]	1136	1 [Reference]	1 [Reference]
<5 years	767	1.01 (0.94-1.10)	0.96 (0.89-1.04)	304	1.03 (0.90-1.17)	1.00 (0.87-1.14)	338	0.94 (0.83-1.07)	0.90 (0.79-1.02)
5-9 years	466	1.07 (0.96-1.18)	1.00 (0.90-1.10)	192	1.05 (0.90-1.23)	1.00 (0.85-1.17)	222	1.07 (0.92-1.24)	1.05 (0.91-1.22)
≥10 years	707	1.04 (0.96-1.13)	0.96 (0.88-1.05)	232	1.01 (0.88-1.17)	0.93 (0.80-1.08)	383	1.00 (0.89-1.12)	0.98 (0.87-1.10)
P-value for trend		.23	.43		.75	.39		.82	.98
Frequency of use									
Non-user	2694	1 [Reference]	1 [Reference]	1120	1 [Reference]	1 [Reference]	1136	1 [Reference]	1 [Reference]
Every ≥5 weeks	831	1.02 (0.94-1.10)	0.93 (0.86-1.00)	309	0.97 (0.85-1.10)	0.92 (0.81-1.05)	429	0.94 (0.84-1.05)	0.91 (0.82-1.03)
Every 1-4 weeks	1109	1.05 (0.98-1.13)	1.00 (0.93-1.08)	419	1.08 (0.96-1.21)	1.02 (0.91-1.14)	514	1.04 (0.94-1.16)	1.01 (0.91-1.13)
P-value for trend		.17	.98		.22	.81		.45	.86
Cumulative dose [g]									
Non-user	2694	1 [Reference]	1 [Reference]	1120	1 [Reference]	1 [Reference]	1136	1 [Reference]	1 [Reference]
1-99 times	921	0.99 (0.92-1.07)	0.93 (0.86-1.01)	365	1.01 (0.90-1.14)	0.98 (0.86-1.10)	425	0.92 (0.82-1.02)	0.88 (0.79-0.99)
100-199 times	509	1.07 (0.98-1.18)	0.99 (0.90-1.09)	198	1.02 (0.88-1.19)	0.97 (0.83-1.13)	247	1.02 (0.88-1.17)	1.00 (0.87-1.16)
≥200 times	510	1.08 (0.98-1.19)	1.03 (0.93-1.13)	165	1.08 (0.92-1.28)	0.98 (0.83-1.17)	271	1.11 (0.97-1.27)	1.08 (0.94-1.24)
P-value for trend [h]		.06	.62		.36	.75		.11	.21
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.01 (0.99-1.02)	1.00 (0.98-1.02)		1.01 (0.99-1.02)	1.01 (0.99-1.02)
P-value for trend [i]		.65	.87		.28	.86		.29	.48
Age at first use									

Non-user	2694			1120			1136		
<30 years	983	1 [Reference]	1 [Reference]	348	1 [Reference]	1 [Reference]	513	1 [Reference]	1 [Reference]
≥30 years	957	1.03 (0.96-1.11)	0.97 (0.90-1.05)	380	1.03 (0.91-1.16)	1.01 (0.89-1.14)	430	0.98 (0.88-1.08)	0.95 (0.86-1.06)
Time since first use									
Non-user	2694			1120			1136		
<30 years	1229	1 [Reference]	1 [Reference]	489	1 [Reference]	1 [Reference]	574	1 [Reference]	1 [Reference]
≥30 years	711	1.05 (0.98-1.12)	0.98 (0.92-1.05)	239	1.03 (0.92-1.14)	1.00 (0.90-1.12)	369	0.99 (0.89-1.09)	0.96 (0.86-1.06)

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; PR: progesterone receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 12. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER+/PR-)*** (n=1086) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (ER+/PR−)	Any hair color [a] (n=1086)			Dark hair color [b,d] (n=459)			Light hair color [c,d] (n=441)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	607	1 [Reference]	1 [Reference]	264	1 [Reference]	1 [Reference]	219	1 [Reference]	1 [Reference]
Ever-user	479	1.13 (1.00-1.27)	1.09 (0.97-1.24)	195	1.15 (0.95-1.38)	1.11 (0.92-1.35)	222	1.22 (1.01-1.48)	1.20 (0.99-1.45)
Duration of use									
Non-user	607	1 [Reference]	1 [Reference]	264	1 [Reference]	1 [Reference]	219	1 [Reference]	1 [Reference]
<5 years	194	1.17 (0.99-1.37)	1.16 (0.98-1.37)	82	1.21 (0.94-1.56)	1.21 (0.93-1.56)	82	1.24 (0.96-1.60)	1.23 (0.94-1.59)
5-9 years	110	1.11 (0.90-1.36)	1.05 (0.85-1.29)	46	1.01 (0.73-1.39)	0.97 (0.70-1.35)	52	1.31 (0.97-1.78)	1.28 (0.93-1.75)
≥10 years	175	1.10 (0.93-1.30)	1.05 (0.88-1.25)	67	1.18 (0.90-1.55)	1.11 (0.84-1.47)	88	1.16 (0.90-1.49)	1.13 (0.88-1.46)
P-value for trend		.28	.63		.30	.58		.21	.31
Frequency of use									
Non-user	607	1 [Reference]	1 [Reference]	264	1 [Reference]	1 [Reference]	219	1 [Reference]	1 [Reference]
Every ≥5 weeks	228	1.25 (1.07-1.46)	1.20 (1.02-1.40)	95	1.25 (0.99-1.59)	1.23 (0.97-1.57)	117	1.35 (1.08-1.70)	1.32 (1.04-1.66)
Every 1-4 weeks	251	1.03 (0.89-1.20)	1.01 (0.87-1.18)	100	1.06 (0.84-1.34)	1.02 (0.80-1.29)	105	1.10 (0.87-1.39)	1.09 (0.86-1.39)
P-value for trend		.58	.82		52	.82		.39	.46
Cumulative dose [g]									
Non-user	607	1 [Reference]	1 [Reference]	264	1 [Reference]	1 [Reference]	219	1 [Reference]	1 [Reference]
1-99 times	246	1.21 (1.04-1.40)	1.18 (1.01-1.37)	99	1.16 (0.91-1.46)	1.15 (0.90-1.46)	113	1.31 (1.04-1.65)	1.28 (1.01-1.62)
100-199 times	125	1.14 (0.94-1.39)	1.08 (0.89-1.32)	54	1.19 (0.89-1.60)	1.14 (0.84-1.54)	58	1.23 (0.92-1.64)	1.20 (0.89-1.61)
≥200 times	108	0.96 (0.78-1.18)	0.94 (0.76-1.16)	42	1.08 (0.78-1.50)	1.02 (0.72-1.43)	51	1.06 (0.78-1.44)	1.06 (0.78-1.45)
P-value for trend [h]		.98	.73		.42	.72		.57	.60
Per 50-time increment		1.00 (0.98-1.02)	1.00 (0.98-1.02)		1.01 (0.99-1.04)	1.01 (0.99-1.04)		1.00 (0.97-1.03)	1.00 (0.97-1.03)
P-value for trend [i]		.99	.96		.25	.33		.89	.90
Age at first use									

Non-user	607			264			219		
<30 years	238	1 [Reference]	1 [Reference]	99	1 [Reference]	1 [Reference]	109	1 [Reference]	1 [Reference]
≥30 years	241	1.19 (1.03-1.38)	1.18 (1.02-1.38)	96	1.33 (1.05-1.67)	1.33 (1.05-1.68)	113	1.13 (0.90-1.41)	1.14 (0.91-1.43)
Time since first use									
Non-user	607			264			219		
<30 years	337	1 [Reference]	1 [Reference]	142	1 [Reference]	1 [Reference]	155	1 [Reference]	1 [Reference]
≥30 years	142	1.22 (1.07-1.40)	1.17 (1.03-1.35)	53	1.20 (0.97-1.47)	1.18 (0.96-1.46)	67	1.34 (1.09-1.64)	1.29 (1.04-1.59)

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; PR: progesterone receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 13. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence (ER-/PR-)*** (n=1287) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Breast cancer (ER−/PR−)	Any hair color [a] (n=1287)			Dark hair color [b,d] (n=517)			Light hair color [c,d] (n=561)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	741	1 [Reference]	1 [Reference]	300	1 [Reference]	1 [Reference]	303	1 [Reference]	1 [Reference]
Ever-user	546	1.05 (0.94-1.18)	1.03 (0.92-1.15)	217	1.12 (0.94-1.34)	1.15 (0.96-1.38)	258	1.02 (0.86-1.20)	1.02 (0.86-1.21)
Duration of use									
Non-user	741	1 [Reference]	1 [Reference]	300	1 [Reference]	1 [Reference]	303	1 [Reference]	1 [Reference]
<5 years	214	1.04 (0.89-1.21)	1.03 (0.89-1.21)	91	1.16 (0.91-1.47)	1.18 (0.93-1.50)	92	0.99 (0.78-1.25)	1.01 (0.79-1.28)
5-9 years	127	1.04 (0.86-1.26)	1.00 (0.82-1.21)	58	1.14 (0.86-1.52)	1.17 (0.87-1.55)	52	0.90 (0.67-1.21)	0.87 (0.64-1.18)
≥10 years	205	1.07 (0.92-1.25)	1.04 (0.89-1.22)	68	1.06 (0.81-1.39)	1.11 (0.84-1.45)	114	1.11 (0.90-1.38)	1.11 (0.89-1.39)
P-value for trend		.36	.68		.53	.38		.42	.49
Frequency of use									
Non-user	741	1 [Reference]	1 [Reference]	300	1 [Reference]	1 [Reference]	303	1 [Reference]	1 [Reference]
Every ≥5 weeks	211	0.93 (0.80-1.08)	0.89 (0.76-1.04)	89	1.00 (0.79-1.27)	1.04 (0.82-1.33)	103	0.85 (0.68-1.06)	0.85 (0.67-1.07)
Every 1-4 weeks	335	1.15 (1.01-1.31)	1.14 (1.00-1.30)	128	1.23 (1.00-1.51)	1.25 (1.01-1.55)	155	1.18 (0.97-1.43)	1.17 (0.96-1.43)
P-value for trend		.04	.06		.06	.04		.11	.12
Cumulative dose [g]									
Non-user	741	1 [Reference]	1 [Reference]	300	1 [Reference]	1 [Reference]	303	1 [Reference]	1 [Reference]
1-99 times	251	0.99 (0.86-1.14)	0.97 (0.83-1.12)	113	1.15 (0.92-1.43)	1.18 (0.94-1.47)	110	0.91 (0.73-1.13)	0.91 (0.72-1.14)
100-199 times	126	0.94 (0.78-1.14)	0.91 (0.75-1.10)	53	1.00 (0.74-1.34)	1.00 (0.74-1.36)	57	0.86 (0.64-1.14)	0.85 (0.64-1.14)
≥200 times	169	1.29 (1.09-1.52)	1.28 (1.08-1.52)	51	1.22 (0.90-1.66)	1.28 (0.94-1.73)	91	1.39 (1.09-1.76)	1.38 (1.09-1.76)
P-value for trend [h]		.01	.03		.26	.18		.02	.03
Per 50-time increment		1.02 (1.00-1.03)	1.02 (1.01-1.03)		1.01 (0.99-1.04)	1.02 (0.99-1.04)		1.02 (1.00-1.04)	1.02 (1.00-1.05)
P-value for trend [i]		.01	.006		.31	.19		.02	.02
Age at first use									

	N			N			N		
Non-user	741			300			303		
<30 years	274	1 [Reference]	1 [Reference]	108	1 [Reference]	1 [Reference]	133	1 [Reference]	1 [Reference]
≥30 years	272	1.04 (0.91-1.19)	1.01 (0.88-1.16)	109	1.14 (0.92-1.42)	1.16 (0.93-1.45)	125	0.94 (0.77-1.15)	0.95 (0.77-1.16)
Time since first use									
Non-user	741			300			303		
<30 years	388	1 [Reference]	1 [Reference]	165	1 [Reference]	1 [Reference]	171	1 [Reference]	1 [Reference]
≥30 years	158	1.03 (0.91-1.16)	0.99 (0.87-1.12)	52	1.14 (0.94-1.38)	1.18 (0.97-1.43)	87	0.94 (0.78-1.13)	0.91 (0.75-1.10)

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; PR: progesterone receptor; BMI: body mass index

* Hormone receptor status was not available for all the breast cancer cases.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 14. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** (n=1215) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Ovarian cancer	Any hair color [a] (n=1215)			Dark hair color [b,d] (n=449)			Light hair color [c,d] (n=509)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
Ever-user	528	1.09 (0.98-1.23)	1.09 (0.97-1.22)	193	1.17 (0.97-1.41)	1.21 (1.00-1.47)	242	1.08 (0.90-1.28)	1.06 (0.89-1.27)
Duration of use									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
<5 years	195	1.04 (0.88-1.22)	1.04 (0.89-1.22)	79	1.19 (0.92-1.53)	1.21 (0.94-1.57)	78	0.95 (0.73-1.22)	0.94 (0.73-1.21)
5-9 years	130	1.13 (0.94-1.36)	1.13 (0.93-1.36)	50	1.17 (0.86-1.58)	1.22 (0.89-1.66)	53	1.04 (0.77-1.41)	1.04 (0.77-1.40)
≥10 years	203	1.13 (0.96-1.32)	1.11 (0.95-1.30)	64	1.15 (0.87-1.52)	1.20 (0.91-1.59)	111	1.21 (0.97-1.51)	1.19 (0.95-1.49)
P-value for trend		.09	.14		.26	.16		.09	.11
Frequency of use									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
Every ≥5 weeks	223	1.07 (0.92-1.24)	1.06 (0.91-1.24)	80	1.09 (0.85-1.40)	1.12 (0.87-1.45)	114	1.06 (0.85-1.32)	1.04 (0.83-1.30)
Every 1-4 weeks	305	1.11 (0.97-1.27)	1.11 (0.97-1.27)	113	1.24 (0.99-1.55)	1.28 (1.02-1.61)	128	1.09 (0.88-1.35)	1.08 (0.87-1.34)
P-value for trend		.12	.13		.06	.03		.41	.47
Cumulative dose [g]									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
1-99 times	231	0.99 (0.86-1.15)	1.00 (0.86-1.16)	89	1.06 (0.83-1.36)	1.10 (0.86-1.41)	95	0.89 (0.70-1.12)	0.89 (0.70-1.13)
100-199 times	149	1.21 (1.01-1.44)	1.20 (1.01-1.44)	58	1.31 (0.98-1.75)	1.36 (1.02-1.82)	72	1.23 (0.94-1.60)	1.21 (0.93-1.57)
≥200 times	148	1.17 (0.97-1.39)	1.15 (0.96-1.37)	46	1.24 (0.90-1.71)	1.28 (0.93-1.77)	75	1.27 (0.98-1.65)	1.24 (0.95-1.61)
P-value for trend [h]		.03	.046		.07	.04		.03	.048
Per 50-time increment		1.01 (0.99-1.02)	1.01 (0.99-1.02)		1.03 (0.99-1.06)	1.03 (1.00-1.06)		1.02 (1.00-1.04)	1.02 (0.99-1.04)
P-value for trend [i]		.24	.33		.13	.09		.11	.16
Age at first use									

Non-user	687			256			267		
<30 years	294	1 [Reference]	1 [Reference]	106	1 [Reference]	1 [Reference]	128	1 [Reference]	1 [Reference]
≥30 years	234	0.81 (0.67-0.93)	0.80 (0.66-0.97)	87	0.92 (0.67-1.28)	0.95 (0.68-1.32)	114	0.72 (0.54-0.96)	0.72 (0.54-0.97)
Time since first use									
Non-user	687			256			267		
<30 years	187	1 [Reference]	1 [Reference]	50	1 [Reference]	1 [Reference]	110	1 [Reference]	1 [Reference]
≥30 years	341	1.00 (0.80-1.24)	1.03 (0.83-1.29)	143	1.29 (0.87-1.90)	1.29 (0.87-1.92)	132	0.76 (0.55-1.03)	0.77 (0.56-1.05)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 15. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **colorectal cancer incidence** (n=2394) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Colorectal cancer	Any hair color [a] (n=2394)			Dark hair color [b,d] (n=858)			Light hair color [c,d] (n=991)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	1378	1 [Reference]	1 [Reference]	511	1 [Reference]	1 [Reference]	534	1 [Reference]	1 [Reference]
Ever-user	1016	1.05 (0.97-1.14)	1.05 (0.97-1.14)	347	1.05 (0.92-1.21)	1.07 (0.93-1.23)	457	1.02 (0.90-1.16)	1.03 (0.91-1.18)
Duration of use									
Non-user	1378	1 [Reference]	1 [Reference]	511	1 [Reference]	1 [Reference]	534	1 [Reference]	1 [Reference]
<5 years	396	1.09 (0.97-1.21)	1.09 (0.97-1.22)	142	1.10 (0.91-1.33)	1.13 (0.93-1.36)	164	1.05 (0.88-1.25)	1.05 (0.88-1.26)
5-9 years	234	1.03 (0.89-1.18)	1.04 (0.90-1.19)	80	0.95 (0.75-1.21)	0.97 (0.76-1.23)	103	1.05 (0.85-1.30)	1.07 (0.86-1.32)
≥10 years	386	1.02 (0.91-1.15)	1.03 (0.92-1.15)	125	1.07 (0.88-1.30)	1.09 (0.89-1.33)	190	0.99 (0.84-1.17)	1.00 (0.85-1.19)
P-value for trend		.73	.68		.66	.52		.95	.93
Frequency of use									
Non-user	1378	1 [Reference]	1 [Reference]	511	1 [Reference]	1 [Reference]	534	1 [Reference]	1 [Reference]
Every ≥5 weeks	408	0.99 (0.88-1.10)	0.98 (0.88-1.10)	156	1.09 (0.91-1.31)	1.11 (0.92-1.33)	194	0.92 (0.78-1.08)	0.92 (0.78-1.09)
Every 1-4 weeks	608	1.09 (0.99-1.20)	1.10 (1.00-1.22)	191	1.02 (0.86-1.21)	1.05 (0.88-1.24)	263	1.12 (0.97-1.30)	1.14 (0.98-1.32)
P-value for trend		.08	.049		.77	.55		.14	.09
Cumulative dose [g]									
Non-user	1378	1 [Reference]	1 [Reference]	511	1 [Reference]	1 [Reference]	534	1 [Reference]	1 [Reference]
1-99 times	461	1.02 (0.92-1.14)	1.02 (0.92-1.14)	160	1.02 (0.85-1.22)	1.04 (0.87-1.25)	203	0.99 (0.84-1.17)	1.00 (0.85-1.18)
100-199 times	272	1.07 (0.94-1.22)	1.08 (0.94-1.23)	103	1.12 (0.90-1.38)	1.13 (0.91-1.40)	115	0.95 (0.77-1.16)	0.96 (0.78-1.19)
≥200 times	283	1.07 (0.94-1.22)	1.08 (0.95-1.23)	84	1.04 (0.82-1.31)	1.08 (0.85-1.36)	139	1.16 (0.96-1.40)	1.17 (0.97-1.42)
P-value for trend [h]		.23	.16		.53	.36		.22	.17
Per 50-time increment		1.00 (0.99-1.02)	1.00 (0.99-1.02)		1.01 (0.98-1.03)	1.01 (0.99-1.03)		1.01 (0.99-1.03)	1.01 (0.99-1.02)
P-value for trend [i]		.66	.58		.65	.50		.44	.43
Age at first use									

	N	HR	MV HR	N	HR	MV HR	N	HR	MV HR
Non-user	1378			511			534		
<30 years	576	1 [Reference]	1 [Reference]	200	1 [Reference]	1 [Reference]	253	1 [Reference]	1 [Reference]
≥30 years	440	1.07 (0.93-1.22)	1.05 (0.92-1.21)	147	1.13 (0.89-1.42)	1.15 (0.91-1.46)	204	0.92 (0.75-1.13)	0.89 (0.72-1.09)
Time since first use									
Non-user	1378			511			534		
<30 years	402	1 [Reference]	1 [Reference]	132	1 [Reference]	1 [Reference]	200	1 [Reference]	1 [Reference]
≥30 years	614	0.92 (0.79-1.07)	0.94 (0.81-1.10)	215	0.86 (0.66-1.12)	0.86 (0.66-1.13)	257	0.84 (0.67-1.05)	0.99 (0.62-1.57)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index; NSAIDs: nonsteroidal anti-inflammatory drugs

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, physical activity, menopausal status, postmenopausal hormone use, family history of colorectal cancer, history of diabetes mellitus, screening colonoscopy or sigmoidoscopy in the previous 2 years, regular use of aspirin, regular use of non-aspirin NSAIDs, multivitamin use, total calories intake, red or processed meat intake, and intake of fiber, folate, calcium, and vitamin D. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 16. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **bladder cancer incidence** (n=596) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Bladder cancer	Any hair color [a] (n=596)			Dark hair color [b,d] (n=227)			Light hair color [c,d] (n=260)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	333	1 [Reference]	1 [Reference]	129	1 [Reference]	1 [Reference]	133	1 [Reference]	1 [Reference]
Ever-user	263	1.14 (0.97-1.34)	1.05 (0.90-1.24)	98	1.13 (0.87-1.48)	1.06 (0.81-1.38)	127	1.18 (0.93-1.51)	1.09 (0.85-1.39)
Duration of use									
Non-user	333	1 [Reference]	1 [Reference]	129	1 [Reference]	1 [Reference]	133	1 [Reference]	1 [Reference]
<5 years	93	1.06 (0.84-1.34)	0.99 (0.78-1.24)	41	1.20 (0.84-1.71)	1.11 (0.78-1.59)	41	1.07 (0.75-1.53)	0.96 (0.67-1.38)
5-9 years	75	1.37 (1.07-1.76)	1.28 (0.99-1.65)	29	1.29 (0.86-1.94)	1.23 (0.82-1.86)	33	1.37 (0.93-2.01)	1.29 (0.88-1.90)
≥10 years	95	1.08 (0.86-1.36)	0.99 (0.78-1.24)	28	0.94 (0.62-1.42)	0.87 (0.57-1.32)	53	1.18 (0.85-1.63)	1.09 (0.78-1.50)
P-value for trend		.24	.72		1.00	.71		.21	.45
Frequency of use									
Non-user	333	1 [Reference]	1 [Reference]	129	1 [Reference]	1 [Reference]	133	1 [Reference]	1 [Reference]
Every ≥5 weeks	121	1.21 (0.98-1.49)	1.08 (0.87-1.33)	51	1.32 (0.95-1.83)	1.21 (0.87-1.68)	58	1.12 (0.82-1.54)	1.02 (0.74-1.40)
Every 1-4 weeks	142	1.09 (0.89-1.33)	1.04 (0.85-1.27)	47	0.98 (0.70-1.38)	0.93 (0.67-1.31)	69	1.24 (0.92-1.66)	1.15 (0.85-1.55)
P-value for trend		.36	.70		1.00	.75		.15	.36
Cumulative dose [g]									
Non-user	333	1 [Reference]	1 [Reference]	129	1 [Reference]	1 [Reference]	133	1 [Reference]	1 [Reference]
1-99 times	125	1.15 (0.94-1.42)	1.05 (0.85-1.30)	56	1.34 (0.97-1.84)	1.24 (0.90-1.71)	55	1.10 (0.80-1.51)	0.99 (0.72-1.37)
100-199 times	66	1.11 (0.85-1.44)	1.02 (0.78-1.33)	26	1.11 (0.72-1.69)	1.02 (0.67-1.57)	30	1.06 (0.71-1.57)	1.00 (0.67-1.49)
≥200 times	72	1.16 (0.89-1.49)	1.10 (0.85-1.42)	16	0.76 (0.45-1.28)	0.73 (0.43-1.23)	42	1.46 (1.03-2.07)	1.34 (0.94-1.90)
P-value for trend [h]		.24	.51		.45	.31		.049	.14
Per 50-time increment		1.01 (0.99-1.03)	1.00 (0.98-1.03)		0.98 (0.93-1.04)	0.98 (0.92-1.04)		1.01 (0.97-1.05)	1.00 (0.96-1.04)
P-value for trend [i]		.50	.73		.56	.44		.67	.99
Age at first use									

	N			N			N		
Non-user	333			129			133		
<30 years	153	1 [Reference]	1 [Reference]	59	1 [Reference]	1 [Reference]	68	1 [Reference]	1 [Reference]
≥30 years	110	0.84 (0.64-1.10)	0.81 (0.62-1.08)	39	0.79 (0.50-1.24)	0.79 (0.50-1.24)	59	0.87 (0.58-1.28)	0.79 (0.53-1.18)
Time since first use									
Non-user	333			129			133		
<30 years	116	1 [Reference]	1 [Reference]	34	1 [Reference]	1 [Reference]	65	1 [Reference]	1 [Reference]
≥30 years	147	1.02 (0.77-1.37)	1.04 (0.78-1.40)	64	1.19 (0.72-1.96)	1.26 (0.76-2.09)	62	0.93 (0.62-1.41)	0.96 (0.63-1.44)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, and total fluid intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 17. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **kidney cancer incidence** (n=477) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Kidney cancer	Any hair color [a] (n=477)			Dark hair color [b,d] (n=184)			Light hair color [c,d] (n=190)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	278	1 [Reference]	1 [Reference]	113	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
Ever-user	199	1.03 (0.86-1.24)	1.03 (0.85-1.23)	71	0.99 (0.73-1.33)	0.99 (0.73-1.34)	93	1.12 (0.84-1.50)	1.13 (0.84-1.51)
Duration of use									
Non-user	278	1 [Reference]	1 [Reference]	113	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
<5 years	83	1.08 (0.85-1.38)	1.06 (0.83-1.36)	31	1.04 (0.70-1.56)	1.04 (0.70-1.56)	41	1.38 (0.96-2.00)	1.39 (0.95-2.01)
5-9 years	42	0.94 (0.68-1.30)	0.93 (0.67-1.29)	15	0.80 (0.46-1.38)	0.79 (0.46-1.36)	17	0.94 (0.56-1.58)	0.95 (0.56-1.59)
≥10 years	74	1.03 (0.80-1.34)	1.04 (0.80-1.35)	25	1.06 (0.68-1.65)	1.08 (0.69-1.68)	35	1.00 (0.67-1.48)	1.00 (0.67-1.50)
P-value for trend		.92	.89		1.00	.96		.77	.80
Frequency of use									
Non-user	278	1 [Reference]	1 [Reference]	113	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
Every ≥5 weeks	83	1.00 (0.79-1.28)	0.98 (0.76-1.26)	34	1.06 (0.72-1.55)	1.03 (0.70-1.52)	42	1.08 (0.75-1.55)	1.07 (0.74-1.55)
Every 1-4 weeks	116	1.05 (0.85-1.31)	1.06 (0.85-1.32)	37	0.93 (0.64-1.35)	0.95 (0.65-1.39)	51	1.17 (0.83-1.65)	1.18 (0.84-1.68)
P-value for trend		.64	.61		.73	.81		.38	.34
Cumulative dose [g]									
Non-user	278	1 [Reference]	1 [Reference]	113	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
1-99 times	101	1.09 (0.86-1.37)	1.06 (0.84-1.33)	38	1.05 (0.73-1.53)	1.02 (0.70-1.49)	47	1.23 (0.86-1.74)	1.22 (0.85-1.74)
100-199 times	50	1.03 (0.76-1.39)	1.02 (0.76-1.39)	22	1.14 (0.72-1.81)	1.14 (0.72-1.82)	20	0.93 (0.58-1.52)	0.95 (0.58-1.54)
≥200 times	48	0.94 (0.69-1.27)	0.97 (0.71-1.32)	11	0.66 (0.35-1.24)	0.71 (0.38-1.33)	26	1.13 (0.72-1.77)	1.15 (0.74-1.81)
P-value for trend [h]		.74	.88		.36	.48		.76	.70
Per 50-time increment		0.98 (0.95-1.02)	0.99 (0.95-1.02)		0.96 (0.89-1.03)	0.96 (0.90-1.04)		0.98 (0.93-1.04)	0.99 (0.93-1.04)
P-value for trend [i]		.36	.50		.25	.33		.52	.59
Age at first use									

Non-user	278			113			97		
<30 years	98	1 [Reference]	1 [Reference]	38	1 [Reference]	1 [Reference]	40	1 [Reference]	1 [Reference]
≥30 years	101	1.10 (0.80-1.50)	1.08 (0.79-1.48)	33	0.84 (0.50-1.42)	0.87 (0.51-1.48)	53	1.35 (0.85-2.14)	1.34 (0.84-2.14)
Time since first use									
Non-user	278			113			97		
<30 years	87	1 [Reference]	1 [Reference]	25	1 [Reference]	1 [Reference]	44	1 [Reference]	1 [Reference]
≥30 years	112	1.15 (0.83-1.59)	1.16 (0.84-1.62)	46	1.21 (0.69-2.11)	1.29 (0.73-2.28)	49	1.13 (0.70-1.82)	1.21 (0.75-1.95)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 18. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **lung cancer incidence** (n=2623) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Lung cancer	Any hair color [a] (n=2623)			Dark hair color [b,d] (n=908)			Light hair color [c,d] (n=1017)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	1509	1 [Reference]	1 [Reference]	568	1 [Reference]	1 [Reference]	525	1 [Reference]	1 [Reference]
Ever-user	1114	1.06 (0.98-1.14)	0.94 (0.87-1.01)	340	0.90 (0.79-1.03)	0.81 (0.70-0.93)	492	1.13 (1.00-1.28)	0.97 (0.85-1.10)
Duration of use									
Non-user	1509	1 [Reference]	1 [Reference]	568	1 [Reference]	1 [Reference]	525	1 [Reference]	1 [Reference]
<5 years	426	1.08 (0.96-1.20)	0.95 (0.85-1.06)	133	0.91 (0.76-1.11)	0.82 (0.68-1.00)	171	1.10 (0.92-1.30)	0.94 (0.79-1.12)
5-9 years	271	1.10 (0.96-1.25)	0.99 (0.87-1.13)	95	0.99 (0.79-1.23)	0.89 (0.72-1.12)	112	1.16 (0.94-1.43)	1.03 (0.83-1.27)
≥10 years	417	1.01 (0.91-1.13)	0.89 (0.80-1.00)	112	0.83 (0.67-1.01)	0.74 (0.60-0.91)	209	1.14 (0.97-1.34)	0.97 (0.82-1.14)
P-value for trend		.65	.07		.09	.004		.10	.84
Frequency of use									
Non-user	1509	1 [Reference]	1 [Reference]	568	1 [Reference]	1 [Reference]	525	1 [Reference]	1 [Reference]
Every ≥5 weeks	486	1.09 (0.98-1.21)	0.94 (0.85-1.04)	147	0.90 (0.75-1.08)	0.78 (0.65-0.94)	250	1.22 (1.05-1.42)	1.03 (0.88-1.20)
Every 1-4 weeks	628	1.03 (0.94-1.13)	0.93 (0.85-1.03)	193	0.90 (0.76-1.06)	0.83 (0.71-0.99)	242	1.04 (0.90-1.22)	0.91 (0.78-1.07)
P-value for trend		.47	.15		.19	.02		.53	.26
Cumulative dose [g]									
Non-user	1509	1 [Reference]	1 [Reference]	568	1 [Reference]	1 [Reference]	525	1 [Reference]	1 [Reference]
1-99 times	545	1.12 (1.02-1.24)	0.96 (0.87-1.06)	173	0.99 (0.83-1.17)	0.86 (0.72-1.02)	231	1.13 (0.97-1.33)	0.95 (0.81-1.11)
100-199 times	283	1.02 (0.90-1.16)	0.93 (0.82-1.06)	94	0.87 (0.70-1.09)	0.79 (0.63-0.99)	137	1.19 (0.98-1.44)	1.08 (0.89-1.31)
≥200 times	286	0.98 (0.86-1.11)	0.89 (0.78-1.01)	73	0.77 (0.60-0.99)	0.73 (0.57-0.94)	124	1.06 (0.87-1.29)	0.90 (0.74-1.11)
P-value for trend [h]		.79	.06		.02	.003		.35	.56
Per 50-time increment		1.00 (0.99-1.01)	0.99 (0.97-1.00)		0.97 (0.94-0.99)	0.96 (0.93-0.99)		1.00 (0.98-1.02)	0.99 (0.97-1.01)
P-value for trend [i]		.78	.08		.02	.005		.76	.30
Age at first use									

Non-user	1509			568			525		
<30 years	639	1 [Reference]	1 [Reference]	206	1 [Reference]	1 [Reference]	268	1 [Reference]	1 [Reference]
≥30 years	475	1.01 (0.88-1.15)	0.97 (0.85-1.11)	134	0.99 (0.78-1.26)	1.02 (0.80-1.31)	224	0.92 (0.75-1.12)	0.88 (0.72-1.08)
Time since first use									
Non-user	1509			568			525		
<30 years	569	1 [Reference]	1 [Reference]	164	1 [Reference]	1 [Reference]	283	1 [Reference]	1 [Reference]
≥30 years	545	0.80 (0.69-0.92)	0.91 (0.79-1.04)	176	0.78 (0.61-1.00)	0.88 (0.68-1.14)	209	0.65 (0.53-0.80)	0.74 (0.60-0.91)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 19. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **brain cancer incidence** (n=277) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Brain cancer	Any hair color [a] (n=277)			Dark hair color [b,d] (n=100)			Light hair color [c,d] (n=100)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	186	1 [Reference]	1 [Reference]	63	1 [Reference]	1 [Reference]	69	1 [Reference]	1 [Reference]
Ever-user	91	0.70 (0.54-0.90)	0.72 (0.56-0.93)	37	0.91 (0.60-1.36)	0.91 (0.60-1.37)	31	0.54 (0.36-0.83)	0.53 (0.35-0.82)
Duration of use									
Non-user	186	1 [Reference]	1 [Reference]	63	1 [Reference]	1 [Reference]	69	1 [Reference]	1 [Reference]
<5 years	33	0.67 (0.46-0.97)	0.68 (0.47-0.98)	15	0.94 (0.53-1.65)	0.92 (0.52-1.63)	11	0.54 (0.28-1.02)	0.52 (0.27-0.98)
5-9 years	25	0.80 (0.53-1.22)	0.84 (0.55-1.27)	10	0.91 (0.46-1.78)	0.94 (0.48-1.84)	7	0.53 (0.24-1.15)	0.52 (0.24-1.14)
≥10 years	33	0.67 (0.46-0.97)	0.69 (0.47-1.00)	12	0.87 (0.47-1.63)	0.86 (0.46-1.61)	13	0.56 (0.31-1.02)	0.55 (0.30-1.01)
P-value for trend		.03	.05		.64	.63		.04	.04
Frequency of use									
Non-user	186	1 [Reference]	1 [Reference]	63	1 [Reference]	1 [Reference]	69	1 [Reference]	1 [Reference]
Every ≥5 weeks	32	0.57 (0.39-0.83)	0.60 (0.41-0.87)	18	0.97 (0.57-1.65)	0.97 (0.57-1.65)	11	0.39 (0.21-0.75)	0.38 (0.20-0.72)
Every 1-4 weeks	59	0.80 (0.60-1.07)	0.81 (0.60-1.09)	19	0.85 (0.51-1.43)	0.85 (0.51-1.43)	20	0.69 (0.42-1.14)	0.68 (0.41-1.13)
P-value for trend		.09	.12		.54	.55		.10	.10
Cumulative dose [g]									
Non-user	186	1 [Reference]	1 [Reference]	63	1 [Reference]	1 [Reference]	69	1 [Reference]	1 [Reference]
1-99 times	41	0.66 (0.47-0.93)	0.68 (0.48-0.96)	22	1.07 (0.66-1.75)	1.07 (0.65-1.75)	12	0.44 (0.23-0.81)	0.43 (0.23-0.79)
100-199 times	25	0.75 (0.50-1.15)	0.78 (0.51-1.19)	7	0.64 (0.29-1.40)	0.65 (0.29-1.42)	11	0.75 (0.40-1.43)	0.74 (0.39-1.41)
≥200 times	25	0.72 (0.47-1.09)	0.73 (0.48-1.11)	8	0.85 (0.41-1.80)	0.84 (0.40-1.78)	8	0.54 (0.26-1.12)	0.52 (0.25-1.10)
P-value for trend [h]		.07	.09		.43	.42		.08	.08
Per 50-time increment		0.96 (0.91-1.01)	0.96 (0.92-1.01)		0.96 (0.87-1.06)	0.96 (0.87-1.06)		0.93 (0.84-1.03)	0.93 (0.84-1.03)
P-value for trend [i]		.14	.15		.42	.39		.16	.15
Age at first use									

	Cases	HR (95% CI)	MV HR (95% CI)	Cases	HR (95% CI)	MV HR (95% CI)	Cases	HR (95% CI)	MV HR (95% CI)
Non-user	186			63			69		
<30 years	57	1 [Reference]	1 [Reference]	22	1 [Reference]	1 [Reference]	18	1 [Reference]	1 [Reference]
≥30 years	34	0.86 (0.54-1.36)	0.87 (0.55-1.40)	15	0.90 (0.44-1.84)	0.86 (0.42-1.78)	13	0.89 (0.41-1.96)	0.81 (0.36-1.80)
Time since first use									
Non-user	186			63			69		
<30 years	28	1 [Reference]	1 [Reference]	10	1 [Reference]	1 [Reference]	11	1 [Reference]	1 [Reference]
≥30 years	63	1.36 (0.79-2.35)	1.39 (0.80-1.41)	27	1.78 (0.73-4.34)	1.73 (0.70-4.29)	20	1.27 (0.54-2.98)	1.50 (0.61-1.71)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 20. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall hematopoietic cancer incidence** (n=1807) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

All hematopoietic cancers	Any hair color [a] (n=1807)			Dark hair color [b,d] (n=741)			Light hair color [c,d] (n=709)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	1067	1 [Reference]	1 [Reference]	437	1 [Reference]	1 [Reference]	402	1 [Reference]	1 [Reference]
Ever-user	740	1.00 (0.91-1.10)	1.00 (0.91-1.10)	304	1.09 (0.94-1.26)	1.08 (0.93-1.26)	307	0.93 (0.80-1.08)	0.94 (0.81-1.10)
Duration of use									
Non-user	1067	1 [Reference]	1 [Reference]	437	1 [Reference]	1 [Reference]	402	1 [Reference]	1 [Reference]
<5 years	277	0.97 (0.85-1.10)	0.96 (0.84-1.10)	122	1.09 (0.89-1.34)	1.08 (0.88-1.33)	108	0.90 (0.73-1.11)	0.91 (0.74-1.13)
5-9 years	186	1.07 (0.92-1.25)	1.06 (0.91-1.25)	80	1.13 (0.89-1.44)	1.13 (0.89-1.44)	76	1.03 (0.80-1.32)	1.04 (0.81-1.33)
≥10 years	277	0.98 (0.86-1.12)	0.99 (0.86-1.13)	102	1.05 (0.84-1.31)	1.05 (0.84-1.30)	123	0.90 (0.73-1.10)	0.92 (0.75-1.13)
P-value for trend		.97	.93		.53	.54		.42	.54
Frequency of use									
Non-user	1067	1 [Reference]	1 [Reference]	437	1 [Reference]	1 [Reference]	402	1 [Reference]	1 [Reference]
Every ≥5 weeks	335	1.05 (0.93-1.18)	1.03 (0.91-1.17)	144	1.15 (0.95-1.40)	1.14 (0.94-1.38)	148	0.94 (0.78-1.13)	0.95 (0.79-1.15)
Every 1-4 weeks	405	0.96 (0.86-1.08)	0.97 (0.86-1.09)	160	1.03 (0.86-1.24)	1.04 (0.86-1.25)	159	0.92 (0.77-1.11)	0.93 (0.78-1.13)
P-value for trend		.51	.59		.65	.64		.37	.47
Cumulative dose [g]									
Non-user	1067	1 [Reference]	1 [Reference]	437	1 [Reference]	1 [Reference]	402	1 [Reference]	1 [Reference]
1-99 times	369	1.05 (0.93-1.18)	1.04 (0.92-1.17)	166	1.22 (1.02-1.46)	1.21 (1.01-1.45)	142	0.91 (0.75-1.10)	0.92 (0.76-1.11)
100-199 times	172	0.90 (0.77-1.06)	0.90 (0.76-1.05)	63	0.81 (0.62-1.06)	0.81 (0.62-1.06)	89	1.02 (0.81-1.29)	1.04 (0.83-1.31)
≥200 times	199	1.00 (0.86-1.17)	1.02 (0.88-1.19)	75	1.14 (0.89-1.46)	1.14 (0.89-1.46)	76	0.88 (0.68-1.12)	0.89 (0.70-1.14)
P-value for trend [h]		.68	.81		.75	.75		.41	.52
Per 50-time increment		1.00 (0.99-1.02)	1.00 (0.99-1.02)		1.00 (0.97-1.03)	1.00 (0.97-1.03)		1.00 (0.98-1.02)	1.00 (0.98-1.02)
P-value for trend [i]		.92	.72		.91	.90		.93	.95
Age at first use									

Non-user	1067			437			402		
<30 years	412	1 [Reference]	1 [Reference]	177	1 [Reference]	1 [Reference]	158	1 [Reference]	1 [Reference]
≥30 years	328	0.90 (0.76-1.05)	0.90 (0.76-1.06)	127	0.89 (0.68-1.15)	0.88 (0.68-1.14)	149	0.87 (0.67-1.12)	0.87 (0.67-1.13)
Time since first use									
Non-user	1067			437			402		
<30 years	320	1 [Reference]	1 [Reference]	126	1 [Reference]	1 [Reference]	134	1 [Reference]	1 [Reference]
≥30 years	420	0.99 (0.84-1.18)	0.97 (0.82-1.16)	178	0.99 (0.75-1.30)	0.99 (0.75-1.30)	173	1.00 (0.77-1.30)	1.00 (0.77-1.30)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 21. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall non-Hodgkin lymphoma incidence** (n=1277) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

All non-Hodgkin lymphomas	Any hair color [a] (n=1277)			Dark hair color [b,d] (n=529)			Light hair color [c,d] (n=510)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	771	1 [Reference]	1 [Reference]	324	1 [Reference]	1 [Reference]	292	1 [Reference]	1 [Reference]
Ever-user	506	0.95 (0.84-1.06)	0.94 (0.84-1.05)	205	0.99 (0.83-1.18)	0.99 (0.83-1.18)	218	0.90 (0.76-1.08)	0.92 (0.77-1.09)
Duration of use									
Non-user	771	1 [Reference]	1 [Reference]	324	1 [Reference]	1 [Reference]	292	1 [Reference]	1 [Reference]
<5 years	197	0.95 (0.81-1.11)	0.95 (0.81-1.11)	79	0.95 (0.74-1.22)	0.95 (0.74-1.21)	86	0.99 (0.78-1.26)	1.01 (0.79-1.28)
5-9 years	114	0.91 (0.75-1.11)	0.90 (0.74-1.09)	56	1.06 (0.80-1.41)	1.05 (0.79-1.40)	42	0.77 (0.56-1.07)	0.78 (0.56-1.08)
≥10 years	195	0.96 (0.82-1.13)	0.95 (0.81-1.12)	70	0.99 (0.76-1.28)	0.98 (0.76-1.28)	90	0.89 (0.70-1.13)	0.91 (0.71-1.15)
P-value for trend		.53	.45		.96	.99		.22	.28
Frequency of use									
Non-user	771	1 [Reference]	1 [Reference]	324	1 [Reference]	1 [Reference]	292	1 [Reference]	1 [Reference]
Every ≥5 weeks	233	1.02 (0.88-1.18)	0.99 (0.85-1.15)	95	1.03 (0.82-1.30)	1.01 (0.80-1.28)	105	0.91 (0.73-1.14)	0.93 (0.74-1.16)
Every 1-4 weeks	273	0.89 (0.78-1.02)	0.90 (0.78-1.03)	110	0.96 (0.77-1.19)	0.96 (0.77-1.20)	113	0.89 (0.72-1.11)	0.91 (0.73-1.13)
P-value for trend		.11	.14		.74	.75		.30	.37
Cumulative dose [g]									
Non-user	771	1 [Reference]	1 [Reference]	324	1 [Reference]	1 [Reference]	292	1 [Reference]	1 [Reference]
1-99 times	253	1.00 (0.86-1.15)	0.98 (0.85-1.13)	111	1.10 (0.88-1.36)	1.09 (0.87-1.35)	102	0.89 (0.71-1.12)	0.90 (0.72-1.14)
100-199 times	113	0.82 (0.68-1.00)	0.81 (0.66-0.99)	40	0.69 (0.50-0.96)	0.69 (0.49-0.96)	61	0.97 (0.74-1.28)	0.99 (0.75-1.31)
≥200 times	140	0.97 (0.81-1.17)	0.98 (0.82-1.18)	54	1.13 (0.84-1.51)	1.13 (0.84-1.52)	55	0.85 (0.64-1.13)	0.86 (0.64-1.15)
P-value for trend [h]		.36	.40		.91	.92		.31	.39
Per 50-time increment		1.00 (0.98-1.02)	1.00 (0.98-1.02)		0.99 (0.96-1.03)	0.99 (0.96-1.03)		1.00 (0.97-1.03)	1.00 (0.97-1.03)
P-value for trend [i]		.78	.95		.70	.72		.98	.93
Age at first use									

Non-user	771			324			292		
<30 years	284	1 [Reference]	1 [Reference]	123	1 [Reference]	1 [Reference]	112	1 [Reference]	1 [Reference]
≥30 years	222	0.93 (0.76-1.13)	0.93 (0.76-1.13)	82	0.88 (0.64-1.21)	0.89 (0.65-1.22)	106	0.92 (0.68-1.25)	0.92 (0.68-1.25)
Time since first use									
Non-user	771			324			292		
<30 years	218	1 [Reference]	1 [Reference]	80	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]
≥30 years	288	0.95 (0.77-1.17)	0.93 (0.75-1.15)	125	1.10 (0.79-1.54)	1.09 (0.78-1.53)	121	0.90 (0.66-1.23)	0.89 (0.65-1.22)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 22. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **T-cell lymphoma incidence** (n=51) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

T-cell lymphoma	Any hair color [a] (n=51)			Dark hair color [b,d] (n=25)			Light hair color [c,d] (n=15)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	28	1 [Reference]	1 [Reference]	16	1 [Reference]	1 [Reference]	6	1 [Reference]	1 [Reference]
Ever-user	23	1.18 (0.68-2.06)	1.24 (0.71-2.17)	9	0.85 (0.37-1.92)	0.88 (0.38-2.04)	9	1.82 (0.65-5.12)	1.64 (0.56-4.75)
Duration of use									
Non-user	28	1 [Reference]	1 [Reference]	16	1 [Reference]	1 [Reference]	6	1 [Reference]	1 [Reference]
<5 years	10	1.29 (0.63-2.67)	1.36 (0.65-2.81)	3	0.70 (0.20-2.43)	0.71 (0.20-2.51)	4	2.24 (0.63-8.01)	2.09 (0.57-7.73)
5-9 years	2	0.44 (0.10-1.85)	0.44 (0.10-1.86)	1	0.39 (0.05-2.96)	0.43 (0.06-3.34)	1	0.89 (0.11-7.47)	0.71 (0.08-6.14)
≥10 years	11	1.53 (0.76-3.09)	1.66 (0.82-3.38)	5	1.32 (0.48-3.67)	1.35 (0.47-3.82)	4	1.95 (0.55-6.93)	1.82 (0.50-6.63)
P-value for trend		.41	.31		.75	.70		.43	.53
Frequency of use									
Non-user	28	1 [Reference]	1 [Reference]	16	1 [Reference]	1 [Reference]	6	1 [Reference]	1 [Reference]
Every ≥5 weeks	10	1.15 (0.56-2.38)	1.22 (0.59-2.54)	4	0.74 (0.24-2.25)	0.77 (0.25-2.39)	4	1.68 (0.47-5.98)	1.46 (0.40-5.39)
Every 1-4 weeks	13	1.21 (0.62-2.34)	1.25 (0.64-2.44)	5	0.95 (0.35-2.62)	0.98 (0.35-2.75)	5	1.95 (0.59-6.43)	1.81 (0.53-6.13)
P-value for trend		.57	.50		.88	.94		.28	.35
Cumulative dose [g]									
Non-user	28	1 [Reference]	1 [Reference]	16	1 [Reference]	1 [Reference]	6	1 [Reference]	1 [Reference]
1-99 times	14	1.47 (0.77-2.81)	1.54 (0.81-2.95)	6	1.15 (0.45-2.97)	1.18 (0.44-3.14)	5	2.17 (0.66-7.16)	1.97 (0.58-6.71)
100-199 times	4	0.81 (0.28-2.31)	0.83 (0.29-2.38)	1	0.34 (0.04-2.58)	0.35 (0.05-2.66)	3	2.20 (0.55-8.86)	2.11 (0.50-8.91)
≥200 times	5	1.01 (0.39-2.61)	1.07 (0.41-2.80)	2	0.80 (0.18-3.56)	0.90 (0.20-4.04)	1	0.78 (0.09-6.50)	0.66 (0.08-5.61)
P-value for trend [h]		.87	.97		.51	.60		.92	.90
Per 50-time increment		0.95 (0.84-1.08)	0.96 (0.85-1.09)		0.92 (0.74-1.15)	0.93 (0.75-1.16)		0.96 (0.78-1.19)	0.94 (0.76-1.17)
P-value for trend [i]		.44	.50		.47	.53		.73	.57
Age at first use									

Non-user	28			16			6		
<30 years	14	1 [Reference]	1 [Reference]	4	1 [Reference]	1 [Reference]	7	1 [Reference]	1 [Reference]
≥30 years	9	0.64 (0.25-1.62)	0.62 (0.24-1.58)	5	1.42 (0.32-6.43)	1.04 (0.20-5.31)	2	0.37 (0.07-1.84)	0.36 (0.07-1.81)
Time since first use									
Non-user	28			16			6		
<30 years	11	1 [Reference]	1 [Reference]	5	1 [Reference]	1 [Reference]	3	1 [Reference]	1 [Reference]
≥30 years	12	1.01 (0.42-2.44)	0.99 (0.40-2.43)	4	0.70 (0.14-3.41)	0.62 (0.12-3.22)	6	1.79 (0.42-7.56)	2.01 (0.44-9.10)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 23. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **diffuse large B-cell lymphoma incidence** (n=190) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Diffuse large B-cell lymphoma	Any hair color [a] (n=190)			Dark hair color [b,d] (n=76)			Light hair color [c,d] (n=79)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	108	1 [Reference]	1 [Reference]	44	1 [Reference]	1 [Reference]	46	1 [Reference]	1 [Reference]
Ever-user	82	1.09 (0.82-1.45)	1.06 (0.79-1.42)	32	1.14 (0.72-1.81)	1.16 (0.72-1.84)	33	0.87 (0.55-1.36)	0.87 (0.55-1.37)
Duration of use									
Non-user	108	1 [Reference]	1 [Reference]	44	1 [Reference]	1 [Reference]	46	1 [Reference]	1 [Reference]
<5 years	30	1.02 (0.68-1.54)	1.01 (0.67-1.52)	14	1.29 (0.70-2.38)	1.27 (0.69-2.35)	13	0.96 (0.52-1.80)	0.95 (0.51-1.79)
5-9 years	15	0.87 (0.50-1.49)	0.84 (0.49-1.45)	5	0.74 (0.29-1.88)	0.76 (0.30-1.94)	6	0.72 (0.30-1.68)	0.71 (0.30-1.67)
≥10 years	37	1.29 (0.88-1.88)	1.25 (0.86-1.84)	13	1.25 (0.66-2.35)	1.29 (0.68-2.45)	14	0.87 (0.47-1.58)	0.88 (0.48-1.63)
P-value for trend		.26	.33		.66	.59		.55	.59
Frequency of use									
Non-user	108	1 [Reference]	1 [Reference]	44	1 [Reference]	1 [Reference]	46	1 [Reference]	1 [Reference]
Every ≥5 weeks	37	1.14 (0.78-1.66)	1.07 (0.73-1.57)	14	1.14 (0.62-2.10)	1.15 (0.63-2.13)	17	0.95 (0.54-1.67)	0.94 (0.53-1.67)
Every 1-4 weeks	45	1.05 (0.74-1.49)	1.05 (0.74-1.50)	18	1.14 (0.66-1.99)	1.16 (0.66-2.03)	16	0.80 (0.45-1.41)	0.80 (0.45-1.43)
P-value for trend		.75	.76		.62	.60		.43	.46
Cumulative dose [g]									
Non-user	108	1 [Reference]	1 [Reference]	44	1 [Reference]	1 [Reference]	46	1 [Reference]	1 [Reference]
1-99 times	35	0.97 (0.66-1.43)	0.94 (0.64-1.38)	16	1.20 (0.68-2.15)	1.22 (0.68-2.18)	14	0.79 (0.43-1.44)	0.77 (0.42-1.41)
100-199 times	20	1.05 (0.65-1.70)	1.01 (0.63-1.64)	7	0.89 (0.40-2.01)	0.88 (0.39-1.98)	10	1.01 (0.50-2.00)	1.03 (0.51-2.05)
≥200 times	27	1.33 (0.87-2.03)	1.34 (0.87-2.06)	9	1.32 (0.63-2.74)	1.37 (0.65-2.87)	9	0.87 (0.43-1.80)	0.90 (0.44-1.86)
P-value for trend [h]		.21	.21		.59	.55		.79	.87
Per 50-time increment		1.02 (1.00-1.04)	1.02 (1.00-1.05)		0.99 (0.90-1.09)	1.00 (0.91-1.10)		1.02 (0.96-1.09)	1.03 (0.96-1.09)
P-value for trend [i]		.10	.06		.91	.99		.53	.44
Age at first use									

Non-user	108			44			46		
<30 years	41	1 [Reference]	1 [Reference]	19	1 [Reference]	1 [Reference]	14	1 [Reference]	1 [Reference]
≥30 years	41	1.35 (0.84-2.18)	1.34 (0.83-2.16)	13	1.15 (0.51-2.60)	1.18 (0.50-2.76)	19	1.72 (0.82-3.62)	1.72 (0.81-3.65)
Time since first use									
Non-user	108			44			46		
<30 years	41	1 [Reference]	1 [Reference]	16	1 [Reference]	1 [Reference]	15	1 [Reference]	1 [Reference]
≥30 years	41	0.90 (0.54-1.47)	0.90 (0.54-1.48)	16	1.07 (0.48-2.35)	1.06 (0.47-2.40)	18	0.82 (0.37-1.79)	0.85 (0.38-1.89)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 24. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **follicular lymphoma incidence** (n=204) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Follicular lymphoma	Any hair color [a] (n=204)			Dark hair color [b,d] (n=83)			Light hair color [c,d] (n=87)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	111	1 [Reference]	1 [Reference]	42	1 [Reference]	1 [Reference]	45	1 [Reference]	1 [Reference]
Ever-user	93	1.20 (0.91-1.58)	1.20 (0.91-1.59)	41	1.46 (0.94-2.26)	1.45 (0.93-2.25)	42	1.12 (0.74-1.72)	1.12 (0.73-1.72)
Duration of use									
Non-user	111	1 [Reference]	1 [Reference]	42	1 [Reference]	1 [Reference]	45	1 [Reference]	1 [Reference]
<5 years	37	1.24 (0.85-1.80)	1.25 (0.86-1.82)	15	1.39 (0.77-2.53)	1.40 (0.77-2.54)	17	1.26 (0.72-2.21)	1.25 (0.71-2.21)
5-9 years	29	1.58 (1.05-2.38)	1.57 (1.04-2.37)	16	2.25 (1.26-4.04)	2.22 (1.23-3.99)	9	1.02 (0.50-2.11)	1.02 (0.49-2.10)
≥10 years	27	0.92 (0.60-1.40)	0.91 (0.60-1.40)	10	0.98 (0.49-1.97)	0.97 (0.48-1.95)	16	1.06 (0.60-1.88)	1.06 (0.60-1.89)
P-value for trend		.91	.95		.52	.56		.91	.92
Frequency of use									
Non-user	111	1 [Reference]	1 [Reference]	42	1 [Reference]	1 [Reference]	45	1 [Reference]	1 [Reference]
Every ≥5 weeks	53	1.59 (1.14-2.21)	1.55 (1.11-2.16)	22	1.74 (1.03-2.94)	1.72 (1.02-2.92)	24	1.37 (0.83-2.27)	1.39 (0.84-2.30)
Every 1-4 weeks	40	0.90 (0.63-1.30)	0.93 (0.64-1.34)	19	1.23 (0.71-2.13)	1.23 (0.71-2.13)	18	0.90 (0.52-1.57)	0.89 (0.51-1.55)
P-value for trend		.70	.79		.42	.43		.76	.71
Cumulative dose [g]									
Non-user	111	1 [Reference]	1 [Reference]	42	1 [Reference]	1 [Reference]	45	1 [Reference]	1 [Reference]
1-99 times	53	1.44 (1.03-2.00)	1.42 (1.02-1.98)	22	1.68 (1.00-2.84)	1.67 (0.98-2.83)	23	1.29 (0.77-2.15)	1.30 (0.78-2.17)
100-199 times	18	0.90 (0.54-1.48)	0.89 (0.54-1.47)	11	1.38 (0.71-2.70)	1.37 (0.69-2.68)	7	0.71 (0.32-1.58)	0.69 (0.31-1.56)
≥200 times	22	1.06 (0.67-1.68)	1.10 (0.69-1.75)	8	1.13 (0.53-2.45)	1.13 (0.52-2.45)	12	1.25 (0.66-2.37)	1.23 (0.64-2.35)
P-value for trend [h]		1.00	.91		.60	.61		.80	.84
Per 50-time increment		1.02 (0.99-1.05)	1.02 (0.99-1.05)		1.00 (0.93-1.09)	1.00 (0.93-1.09)		1.02 (0.99-1.05)	1.02 (0.99-1.05)
P-value for trend [i]		.19	.16		.93	.94		.22	.27
Age at first use									

	N	HR	MV-HR	N	HR	MV-HR	N	HR	MV-HR
Non-user	111			42			45		
<30 years	49	1 [Reference]	1 [Reference]	23	1 [Reference]	1 [Reference]	18	1 [Reference]	1 [Reference]
≥30 years	44	1.06 (0.68-1.65)	1.08 (0.69-1.69)	18	1.04 (0.51-2.08)	1.05 (0.51-2.15)	24	1.26 (0.64-2.46)	1.30 (0.66-2.56)
Time since first use									
Non-user	111			42			45		
<30 years	36	1 [Reference]	1 [Reference]	15	1 [Reference]	1 [Reference]	19	1 [Reference]	1 [Reference]
≥30 years	57	1.14 (0.70-1.86)	1.08 (0.66-1.77)	26	1.01 (0.47-2.18)	1.07 (0.49-2.33)	23	0.98 (0.48-2.02)	0.97 (0.47-2.00)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 25. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **chronic lymphocytic leukemia/small lymphocytic lymphoma incidence** (n=272) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Chronic lymphocytic leukemia/small lymphocytic lymphoma	Any hair color [a] (n=272)			Dark hair color [b,d] (n=122)			Light hair color [c,d] (n=111)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	181	1 [Reference]	1 [Reference]	80	1 [Reference]	1 [Reference]	73	1 [Reference]	1 [Reference]
Ever-user	91	0.72 (0.56-0.93)	0.69 (0.53-0.89)	42	0.82 (0.56-1.19)	0.78 (0.54-1.14)	38	0.62 (0.42-0.92)	0.62 (0.41-0.92)
Duration of use									
Non-user	181	1 [Reference]	1 [Reference]	80	1 [Reference]	1 [Reference]	73	1 [Reference]	1 [Reference]
<5 years	41	0.83 (0.59-1.17)	0.82 (0.58-1.15)	16	0.79 (0.46-1.35)	0.77 (0.45-1.32)	17	0.76 (0.45-1.30)	0.76 (0.45-1.30)
5-9 years	20	0.68 (0.43-1.08)	0.65 (0.41-1.03)	11	0.82 (0.43-1.54)	0.78 (0.41-1.47)	8	0.58 (0.28-1.21)	0.57 (0.28-1.20)
≥10 years	30	0.63 (0.43-0.93)	0.59 (0.40-0.87)	15	0.85 (0.49-1.49)	0.80 (0.46-1.40)	13	0.52 (0.29-0.93)	0.51 (0.28-0.93)
P-value for trend		.009	.003		.50	.36		.02	.02
Frequency of use									
Non-user	181	1 [Reference]	1 [Reference]	80	1 [Reference]	1 [Reference]	73	1 [Reference]	1 [Reference]
Every ≥5 weeks	37	0.68 (0.48-0.97)	0.63 (0.44-0.90)	19	0.84 (0.50-1.38)	0.79 (0.48-1.31)	14	0.47 (0.26-0.83)	0.47 (0.26-0.83)
Every 1-4 weeks	54	0.75 (0.55-1.02)	0.74 (0.54-1.00)	23	0.80 (0.50-1.28)	0.77 (0.48-1.24)	24	0.76 (0.48-1.21)	0.76 (0.47-1.21)
P-value for trend		.048	.04		.33	.26		.19	.20
Cumulative dose [g]									
Non-user	181	1 [Reference]	1 [Reference]	80	1 [Reference]	1 [Reference]	73	1 [Reference]	1 [Reference]
1-99 times	43	0.71 (0.51-1.00)	0.69 (0.49-0.96)	22	0.89 (0.55-1.43)	0.86 (0.53-1.38)	16	0.54 (0.31-0.93)	0.54 (0.31-0.93)
100-199 times	23	0.71 (0.46-1.10)	0.67 (0.44-1.04)	8	0.57 (0.27-1.18)	0.54 (0.26-1.12)	12	0.77 (0.42-1.42)	0.77 (0.41-1.43)
≥200 times	25	0.74 (0.48-1.12)	0.71 (0.47-1.08)	12	0.96 (0.52-1.78)	0.91 (0.49-1.69)	10	0.62 (0.32-1.21)	0.62 (0.32-1.20)
P-value for trend [h]		.08	.047		.50	.38		.14	.14

	Cases	HR	HR	Cases	HR	HR	Cases	HR	HR
Per 50-time increment		0.95 (0.90-1.00)	0.95 (0.90-1.00)		0.96 (0.88-1.04)	0.95 (0.87-1.04)		0.95 (0.88-1.04)	0.95 (0.88-1.04)
P-value for trend [i]		.07	.06		.32	.25		.26	.28
Age at first use									
Non-user	181			80			73		
<30 years	58	1 [Reference]	1 [Reference]	28	1 [Reference]	1 [Reference]	22	1 [Reference]	1 [Reference]
≥30 years	33	0.66 (0.41-1.06)	0.65 (0.40-1.06)	14	0.61 (0.30-1.26)	0.61 (0.29-1.27)	16	0.73 (0.36-1.51)	0.74 (0.36-1.54)
Time since first use									
Non-user	181			80			73		
<30 years	41	1 [Reference]	1 [Reference]	18	1 [Reference]	1 [Reference]	17	1 [Reference]	1 [Reference]
≥30 years	50	1.06 (0.66-1.70)	1.04 (0.65-1.69)	24	1.07 (0.53-2.19)	1.08 (0.52-2.24)	21	0.93 (0.44-1.99)	1.00 (0.47-2.16)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 26. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **Hodgkin lymphoma incidence** (n=70) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Hodgkin lymphoma	Any hair color [a] (n=70)			Dark hair color [b,d] (n=24)			Light hair color [c,d] (n=31)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	37	1 [Reference]	1 [Reference]	8	1 [Reference]	1 [Reference]	20	1 [Reference]	1 [Reference]
Ever-user	33	1.28 (0.80-2.05)	1.32 (0.82-2.13)	16	3.64 (1.55-8.56)	3.89 (1.61-9.40)	11	0.61 (0.29-1.29)	0.70 (0.33-1.49)
Duration of use									
Non-user	37	1 [Reference]	1 [Reference]	8	1 [Reference]	1 [Reference]	20	1 [Reference]	1 [Reference]
<5 years	14	1.28 (0.69-2.38)	1.29 (0.69-2.40)	7	3.56 (1.28-9.89)	3.62 (1.25-10.4)	5	0.69 (0.26-1.87)	0.78 (0.28-2.16)
5-9 years	9	1.54 (0.74-3.20)	1.57 (0.75-3.28)	4	3.57 (1.06-12.0)	3.78 (1.08-13.3)	2	0.54 (0.13-2.31)	0.62 (0.14-2.72)
≥10 years	10	1.11 (0.55-2.23)	1.18 (0.58-2.41)	5	3.84 (1.23-12.0)	4.44 (1.36-14.4)	4	0.57 (0.19-1.69)	0.65 (0.22-1.95)
P-value for trend		.62	.50		.02	.01		.27	.40
Frequency of use									
Non-user	37	1 [Reference]	1 [Reference]	8	1 [Reference]	1 [Reference]	20	1 [Reference]	1 [Reference]
Every ≥5 weeks	17	1.49 (0.84-2.66)	1.54 (0.86-2.77)	9	4.25 (1.63-11.1)	4.55 (1.69-12.2)	6	0.70 (0.28-1.77)	0.76 (0.30-1.98)
Every 1-4 weeks	16	1.11 (0.62-2.00)	1.15 (0.63-2.08)	7	3.06 (1.09-8.54)	3.24 (1.12-9.38)	5	0.53 (0.20-1.43)	0.63 (0.23-1.71)
P-value for trend		.68	.62		.03	.03		.20	.35
Cumulative dose [g]									
Non-user	37	1 [Reference]	1 [Reference]	8	1 [Reference]	1 [Reference]	20	1 [Reference]	1 [Reference]
1-99 times	17	1.28 (0.72-2.28)	1.30 (0.73-2.34)	8	3.19 (1.19-8.54)	3.16 (1.14-8.77)	5	0.55 (0.20-1.49)	0.62 (0.22-1.71)
100-199 times	9	1.44 (0.69-3.00)	1.48 (0.71-3.09)	5	5.10 (1.63-15.9)	5.90 (1.83-19.1)	3	0.71 (0.21-2.39)	0.83 (0.24-2.86)
≥200 times	7	1.12 (0.50-2.51)	1.19 (0.52-2.69)	3	3.37 (0.86-13.2)	4.06 (0.97-16.9)	3	0.65 (0.19-2.19)	0.72 (0.21-2.47)
P-value for trend [h]		.59	.50		.02	.01		.45	.60
Per 50-time increment		1.02 (0.95-1.10)	1.03 (0.95-1.11)		1.11 (0.98-1.25)	1.13 (1.00-1.29)		1.00 (0.88-1.14)	1.01 (0.90-1.14)
P-value for trend [i]		.58	.49		.11	.05		.99	.85
Age at first use									

Non-user	37			8			20		
<30 years	11	1 [Reference]	1 [Reference]	6	1 [Reference]	1 [Reference]	2	1 [Reference]	1 [Reference]
≥30 years	22	1.23 (0.53-2.88)	1.19 (0.51, 2.79)	10	1.12 (0.33-3.84)	0.99 (0.27-3.62)	9	2.95 (0.52-6.83)	2.88 (0.49-6.81)
Time since first use									
Non-user	37			8			20		
<30 years	14	1 [Reference]	1 [Reference]	8	1 [Reference]	1 [Reference]	3	1 [Reference]	1 [Reference]
≥30 years	19	0.75 (0.30-1.87)	0.63 (0.25-1.62)	8	0.15 (0.03-0.74)	0.10 (0.02-0.71)	8	2.06 (0.43-9.87)	1.96 (0.41-9.41)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, and regular use of aspirin. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 27. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **multiple myeloma incidence** (n=274) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Multiple myeloma	Any hair color [a] (n=274)			Dark hair color [b,d] (n=113)			Light hair color [c,d] (n=108)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	156	1 [Reference]	1 [Reference]	67	1 [Reference]	1 [Reference]	56	1 [Reference]	1 [Reference]
Ever-user	118	1.09 (0.85-1.38)	1.10 (0.86-1.40)	46	1.06 (0.72-1.54)	1.07 (0.73-1.56)	52	1.15 (0.79-1.68)	1.13 (0.77-1.67)
Duration of use									
Non-user	156	1 [Reference]	1 [Reference]	67	1 [Reference]	1 [Reference]	56	1 [Reference]	1 [Reference]
<5 years	48	1.18 (0.85-1.64)	1.19 (0.86-1.64)	26	1.56 (0.99-2.47)	1.57 (0.99-2.49)	17	1.07 (0.62-1.85)	1.05 (0.61-1.83)
5-9 years	32	1.25 (0.85-1.82)	1.25 (0.85-1.84)	8	0.70 (0.33-1.46)	0.70 (0.33-1.47)	17	1.65 (0.95-2.86)	1.62 (0.93-2.81)
≥10 years	38	0.90 (0.63-1.28)	0.91 (0.64-1.31)	12	0.77 (0.41-1.43)	0.78 (0.42-1.46)	18	0.95 (0.55-1.62)	0.94 (0.55-1.61)
P-value for trend		.73	.80		.26	.29		.85	.90
Frequency of use									
Non-user	156	1 [Reference]	1 [Reference]	67	1 [Reference]	1 [Reference]	56	1 [Reference]	1 [Reference]
Every ≥5 weeks	52	1.11 (0.81-1.53)	1.12 (0.81-1.54)	22	1.14 (0.70-1.86)	1.18 (0.72-1.93)	25	1.17 (0.73-1.89)	1.17 (0.72-1.88)
Every 1-4 weeks	66	1.07 (0.80-1.42)	1.08 (0.81-1.45)	24	0.98 (0.61-1.58)	0.98 (0.61-1.57)	27	1.13 (0.71-1.80)	1.11 (0.69-1.76)
P-value for trend		.65	.58		.98	.96		.60	.67
Cumulative dose [g]									
Non-user	156	1 [Reference]	1 [Reference]	67	1 [Reference]	1 [Reference]	56	1 [Reference]	1 [Reference]
1-99 times	60	1.18 (0.88-1.60)	1.19 (0.88-1.61)	29	1.39 (0.89-2.16)	1.40 (0.90-2.19)	25	1.19 (0.74-1.92)	1.18 (0.73-1.91)
100-199 times	32	1.13 (0.77-1.65)	1.13 (0.77-1.66)	11	0.91 (0.48-1.73)	0.93 (0.49-1.77)	15	1.22 (0.69-2.18)	1.20 (0.67-2.13)
≥200 times	26	0.88 (0.58-1.34)	0.90 (0.59-1.37)	6	0.57 (0.24-1.31)	0.56 (0.24-1.31)	12	1.00 (0.53-1.88)	0.99 (0.53-1.87)
P-value for trend [h]		.71	.78		.21	.21		.86	.90
Per 50-time increment		0.98 (0.94-1.03)	0.99 (0.94-1.03)		0.94 (0.85-1.04)	0.94 (0.85-1.03)		0.99 (0.93-1.05)	0.99 (0.93-1.05)
P-value for trend [i]		.49	.52		.22	.21		.73	.69
Age at first use									

Non-user	156			67			56		
<30 years	65	1 [Reference]	1 [Reference]	26	1 [Reference]	1 [Reference]	24	1 [Reference]	1 [Reference]
≥30 years	53	0.96 (0.63-1.44)	0.95 (0.63-1.44)	20	0.98 (0.51-1.91)	0.98 (0.50-1.91)	28	1.17 (0.63-2.19)	1.17 (0.62-2.21)
Time since first use									
Non-user	156			67			56		
<30 years	49	1 [Reference]	1 [Reference]	21	1 [Reference]	1 [Reference]	20	1 [Reference]	1 [Reference]
≥30 years	69	1.28 (0.84-1.94)	1.27 (0.83-1.93)	25	1.01 (0.51-1.97)	1.02 (0.52-2.01)	32	1.47 (0.77-2.80)	1.53 (0.80-2.94)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, and regular use of aspirin. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 28. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **myeloid leukemias incidence** (n=170) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Myeloid leukemias	Any hair color [a] (n=170)			Dark hair color [b,d] (n=59)			Light hair color [c,d] (n=64)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	100	1 [Reference]	1 [Reference]	34	1 [Reference]	1 [Reference]	37	1 [Reference]	1 [Reference]
Ever-user	70	0.99 (0.73-1.34)	0.99 (0.72-1.34)	25	1.12 (0.66-1.88)	1.17 (0.69-1.97)	27	0.90 (0.55-1.48)	0.90 (0.55-1.50)
Duration of use									
Non-user	100	1 [Reference]	1 [Reference]	34	1 [Reference]	1 [Reference]	37	1 [Reference]	1 [Reference]
<5 years	26	0.95 (0.62-1.47)	0.93 (0.60-1.44)	14	1.60 (0.85-2.99)	1.64 (0.87-3.10)	6	0.54 (0.23-1.27)	0.54 (0.22-1.28)
5-9 years	14	0.85 (0.49-1.49)	0.85 (0.49-1.50)	4	0.73 (0.26-2.06)	0.79 (0.28-2.24)	6	0.93 (0.39-2.21)	0.93 (0.39-2.23)
≥10 years	30	1.11 (0.74-1.67)	1.13 (0.75-1.71)	7	0.86 (0.38-1.95)	0.88 (0.38-2.03)	15	1.21 (0.66-2.22)	1.22 (0.67-2.25)
P-value for trend		.72	.66		.57	.65		.45	.43
Frequency of use									
Non-user	100	1 [Reference]	1 [Reference]	34	1 [Reference]	1 [Reference]	37	1 [Reference]	1 [Reference]
Every ≥5 weeks	26	0.85 (0.55-1.31)	0.87 (0.56-1.35)	10	1.01 (0.50-2.05)	1.02 (0.50-2.08)	12	0.83 (0.43-1.59)	0.82 (0.43-1.59)
Every 1-4 weeks	44	1.09 (0.77-1.56)	1.07 (0.75-1.53)	15	1.20 (0.65-2.22)	1.30 (0.70-2.41)	15	0.97 (0.53-1.77)	0.98 (0.53-1.80)
P-value for trend		.64	.73		.56	.42		.90	.93
Cumulative dose [g]									
Non-user	100	1 [Reference]	1 [Reference]	34	1 [Reference]	1 [Reference]	37	1 [Reference]	1 [Reference]
1-99 times	36	1.07 (0.73-1.57)	1.06 (0.72-1.55)	17	1.61 (0.89-2.89)	1.64 (0.91-2.97)	11	0.76 (0.38-1.49)	0.75 (0.38-1.48)
100-199 times	9	0.50 (0.25-0.98)	0.50 (0.25-1.00)	1	0.17 (0.02-1.25)	0.18 (0.02-1.32)	7	0.83 (0.37-1.88)	0.85 (0.37-1.92)
≥200 times	25	1.32 (0.85-2.05)	1.32 (0.84-2.05)	7	1.17 (0.51-2.67)	1.24 (0.54-2.86)	9	1.27 (0.61-2.65)	1.29 (0.61-2.70)
P-value for trend [h]		.63	.62		.74	.88		.63	.60
Per 50-time increment		1.02 (0.99-1.05)	1.01 (0.99-1.04)		1.03 (0.95-1.11)	1.03 (0.95-1.11)		1.03 (0.95-1.12)	1.03 (0.95-1.12)
P-value for trend [i]		.30	.34		.49	.46		.43	.41
Age at first use									

Non-user	100			34			37		
<30 years	41	1 [Reference]	1 [Reference]	13	1 [Reference]	1 [Reference]	18	1 [Reference]	1 [Reference]
≥30 years	29	0.81 (0.48-1.39)	0.82 (0.48-1.41)	12	1.47 (0.61-3.54)	1.65 (0.64-4.21)	9	0.37 (0.15-0.92)	0.36 (0.14-0.92)
Time since first use									
Non-user	100			34			37		
<30 years	30	1 [Reference]	1 [Reference]	10	1 [Reference]	1 [Reference]	11	1 [Reference]	1 [Reference]
≥30 years	40	1.07 (0.61-1.88)	1.11 (0.63-1.98)	15	1.38 (0.52-3.70)	1.83 (0.61-5.54)	16	1.19 (0.51-2.78)	1.28 (0.53-3.08)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 29. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **cancer-related death** (n=4860) among women in the NHS according to personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values

Cancer-related death	Any hair color [a] (n=4860)			Dark hair color [b,d] (n=1661)			Light hair color [c,d] (n=1801)		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
Ever use									
Non-user	2877	1 [Reference]	1 [Reference]	994	1 [Reference]	1 [Reference]	1000	1 [Reference]	1 [Reference]
Ever-user	1983	0.98 (0.93-1.04)	0.96 (0.91-1.02)	667	1.02 (0.93-1.13)	1.01 (0.91-1.11)	801	0.98 (0.89-1.08)	0.94 (0.85-1.03)
Duration of use									
Non-user	2877	1 [Reference]	1 [Reference]	994	1 [Reference]	1 [Reference]	1000	1 [Reference]	1 [Reference]
<5 years	720	0.97 (0.89-1.05)	0.94 (0.86-1.02)	254	1.05 (0.91-1.20)	1.01 (0.88-1.16)	280	0.98 (0.85-1.12)	0.92 (0.81-1.06)
5-9 years	474	1.00 (0.91-1.11)	0.99 (0.90-1.10)	176	1.06 (0.90-1.24)	1.06 (0.90-1.24)	166	0.91 (0.77-1.08)	0.88 (0.74-1.04)
≥10 years	789	0.99 (0.91-1.07)	0.97 (0.90-1.05)	237	0.97 (0.84-1.12)	0.97 (0.83-1.12)	355	1.02 (0.90-1.15)	0.99 (0.87-1.12)
P-value for trend		.82	.57		.85	.78		.91	.70
Frequency of use									
Non-user	2877	1 [Reference]	1 [Reference]	994	1 [Reference]	1 [Reference]	1000	1 [Reference]	1 [Reference]
Every ≥5 weeks	839	0.99 (0.92-1.07)	0.98 (0.90-1.06)	296	1.06 (0.93-1.21)	1.02 (0.89-1.16)	388	1.02 (0.90-1.14)	0.97 (0.86-1.09)
Every 1-4 weeks	1144	0.98 (0.91-1.05)	0.95 (0.89-1.02)	371	1.00 (0.88-1.12)	1.00 (0.88-1.13)	413	0.95 (0.85-1.07)	0.92 (0.81-1.03)
P-value for trend		.54	.17		.98	.97		.39	.14
Cumulative dose [g]									
Non-user	2877	1 [Reference]	1 [Reference]	994	1 [Reference]	1 [Reference]	1000	1 [Reference]	1 [Reference]
1-99 times	917	1.01 (0.93-1.08)	0.97 (0.90-1.05)	329	1.12 (0.98-1.27)	1.07 (0.95-1.22)	372	1.00 (0.88-1.12)	0.93 (0.83-1.05)
100-199 times	481	0.90 (0.82-1.00)	0.91 (0.83-1.01)	175	0.93 (0.79-1.10)	0.92 (0.78-1.09)	199	0.92 (0.79-1.07)	0.91 (0.78-1.06)
≥200 times	585	1.02 (0.94-1.12)	0.99 (0.91-1.09)	163	0,.96 (0.81-1.13)	0.97 (0.82-1.15)	230	1.02 (0.88-1.17)	0.98 (0.85-1.14)
P-value for trend [h]		.85	.52		.43	.50		.88	.62
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (0.98-1.01)	1.00 (0.98-1.01)		1.00 (0.99-1.02)	1.00 (0.98-1.01)
P-value for trend [i]		.75	.54		.71	.71		.87	.59
Age at first use									

Non-user	2877			994			1000		
<30 years	1208	1 [Reference]	1 [Reference]	425	1 [Reference]	1 [Reference]	457	1 [Reference]	1 [Reference]
≥30 years	775	0.93 (0.84-1.03)	0.92 (0.83-1.02)	242	0.93 (0.78-1.11)	0.94 (0.79-1.13)	344	0.89 (0.76-1.04)	0.85 (0.73-1.00)
Time since first use									
Non-user	2877			994			1000		
<30 years	1043	1 [Reference]	1 [Reference]	339	1 [Reference]	1 [Reference]	464	1 [Reference]	1 [Reference]
≥30 years	940	0.90 (0.81-1.00)	0.97 (0.87-1.08)	328	0.91 (0.76-1.09)	0.95 (0.79-1.14)	337	0.81 (0.69-0.95)	0.84 (0.71-0.99)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index; NSAIDs: nonsteroidal anti-inflammatory drugs

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, physical activity, menopausal status, postmenopausal hormone use, parity, regular use of aspirin, regular use of non-aspirin NSAIDs, multivitamin use, total calories intake, history of hypertension, history of hypercholesterolemia, and history of diabetes mellitus. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[g] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 30. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence *** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

All cancers *	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-2012									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
Ever-user	9367	1.01 (0.99-1.04)	0.98 (0.96-1.01)	3322	1.02 (0.98-1.07)	1.00 (0.96-1.05)	4283	1.00 (0.96-1.04)	0.98 (0.94-1.02)
1988-2012									
Non-user	10290	1 [Reference]	1 [Reference]	4055	1 [Reference]	1 [Reference]	4022	1 [Reference]	1 [Reference]
Ever-user	7357	1.03 (1.00-1.06)	0.99 (0.96-1.02)	2684	1.04 (0.99-1.09)	1.01 (0.96-1.06)	3423	1.02 (0.97-1.07)	0.99 (0.95-1.04)
1992-2012									
Non-user	8740	1 [Reference]	1 [Reference]	3461	1 [Reference]	1 [Reference]	3403	1 [Reference]	1 [Reference]
Ever-user	6237	1.03 (1.00-1.07)	0.99 (0.96-1.02)	2279	1.03 (0.98-1.09)	1.01 (0.95-1.06)	2901	1.02 (0.97-1.07)	0.99 (0.94-1.04)
1998-2012									
Non-user	5959	1 [Reference]	1 [Reference]	2434	1 [Reference]	1 [Reference]	2262	1 [Reference]	1 [Reference]
Ever-user	4300	1.05 (1.01-1.09)	1.01 (0.97-1.05)	1577	1.03 (0.97-1.10)	1.00 (0.94-1.07)	1988	1.05 (0.99-1.12)	1.02 (0.96-1.09)
2002-2012									
Non-user	3820	1 [Reference]	1 [Reference]	1576	1 [Reference]	1 [Reference]	1454	1 [Reference]	1 [Reference]
Ever-user	2768	1.06 (1.01-1.12)	1.02 (0.97-1.07)	1045	1.06 (0.98-1.15)	1.03 (0.95-1.11)	1273	1.05 (0.97-1.13)	1.02 (0.95-1.11)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 31. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** * among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

All cancers *	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-2012									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
1-99 times	4492	1.01 (0.98-1.05)	0.98 (0.94-1.01)	1678	1.05 (0.99-1.11)	1.02 (0.96-1.08)	1988	0.97 (0.92-1.02)	0.95 (0.90-1.00)
100-199 times	2393	1.01 (0.97-1.06)	0.98 (0.94-1.03)	904	1.01 (0.94-1.09)	0.99 (0.92-1.06)	1109	0.99 (0.93-1.06)	0.98 (0.92-1.05)
≥200 times	2482	1.02 (0.98-1.07)	1.00 (0.96-1.05)	740	0.98 (0.91-1.06)	0.97 (0.90-1.05)	1186	1.05 (0.99-1.12)	1.03 (0.97-1.10)
P-value for trend [h]		.34	.94		.81	.47		.14	.36
Per 50-time increment		1.00 (1.00-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (1.00-1.01)
P-value for trend [i]		.84	.74		.66	.44		.31	.59
1988-2012									
Non-user	10290	1 [Reference]	1 [Reference]	4055	1 [Reference]	1 [Reference]	4022	1 [Reference]	1 [Reference]
1-99 times	3586	1.03 (1.00-1.07)	0.99 (0.95-1.02)	1376	1.06 (1.00-1.13)	1.03 (0.97-1.10)	1592	0.99 (0.93-1.05)	0.96 (0.90-1.01)
100-199 times	1886	1.03 (0.98-1.09)	0.99 (0.94-1.04)	712	1.00 (0.93-1.09)	0.98 (0.91-1.07)	910	1.04 (0.97-1.12)	1.02 (0.95-1.10)
≥200 times	1885	1.02 (0.97-1.07)	1.00 (0.95-1.05)	596	1.02 (0.93-1.11)	1.00 (0.92-1.10)	921	1.05 (0.98-1.13)	1.03 (0.96-1.11)
P-value for trend [h]		.27	.94		.68	.92		.09	.28
Per 50-time increment		1.00 (0.99-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.90	.52		.90	.84		.51	.90
1992-2012									
Non-user	8740	1 [Reference]	1 [Reference]	3461	1 [Reference]	1 [Reference]	3403	1 [Reference]	1 [Reference]
1-99 times	3086	1.05 (1.00-1.09)	0.99 (0.95-1.03)	1193	1.07 (1.00-1.14)	1.04 (0.97-1.11)	1367	1.00 (0.94-1.06)	0.96 (0.90-1.03)
100-199 times	1592	1.03 (0.98-1.09)	0.99 (0.94-1.04)	600	1.00 (0.92-1.10)	0.98 (0.90-1.07)	771	1.05 (0.97-1.13)	1.03 (0.95-1.11)
≥200 times	1559	1.01 (0.95-1.06)	0.98 (0.93-1.04)	486	0.99 (0.90-1.09)	0.97 (0.88-1.07)	763	1.04 (0.96-1.13)	1.01 (0.94-1.10)

P-value for trend [h]		.61	.51		.87	.49		.21	.53
Per 50-time increment		1.00 (0.99-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.62	.31		.65	.42		.82	.79
1998-2012									
Non-user	5959	1 [Reference]	1 [Reference]	2434	1 [Reference]	1 [Reference]	2262	1 [Reference]	1 [Reference]
1-99 times	2171	1.07 (1.02-1.13)	1.02 (0.97-1.07)	843	1.08 (0.99-1.16)	1.04 (0.96-1.12)	952	1.04 (0.96-1.12)	1.00 (0.92-1.08)
100-199 times	1065	1.03 (0.96-1.10)	0.98 (0.92-1.05)	391	0.95 (0.85-1.05)	0.92 (0.82-1.02)	527	1.08 (0.98-1.19)	1.06 (0.96-1.16)
≥200 times	1064	1.03 (0.97-1.10)	1.01 (0.94-1.08)	343	1.03 (0.92-1.16)	1.01 (0.90-1.13)	509	1.05 (0.96-1.16)	1.03 (0.93-1.13)
P-value for trend [h]		.29	.99		.96	.65		.16	.38
Per 50-time increment		1.00 (0.99-1.00)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.98-1.01)		1.00 (0.99-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.41	.21		.69	.46		.98	.70
2002-2012									
Non-user	3820	1 [Reference]	1 [Reference]	1576	1 [Reference]	1 [Reference]	1454	1 [Reference]	1 [Reference]
1-99 times	1405	1.08 (1.02-1.15)	1.02 (0.96-1.09)	566	1.10 (1.00-1.22)	1.07 (0.97-1.17)	613	1.03 (0.94-1.14)	1.00 (0.91-1.10)
100-199 times	681	1.04 (0.96-1.13)	0.99 (0.91-1.08)	258	0.97 (0.85-1.11)	0.94 (0.82-1.08)	335	1.08 (0.96-1.22)	1.07 (0.94-1.20)
≥200 times	682	1.05 (0.97-1.14)	1.04 (0.95-1.13)	221	1.06 (0.91-1.22)	1.04 (0.90-1.20)	325	1.06 (0.94-1.20)	1.04 (0.92-1.17)
P-value for trend [h]		.18	.51		.63	.92		.23	.39
Per 50-time increment		1.00 (0.99-1.00)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	1.01 (1.00-1.02)
P-value for trend [i]		.61	.76		.84	.87		.44	.15

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 32. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Basal cell carcinoma	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-2012									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
Ever-user	10024	1.15 (1.12-1.18)	1.05 (1.02-1.08)	3199	1.10 (1.05-1.15)	1.01 (0.96-1.06)	5443	1.11 (1.07-1.15)	1.06 (1.02-1.11)
1988-2012									
Non-user	9655	1 [Reference]	1 [Reference]	3555	1 [Reference]	1 [Reference]	4468	1 [Reference]	1 [Reference]
Ever-user	7723	1.15 (1.12-1.19)	1.06 (1.03-1.10)	2506	1.11 (1.05-1.17)	1.03 (0.98-1.09)	4140	1.11 (1.07-1.16)	1.07 (1.03-1.12)
1992-2012									
Non-user	8148	1 [Reference]	1 [Reference]	3035	1 [Reference]	1 [Reference]	3747	1 [Reference]	1 [Reference]
Ever-user	6476	1.15 (1.11-1.19)	1.06 (1.02-1.10)	2106	1.09 (1.04-1.16)	1.02 (0.96-1.08)	3486	1.12 (1.07-1.17)	1.08 (1.03-1.14)
1998-2012									
Non-user	5838	1 [Reference]	1 [Reference]	2237	1 [Reference]	1 [Reference]	2665	1 [Reference]	1 [Reference]
Ever-user	4561	1.14 (1.10-1.18)	1.05 (1.00-1.09)	1500	1.07 (1.00-1.14)	1.00 (0.93-1.07)	2468	1.12 (1.06-1.18)	1.08 (1.02-1.15)
2002-2012									
Non-user	4115	1 [Reference]	1 [Reference]	1632	1 [Reference]	1 [Reference]	1868	1 [Reference]	1 [Reference]
Ever-user	3102	1.11 (1.06-1.16)	1.02 (0.97-1.07)	1056	1.04 (0.96-1.12)	0.98 (0.90-1.06)	1676	1.09 (1.02-1.16)	1.05 (0.98-1.12)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 33. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Basal cell carcinoma	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-2012									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
1-99 times	4808	1.14 (1.10-1.18)	1.05 (1.02-1.09)	1526	1.05 (0.99-1.11)	0.98 (0.93-1.05)	2645	1.13 (1.08-1.18)	1.09 (1.04-1.15)
100-199 times	2605	1.16 (1.11-1.21)	1.04 (1.00-1.09)	895	1.12 (1.04-1.20)	1.03 (0.96-1.11)	1387	1.09 (1.03-1.16)	1.03 (0.97-1.10)
≥200 times	2611	1.15 (1.10-1.20)	1.05 (1.00-1.09)	778	1.17 (1.09-1.27)	1.04 (0.96-1.13)	1411	1.11 (1.04-1.17)	1.04 (0.98-1.11)
P-value for trend [h]		<0.001	.03		<0.001	.25		<0.001	.23
Per 50-time increment		1.01 (1.01-1.01)	1.00 (1.00-1.01)		1.01 (1.01-1.02)	1.00 (1.00-1.01)		1.01 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		<0.001	.40		<0.001	.29		.07	.96
1988-2012									
Non-user	9655	1 [Reference]	1 [Reference]	3555	1 [Reference]	1 [Reference]	4468	1 [Reference]	1 [Reference]
1-99 times	3762	1.15 (1.11-1.19)	1.07 (1.03-1.11)	1212	1.06 (0.99-1.13)	1.01 (0.94-1.08)	2044	1.13 (1.08-1.20)	1.10 (1.04-1.17)
100-199 times	2001	1.17 (1.11-1.23)	1.06 (1.01-1.11)	694	1.13 (1.04-1.22)	1.04 (0.96-1.13)	1052	1.09 (1.02-1.17)	1.04 (0.97-1.12)
≥200 times	1960	1.15 (1.09-1.21)	1.05 (1.00-1.11)	600	1.20 (1.10-1.31)	1.07 (0.98-1.17)	1044	1.10 (1.02-1.17)	1.05 (0.98-1.13)
P-value for trend [h]		<0.001	.02		<0.001	.10		.004	.20
Per 50-time increment		1.01 (1.00-1.01)	1.00 (1.00-1.01)		1.01 (1.00-1.02)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		<0.001	.50		.002	.45		.22	.86
1992-2012									
Non-user	8148	1 [Reference]	1 [Reference]	3035	1 [Reference]	1 [Reference]	3747	1 [Reference]	1 [Reference]
1-99 times	3199	1.15 (1.11-1.20)	1.07 (1.02-1.12)	1031	1.05 (0.98-1.13)	1.00 (0.93-1.07)	1746	1.15 (1.09-1.22)	1.12 (1.06-1.19)
100-199 times	1677	1.17 (1.11-1.24)	1.06 (1.00-1.12)	586	1.12 (1.03-1.23)	1.03 (0.94-1.13)	884	1.10 (1.02-1.18)	1.05 (0.98-1.14)
≥200 times	1600	1.12 (1.07-1.19)	1.04 (0.98-1.10)	489	1.17 (1.06-1.29)	1.05 (0.95-1.16)	856	1.08 (1.00-1.16)	1.04 (0.97-1.13)

P-value for trend [h]		<0.001	.09		<0.001	.29		.03	.29
Per 50-time increment		1.01 (1.00-1.01)	1.00 (0.99-1.01)		1.01 (1.00-1.02)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.009	.90		.04	.99		.71	.67
1998-2012									
Non-user	5838	1 [Reference]	1 [Reference]	2237	1 [Reference]	1 [Reference]	2665	1 [Reference]	1 [Reference]
1-99 times	2274	1.13 (1.08-1.19)	1.05 (1.00-1.11)	762	1.04 (0.96-1.13)	0.99 (0.91-1.08)	1228	1.12 (1.05-1.20)	1.10 (1.02-1.18)
100-199 times	1184	1.17 (1.10-1.25)	1.05 (0.98-1.12)	417	1.10 (0.99-1.23)	1.01 (0.91-1.13)	635	1.12 (1.03-1.23)	1.07 (0.98-1.17)
≥200 times	1103	1.12 (1.05-1.19)	1.04 (0.97-1.11)	321	1.10 (0.98-1.24)	1.00 (0.88-1.13)	605	1.09 (1.00-1.20)	1.07 (0.97-1.17)
P-value for trend [h]		<0.001	.20		.04	.97		.02	.14
Per 50-time increment		1.01 (1.00-1.01)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	0.99 (0.98-1.01)		1.00 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.07	.74		.75	.21		.39	.72
2002-2012									
Non-user	4115	1 [Reference]	1 [Reference]	1632	1 [Reference]	1 [Reference]	1868	1 [Reference]	1 [Reference]
1-99 times	1558	1.10 (1.04-1.17)	1.02 (0.95-1.08)	554	1.03 (0.93-1.13)	0.98 (0.88-1.08)	830	1.08 (0.99-1.17)	1.04 (0.96-1.14)
100-199 times	796	1.13 (1.04-1.22)	1.01 (0.93-1.09)	284	1.04 (0.92-1.19)	0.98 (0.86-1.12)	429	1.09 (0.98-1.21)	1.04 (0.93-1.16)
≥200 times	748	1.10 (1.02-1.19)	1.03 (0.95-1.12)	218	1.06 (0.91-1.22)	0.97 (0.84-1.13)	417	1.10 (0.99-1.22)	1.06 (0.95-1.19)
P-value for trend [h]		.002	.46		.37	.65		.048	.26
Per 50-time increment		1.01 (1.00-1.01)	1.00 (0.99-1.01)		1.00 (0.99-1.01)	0.99 (0.98-1.01)		1.00 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.04	.75		.66	.24		.37	.84

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 34. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Breast cancer	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-2012									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
Ever-user	3920	1.06 (1.01-1.10)	1.02 (0.98-1.06)	1448	1.08 (1.01-1.15)	1.05 (0.98-1.12)	1818	1.04 (0.98-1.11)	1.02 (0.95-1.09)
1988-2012									
Non-user	3874	1 [Reference]	1 [Reference]	1571	1 [Reference]	1 [Reference]	1507	1 [Reference]	1 [Reference]
Ever-user	2787	1.04 (0.99-1.09)	1.00 (0.95-1.05)	1065	1.08 (1.00-1.17)	1.05 (0.97-1.14)	1290	1.02 (0.95-1.10)	1.00 (0.93-1.08)
1992-2012									
Non-user	3233	1 [Reference]	1 [Reference]	1309	1 [Reference]	1 [Reference]	1254	1 [Reference]	1 [Reference]
Ever-user	2288	1.03 (0.97-1.08)	0.99 (0.94-1.05)	868	1.06 (0.97-1.15)	1.04 (0.95-1.14)	1067	1.02 (0.94-1.10)	1.00 (0.92-1.09)
1998-2012									
Non-user	2101	1 [Reference]	1 [Reference]	881	1 [Reference]	1 [Reference]	798	1 [Reference]	1 [Reference]
Ever-user	1497	1.04 (0.98-1.12)	1.00 (0.93-1.07)	578	1.07 (0.96-1.19)	1.04 (0.93-1.16)	677	1.02 (0.92-1.13)	0.99 (0.89-1.10)
2002-2012									
Non-user	1280	1 [Reference]	1 [Reference]	540	1 [Reference]	1 [Reference]	492	1 [Reference]	1 [Reference]
Ever-user	882	1.02 (0.93-1.11)	0.98 (0.90-1.07)	360	1.09 (0.95-1.25)	1.06 (0.92-1.21)	382	0.93 (0.81-1.07)	0.92 (0.80-1.06)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 35. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Breast cancer	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-2012									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
1-99 times	1884	1.04 (0.98-1.09)	1.00 (0.95-1.06)	741	1.09 (1.00-1.18)	1.07 (0.98-1.17)	833	0.99 (0.91-1.07)	0.96 (0.88-1.05)
100-199 times	972	1.03 (0.96-1.10)	0.99 (0.92-1.06)	384	1.04 (0.93-1.16)	1.01 (0.90-1.13)	447	1.00 (0.90-1.11)	0.98 (0.89-1.09)
≥200 times	1064	1.12 (1.04-1.19)	1.08 (1.01-1.16)	323	1.09 (0.97-1.23)	1.04 (0.92-1.17)	538	1.19 (1.08-1.31)	1.16 (1.05-1.28)
P-value for trend [h]		.001	.06		.14	.57		.001	.007
Per 50-time increment		1.01 (1.00-1.01)	1.00 (1.00-1.01)		1.01 (1.00-1.02)	1.01 (0.99-1.02)		1.01 (1.00-1.02)	1.01 (1.00-1.02)
P-value for trend [i]		.05	.17		.14	.39		.006	.02
1988-2012									
Non-user	3874	1 [Reference]	1 [Reference]	1571	1 [Reference]	1 [Reference]	1507	1 [Reference]	1 [Reference]
1-99 times	1357	1.02 (0.96-1.08)	0.98 (0.92-1.04)	536	1.05 (0.95-1.16)	1.04 (0.94-1.15)	608	0.98 (0.89-1.08)	0.95 (0.86-1.05)
100-199 times	696	1.03 (0.95-1.12)	0.98 (0.90-1.07)	290	1.08 (0.95-1.23)	1.06 (0.93-1.20)	318	0.99 (0.88-1.12)	0.98 (0.87-1.11)
≥200 times	734	1.10 (1.01-1.19)	1.07 (0.99-1.16)	239	1.14 (0.99-1.31)	1.09 (0.94-1.25)	364	1.13 (1.01-1.27)	1.12 (0.99-1.26)
P-value for trend [h]		.02	.16		.04	.19		.06	.10
Per 50-time increment		1.00 (1.00-1.01)	1.00 (1.00-1.01)		1.01 (1.00-1.02)	1.01 (1.00-1.02)		1.01 (1.00-1.02)	1.01 (1.00-1.02)
P-value for trend [i]		.21	.27		.07	.17		.12	.15
1992-2012									
Non-user	3233	1 [Reference]	1 [Reference]	1309	1 [Reference]	1 [Reference]	1254	1 [Reference]	1 [Reference]
1-99 times	1134	1.01 (0.95-1.09)	0.98 (0.91-1.05)	446	1.04 (0.93-1.16)	1.03 (0.92-1.15)	515	1.00 (0.90-1.11)	0.97 (0.87-1.08)
100-199 times	574	1.03 (0.94-1.12)	0.98 (0.89-1.08)	244	1.11 (0.97-1.28)	1.09 (0.94-1.26)	263	0.99 (0.86-1.13)	0.98 (0.86-1.13)
≥200 times	580	1.05 (0.96-1.15)	1.03 (0.94-1.13)	178	1.04 (0.89-1.22)	1.00 (0.85-1.18)	289	1.09 (0.95-1.23)	1.08 (0.95-1.23)
P-value for trend [h]		.23	.61		.31	.66		.28	.31

	N	HR (95% CI)	MV HR (95% CI)	N	HR (95% CI)	MV HR (95% CI)	N	HR (95% CI)	MV HR (95% CI)
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.01 (0.99-1.02)	1.00 (0.99-1.02)		1.01 (0.99-1.02)	1.01 (0.99-1.02)
P-value for trend [i]		.63	.64		.43	.65		.41	.37
1998-2012									
Non-user	2101	1 [Reference]	1 [Reference]	881	1 [Reference]	1 [Reference]	798	1 [Reference]	1 [Reference]
1-99 times	753	1.03 (0.95-1.12)	0.99 (0.91-1.08)	294	1.02 (0.89-1.17)	1.00 (0.87-1.15)	333	1.00 (0.88-1.14)	0.96 (0.84-1.10)
100-199 times	359	1.01 (0.90-1.13)	0.95 (0.84-1.06)	155	1.08 (0.91-1.29)	1.04 (0.87-1.24)	166	0.99 (0.84-1.17)	0.99 (0.83-1.17)
≥200 times	385	1.10 (0.99-1.23)	1.08 (0.97-1.21)	129	1.18 (0.98-1.43)	1.12 (0.92-1.36)	178	1.06 (0.90-1.26)	1.05 (0.88-1.24)
P-value for trend [h]		.11	.36		.06	.24		.52	.63
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.02)		1.01 (1.00-1.03)	1.01 (0.99-1.03)		1.00 (0.98-1.02)	1.00 (0.98-1.02)
P-value for trend [i]		.52	.47		.12	.19		.97	.96
2002-2012									
Non-user	1280	1 [Reference]	1 [Reference]	540	1 [Reference]	1 [Reference]	492	1 [Reference]	1 [Reference]
1-99 times	450	1.01 (0.91-1.13)	0.97 (0.87-1.08)	189	1.06 (0.89-1.25)	1.03 (0.87-1.22)	188	0.91 (0.77-1.08)	0.89 (0.75-1.06)
100-199 times	207	0.97 (0.83-1.12)	0.92 (0.79-1.07)	98	1.13 (0.91-1.40)	1.09 (0.87-1.35)	89	0.87 (0.69-1.09)	0.87 (0.69-1.10)
≥200 times	225	1.09 (0.94-1.25)	1.08 (0.94-1.25)	73	1.14 (0.89-1.46)	1.09 (0.85-1.40)	105	1.04 (0.84-1.28)	1.04 (0.84-1.29)
P-value for trend [h]		.39	.55		.19	.38		.96	.95
Per 50-time increment		1.00 (0.99-1.01)	1.00 (0.99-1.02)		1.01 (1.00-1.02)	1.01 (1.00-1.03)		1.00 (0.99-1.02)	1.01 (0.99-1.02)
P-value for trend [i]		.54	.36		.13	.16		.56	.42

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 36. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Ovarian cancer	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-2012									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
Ever-user	528	1.09 (0.98-1.23)	1.09 (0.97-1.22)	193	1.17 (0.97-1.41)	1.21 (1.00-1.47)	242	1.08 (0.90-1.28)	1.06 (0.89-1.27)
1988-2012									
Non-user	497	1 [Reference]	1 [Reference]	204	1 [Reference]	1 [Reference]	192	1 [Reference]	1 [Reference]
Ever-user	384	1.10 (0.96-1.26)	1.09 (0.95-1.24)	141	1.07 (0.86-1.34)	1.10 (0.88-1.37)	193	1.20 (0.98-1.46)	1.18 (0.96-1.45)
1992-2012									
Non-user	411	1 [Reference]	1 [Reference]	172	1 [Reference]	1 [Reference]	157	1 [Reference]	1 [Reference]
Ever-user	324	1.14 (0.98-1.32)	1.12 (0.96-1.30)	118	1.07 (0.85-1.36)	1.09 (0.86-1.39)	164	1.27 (1.02-1.59)	1.26 (1.01-1.58)
1998-2012									
Non-user	281	1 [Reference]	1 [Reference]	125	1 [Reference]	1 [Reference]	108	1 [Reference]	1 [Reference]
Ever-user	216	1.10 (0.92-1.32)	1.06 (0.89-1.28)	73	0.92 (0.68-1.23)	0.91 (0.68-1.23)	118	1.28 (0.98-1.67)	1.27 (0.97-1.66)
2002-2012									
Non-user	191	1 [Reference]	1 [Reference]	88	1 [Reference]	1 [Reference]	71	1 [Reference]	1 [Reference]
Ever-user	150	1.14 (0.92-1.41)	1.11 (0.89-1.38)	54	0.99 (0.70-1.39)	1.02 (0.72-1.44)	81	1.35 (0.98-1.86)	1.32 (0.95-1.83)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 37. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (assuming a latency of 6, 10, 16 and 20 years)

Ovarian cancer	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-2012									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
1-99 times	231	0.99 (0.86-1.15)	1.00 (0.86-1.16)	89	1.06 (0.83-1.36)	1.10 (0.86-1.41)	95	0.89 (0.70-1.12)	0.89 (0.70-1.13)
100-199 times	149	1.21 (1.01-1.44)	1.20 (1.01-1.44)	58	1.31 (0.98-1.75)	1.36 (1.02-1.82)	72	1.23 (0.94-1.60)	1.21 (0.93-1.57)
≥200 times	148	1.17 (0.97-1.39)	1.15 (0.96-1.37)	46	1.24 (0.90-1.71)	1.28 (0.93-1.77)	75	1.27 (0.98-1.65)	1.24 (0.95-1.61)
P-value for trend [h]		.03	.046		.07	.04		.03	.047
Per 50-time increment		1.01 (0.99-1.02)	1.01 (0.99-1.02)		1.03 (0.99-1.06)	1.03 (1.00-1.06)		1.02 (1.00-1.04)	1.02 (0.99-1.04)
P-value for trend [i]		.24	.33		.13	.09		.11	.16
1988-2012									
Non-user	497	1 [Reference]	1 [Reference]	204	1 [Reference]	1 [Reference]	192	1 [Reference]	1 [Reference]
1-99 times	168	0.99 (0.83-1.17)	0.97 (0.81-1.16)	67	0.98 (0.75-1.30)	1.02 (0.77-1.35)	73	0.94 (0.71-1.23)	0.93 (0.71-1.23)
100-199 times	114	1.29 (1.05-1.58)	1.26 (1.03-1.55)	45	1.29 (0.93-1.79)	1.30 (0.93-1.81)	59	1.42 (1.05-1.90)	1.39 (1.03-1.88)
≥200 times	102	1.14 (0.92-1.41)	1.14 (0.92-1.42)	29	1.02 (0.69-1.52)	1.03 (0.69-1.54)	61	1.46 (1.09-1.95)	1.44 (1.07-1.94)
P-value for trend [h]		.06	.07		.48	.46		.002	.003
Per 50-time increment		1.01 (0.99-1.03)	1.01 (0.99-1.03)		1.00 (0.95-1.04)	1.00 (0.95-1.04)		1.03 (1.01-1.05)	1.03 (1.01-1.05)
P-value for trend [i]		.50	.46		.88	.88		.01	.01
1992-2012									
Non-user	411	1 [Reference]	1 [Reference]	172	1 [Reference]	1 [Reference]	157	1 [Reference]	1 [Reference]
1-99 times	148	1.06 (0.88-1.28)	1.04 (0.86-1.26)	60	1.06 (0.78-1.42)	1.09 (0.81-1.46)	65	1.04 (0.78-1.39)	1.04 (0.78-1.40)
100-199 times	91	1.25 (1.00-1.58)	1.22 (0.97-1.53)	35	1.20 (0.83-1.73)	1.20 (0.83-1.74)	47	1.41 (1.02-1.96)	1.39 (1.00-1.94)
≥200 times	95	1.18 (0.93-1.49)	1.17 (0.92-1.49)	23	0.97 (0.62-1.51)	0.98 (0.63-1.53)	52	1.57 (1.14-2.15)	1.55 (1.13-2.13)

P-value for trend [h]		.06	.09		.79	.76		.002	.003
Per 50-time increment		1.01 (0.99-1.03)	1.01 (0.99-1.03)		0.98 (0.93-1.04)	0.98 (0.93-1.04)		1.03 (1.01-1.05)	1.03 (1.00-1.05)
P-value for trend [i]		.56	.52		.55	.56		.01	.02
1998-2012									
Non-user	281	1 [Reference]	1 [Reference]	125	1 [Reference]	1 [Reference]	108	1 [Reference]	1 [Reference]
1-99 times	97	0.99 (0.79-1.25)	0.96 (0.76-1.21)	39	0.92 (0.64-1.33)	0.93 (0.65-1.35)	46	1.01 (0.71-1.43)	1.01 (0.71-1.43)
100-199 times	58	1.18 (0.89-1.57)	1.12 (0.84-1.50)	20	0.98 (0.61-1.58)	0.96 (0.59-1.55)	33	1.43 (0.96-2.11)	1.41 (0.95-2.09)
≥200 times	61	1.25 (0.94-1.65)	1.22 (0.92-1.63)	14	0.83 (0.47-1.45)	0.81 (0.46-1.43)	39	1.67 (1.15-2.44)	1.67 (1.14-2.44)
P-value for trend [h]		.08	.12156		.53	.48		.003	.003
Per 50-time increment		1.01 (0.99-1.03)	1.01 (0.99-1.03)		0.97 (0.90-1.04)	0.96 (0.90-1.03)		1.03 (1.01-1.05)	1.03 (1.00-1.05)
P-value for trend [i]		.38	.40		.33	.29		.02	.02
2002-2012									
Non-user	191	1 [Reference]	1 [Reference]	88	1 [Reference]	1 [Reference]	71	1 [Reference]	1 [Reference]
1-99 times	73	1.10 (0.84-1.44)	1.07 (0.81-1.41)	30	1.00 (0.66-1.53)	1.04 (0.68-1.59)	35	1.16 (0.77-1.74)	1.15 (0.76-1.74)
100-199 times	34	1.02 (0.71-1.47)	0.98 (0.68-1.41)	14	1.02 (0.58-1.81)	1.05 (0.59-1.87)	17	1.14 (0.67-1.94)	1.07 (0.62-1.84)
≥200 times	43	1.33 (0.95-1.87)	1.33 (0.94-1.87)	10	0.90 (0.46-1.76)	0.91 (0.47-1.79)	29	1.98 (1.27-3.10)	1.94 (1.23-3.04)
P-value for trend [h]		.13	.16		.82	.88		.004	.008
Per 50-time increment		1.01 (0.99-1.03)	1.01 (0.99-1.03)		0.97 (0.91-1.04)	0.98 (0.92-1.04)		1.03 (1.01-1.06)	1.03 (1.01-1.05)
P-value for trend [i]		.25	.19		.45	.48		.006	.01

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

^f Models were adjusted for age and follow-up cycle.

^g Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

^h *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

ⁱ *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 38. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence *** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

All cancers *	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-1992									
Non-user	4448	1 [Reference]	1 [Reference]	1582	1 [Reference]	1 [Reference]	1717	1 [Reference]	1 [Reference]
Ever-user	3091	1.01 (0.96-1.06)	0.99 (0.94-1.03)	1027	1.02 (0.94-1.10)	1.00 (0.92-1.08)	1369	0.98 (0.91-1.05)	0.96 (0.90-1.04)
1976-2002									
Non-user	9275	1 [Reference]	1 [Reference]	3428	1 [Reference]	1 [Reference]	3649	1 [Reference]	1 [Reference]
Ever-user	6516	1.01 (0.98-1.04)	0.98 (0.95-1.01)	2257	1.02 (0.97-1.08)	1.00 (0.95-1.06)	2972	0.98 (0.93-1.03)	0.96 (0.91-1.01)
1976-2012									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
Ever-user	9367	1.01 (0.99-1.04)	0.98 (0.96-1.01)	3322	1.02 (0.98-1.07)	1.00 (0.96-1.05)	4283	1.00 (0.96-1.04)	0.98 (0.94-1.02)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 39. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall cancer incidence** * among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

All cancers *	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-1992									
Non-user	4448	1 [Reference]	1 [Reference]	1582	1 [Reference]	1 [Reference]	1717	1 [Reference]	1 [Reference]
1-99 times	1387	0.98 (0.92-1.04)	0.96 (0.90-1.02)	477	1.00 (0.90-1.11)	0.99 (0.89-1.10)	615	0.95 (0.87-1.04)	0.94 (0.85-1.03)
100-199 times	791	1.00 (0.93-1.08)	0.98 (0.91-1.06)	299	1.04 (0.92-1.18)	1.02 (0.90-1.16)	335	0.92 (0.81-1.03)	0.91 (0.81-1.02)
≥200 times	913	1.06 (0.99-1.14)	1.04 (0.97-1.12)	251	1.01 (0.88-1.16)	0.99 (0.87-1.13)	419	1.08 (0.97-1.20)	1.06 (0.95-1.18)
P-value for trend [h]		.14	.40		.69	.98		.38	.54
Per 50-time increment		1.00 (1.00-1.01)	1.00 (1.00-1.01)		1.00 (0.99-1.02)	1.00 (0.99-1.01)		1.01 (1.00-1.02)	1.00 (0.99-1.02)
P-value for trend [i]		.28	.53		.78	.99		.27	.39
1976-2002									
Non-user	9275	1 [Reference]	1 [Reference]	3428	1 [Reference]	1 [Reference]	3649	1 [Reference]	1 [Reference]
1-99 times	3044	1.00 (0.96-1.04)	0.96 (0.92-1.00)	1100	1.03 (0.96-1.11)	1.01 (0.94-1.08)	1360	0.95 (0.89-1.01)	0.93 (0.87-0.99)
100-199 times	1691	1.02 (0.96-1.07)	0.98 (0.93-1.04)	641	1.04 (0.96-1.14)	1.02 (0.94-1.11)	763	0.97 (0.90-1.05)	0.95 (0.88-1.03)
≥200 times	1781	1.02 (0.97-1.07)	1.00 (0.95-1.05)	516	0.98 (0.89-1.07)	0.96 (0.87-1.05)	849	1.05 (0.97-1.13)	1.02 (0.95-1.10)
P-value for trend [h]		.37	.81		.93	.56		.34	.69
Per 50-time increment		1.00 (1.00-1.01)	1.00 (0.99-1.00)		1.00 (0.99-1.01)	1.00 (0.99-1.01)		1.00 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		.52	.97		.90	.65		.48	.83
1976-2012									
Non-user	13245	1 [Reference]	1 [Reference]	5067	1 [Reference]	1 [Reference]	5134	1 [Reference]	1 [Reference]
1-99 times	4492	1.01 (0.98-1.05)	0.98 (0.94-1.01)	1678	1.05 (0.99-1.11)	1.02 (0.96-1.08)	1988	0.97 (0.92-1.02)	0.95 (0.90-1.00)
100-199 times	2393	1.01 (0.97-1.06)	0.98 (0.94-1.03)	904	1.01 (0.94-1.09)	0.99 (0.92-1.06)	1109	0.99 (0.93-1.06)	0.98 (0.92-1.05)
≥200 times	2482	1.02 (0.98-1.07)	1.00 (0.96-1.05)	740	0.98 (0.91-1.06)	0.97 (0.90-1.05)	1186	1.05 (0.99-1.12)	1.03 (0.97-1.10)

P-value for trend [h]	.34	.94	.81	.47	.14	.36
Per 50-time increment	1.00 (1.00-1.00)	1.00 (0.99-1.00)	1.00 (0.99-1.01)	1.00 (0.99-1.01)	1.00 (1.00-1.01)	1.00 (1.00-1.01)
P-value for trend [i]	.84	.74	.66	.44	.31	.59

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 40. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Basal cell carcinoma	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-1992									
Non-user	4387	1 [Reference]	1 [Reference]	1503	1 [Reference]	1 [Reference]	2143	1 [Reference]	1 [Reference]
Ever-user	3547	1.17 (1.12-1.22)	1.04 (0.99-1.09)	1092	1.12 (1.03-1.21)	1.00 (0.92-1.09)	1957	1.13 (1.06-1.20)	1.05 (0.98-1.12)
1976-2002									
Non-user	8407	1 [Reference]	1 [Reference]	2900	1 [Reference]	1 [Reference]	4022	1 [Reference]	1 [Reference]
Ever-user	6917	1.18 (1.14-1.21)	1.07 (1.03-1.10)	2142	1.14 (1.07-1.20)	1.03 (0.97-1.09)	3766	1.13 (1.08-1.18)	1.07 (1.02-1.12)
1976-2012									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
Ever-user	10024	1.15 (1.12-1.18)	1.05 (1.02-1.08)	3199	1.10 (1.05-1.15)	1.01 (0.96-1.06)	5443	1.11 (1.07-1.15)	1.06 (1.02-1.11)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 41. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **basal cell carcinoma incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Basal cell carcinoma	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-1992									
Non-user	4387	1 [Reference]	1 [Reference]	1503	1 [Reference]	1 [Reference]	2143	1 [Reference]	1 [Reference]
1-99 times	1609	1.14 (1.08-1.21)	1.04 (0.98-1.10)	495	1.07 (0.97-1.19)	0.99 (0.89-1.10)	899	1.12 (1.03-1.21)	1.07 (0.98-1.16)
100-199 times	928	1.18 (1.10-1.27)	1.03 (0.95-1.11)	309	1.12 (0.99-1.27)	1.00 (0.88-1.14)	503	1.11 (1.01-1.23)	1.03 (0.93-1.13)
≥200 times	1010	1.20 (1.12-1.29)	1.06 (0.98-1.14)	288	1.20 (1.06-1.37)	1.03 (0.91-1.18)	555	1.16 (1.06-1.28)	1.05 (0.95-1.16)
P-value for trend [h]		<.001	.14		.002	.64		.001	.38
Per 50-time increment		1.01 (1.01-1.02)	1.00 (1.00-1.01)		1.02 (1.01-1.02)	1.01 (1.00-1.02)		1.01 (1.00-1.02)	1.00 (0.99-1.01)
P-value for trend [i]		<0.001	.35		<0.001	.16		.03	.91
1976-2002									
Non-user	8407	1 [Reference]	1 [Reference]	2900	1 [Reference]	1 [Reference]	4022	1 [Reference]	1 [Reference]
1-99 times	3247	1.17 (1.12-1.21)	1.07 (1.03-1.12)	971	1.07 (0.99-1.15)	1.00 (0.92-1.07)	1814	1.15 (1.09-1.22)	1.11 (1.05-1.18)
100-199 times	1807	1.19 (1.13-1.25)	1.06 (1.01-1.12)	611	1.16 (1.07-1.27)	1.05 (0.96-1.15)	958	1.10 (1.03-1.19)	1.04 (0.97-1.12)
≥200 times	1863	1.18 (1.12-1.24)	1.06 (1.00-1.12)	560	1.25 (1.14-1.37)	1.08 (0.98-1.19)	994	1.11 (1.04-1.20)	1.04 (0.97-1.12)
P-value for trend [h]		<.001	.02		<.001	.08		.001	.31
Per 50-time increment		1.01 (1.01-1.01)	1.00 (1.00-1.01)		1.02 (1.01-1.02)	1.01 (1.00-1.02)		1.01 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]		<0.001	.24		<0.001	.05		.08	.98
1976-2012									
Non-user	12536	1 [Reference]	1 [Reference]	4538	1 [Reference]	1 [Reference]	5891	1 [Reference]	1 [Reference]
1-99 times	4808	1.14 (1.10-1.18)	1.05 (1.02-1.09)	1526	1.05 (0.99-1.11)	0.98 (0.93-1.05)	2645	1.13 (1.08-1.18)	1.09 (1.04-1.15)
100-199 times	2605	1.16 (1.11-1.21)	1.04 (1.00-1.09)	895	1.12 (1.04-1.20)	1.03 (0.96-1.11)	1387	1.09 (1.03-1.16)	1.03 (0.97-1.10)
≥200 times	2611	1.15 (1.10-1.20)	1.05 (1.00-1.09)	778	1.17 (1.09-1.27)	1.04 (0.96-1.13)	1411	1.11 (1.04-1.17)	1.04 (0.98-1.11)

P-value for trend [h]	<.001	.03	<.001	.25	<.001	.23
Per 50-time increment	1.01 (1.01-1.01)	1.00 (1.00-1.01)	1.01 (1.01-1.02)	1.00 (1.00-1.01)	1.01 (1.00-1.01)	1.00 (0.99-1.01)
P-value for trend [i]	<0.001	.40	<0.001	.29	.07	.96

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 42. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Breast cancer	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-1992									
Non-user	2189	1 [Reference]	1 [Reference]	828	1 [Reference]	1 [Reference]	861	1 [Reference]	1 [Reference]
Ever-user	1657	1.10 (1.03-1.18)	1.05 (0.99-1.12)	588	1.11 (1.00-1.24)	1.07 (0.96-1.19)	755	1.07 (0.97-1.18)	1.03 (0.94-1.14)
1976-2002									
Non-user	4043	1 [Reference]	1 [Reference]	1555	1 [Reference]	1 [Reference]	1607	1 [Reference]	1 [Reference]
Ever-user	3030	1.08 (1.03-1.13)	1.04 (0.99-1.09)	1092	1.10 (1.01-1.19)	1.07 (0.99-1.16)	1420	1.06 (0.99-1.14)	1.03 (0.96-1.11)
1976-2012									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
Ever-user	3920	1.06 (1.01-1.10)	1.02 (0.98-1.06)	1448	1.08 (1.01-1.15)	1.05 (0.98-1.12)	1818	1.04 (0.98-1.11)	1.02 (0.95-1.09)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 43. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **breast cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Breast cancer	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-1992									
Non-user	2189	1 [Reference]	1 [Reference]	828	1 [Reference]	1 [Reference]	861	1 [Reference]	1 [Reference]
1-99 times	763	1.08 (1.00-1.17)	1.04 (0.95-1.13)	297	1.16 (1.02-1.33)	1.13 (0.98-1.29)	321	0.97 (0.85-1.11)	0.94 (0.82-1.07)
100-199 times	404	1.04 (0.93-1.16)	0.99 (0.89-1.10)	146	0.98 (0.82-1.17)	0.94 (0.78-1.12)	184	1.00 (0.85-1.18)	0.97 (0.83-1.14)
≥200 times	490	1.20 (1.08-1.32)	1.14 (1.03-1.26)	145	1.18 (0.99-1.42)	1.11 (0.93-1.33)	250	1.30 (1.13-1.50)	1.26 (1.09-1.45)
P-value for trend [h]		<.001	.03		.14	.49		.001	.004
Per 50-time increment		1.01 (1.00-1.02)	1.01 (1.00-1.02)		1.01 (1.00-1.03)	1.01 (0.99-1.02)		1.02 (1.01-1.03)	1.02 (1.00-1.03)
P-value for trend [i]		.02	.10		.12	.35		.003	.01
1976-2002									
Non-user	4043	1 [Reference]	1 [Reference]	1555	1 [Reference]	1 [Reference]	1607	1 [Reference]	1 [Reference]
1-99 times	1433	1.06 (1.00-1.13)	1.02 (0.96-1.09)	554	1.12 (1.02-1.24)	1.11 (1.01-1.23)	638	0.99 (0.91-1.09)	0.97 (0.88-1.06)
100-199 times	762	1.06 (0.98-1.15)	1.01 (0.93-1.10)	290	1.05 (0.92-1.19)	1.02 (0.89-1.16)	354	1.03 (0.92-1.16)	1.02 (0.90-1.14)
≥200 times	835	1.14 (1.05-1.22)	1.09 (1.01-1.17)	248	1.10 (0.96-1.26)	1.04 (0.90-1.19)	428	1.21 (1.09-1.35)	1.18 (1.05-1.31)
P-value for trend [h]		<.001	.047		.16	.62		.001	.005
Per 50-time increment		1.01 (1.00-1.01)	1.01 (1.00-1.01)		1.01 (1.00-1.02)	1.01 (0.99-1.02)		1.01 (1.00-1.02)	1.01 (1.00-1.02)
P-value for trend [i]		.02	.09		.15	.41		.004	.01
1976-2012									
Non-user	5332	1 [Reference]	1 [Reference]	2117	1 [Reference]	1 [Reference]	2084	1 [Reference]	1 [Reference]
1-99 times	1884	1.04 (0.98-1.09)	1.00 (0.95-1.06)	741	1.09 (1.00-1.18)	1.07 (0.98-1.17)	833	0.99 (0.91-1.07)	0.96 (0.88-1.05)
100-199 times	972	1.03 (0.96-1.10)	0.99 (0.92-1.06)	384	1.04 (0.93-1.16)	1.01 (0.90-1.13)	447	1.00 (0.90-1.11)	0.98 (0.89-1.09)
≥200 times	1064	1.12 (1.04-1.19)	1.08 (1.01-1.16)	323	1.09 (0.97-1.23)	1.04 (0.92-1.17)	538	1.19 (1.08-1.31)	1.16 (1.05-1.28)

P-value for trend [h]	.001	.06	.14	.57	.001	.007
Per 50-time increment	1.01 (1.00-1.01)	1.00 (1.00-1.01)	1.01 (1.00-1.02)	1.01 (0.99-1.02)	1.01 (1.00-1.02)	1.01 (1.00-1.02)
P-value for trend [i]	.05	.17	.14	.39	.006	.02

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] P-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] P-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 44. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to status of personal use of permanent hair dyes and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Ovarian cancer	Any hair color [a]			Dark hair color [b,d]			Light hair color [c,d]		
	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)	No. of cases	Age-adjusted [e] HR (95% CI)	MV-adjusted [f] HR (95% CI)
1976-1992									
Non-user	303	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]	116	1 [Reference]	1 [Reference]
Ever-user	219	1.05 (0.88-1.25)	1.05 (0.88-1.25)	79	1.28 (0.95-1.73)	1.35 (0.99-1.83)	88	0.92 (0.70-1.22)	0.89 (0.67-1.18)
1976-2002									
Non-user	510	1 [Reference]	1 [Reference]	176	1 [Reference]	1 [Reference]	198	1 [Reference]	1 [Reference]
Ever-user	383	1.08 (0.94-1.23)	1.07 (0.94-1.23)	140	1.22 (0.98-1.53)	1.27 (1.01-1.60)	168	1.02 (0.83-1.26)	1.01 (0.81-1.24)
1976-2012									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
Ever-user	528	1.09 (0.98-1.23)	1.09 (0.97-1.22)	193	1.17 (0.97-1.41)	1.21 (1.00-1.47)	242	1.08 (0.90-1.28)	1.06 (0.89-1.27)

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age and follow-up cycle.

[f] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

Supplementary Table 45. Age-adjusted and multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **ovarian cancer incidence** among women in the NHS according to cumulative dose of permanent hair dye use [a] and natural hair color, obtained from Cox models with updated covariate values (restricting follow-up to the first 10 and 20 years after exposure assessments stopped)

Ovarian cancer	Any hair color [b]			Dark hair color [c,e]			Light hair color [d,e]		
	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)	No. of cases	Age-adjusted [f] HR (95% CI)	MV-adjusted [g] HR (95% CI)
1976-1992									
Non-user	303	1 [Reference]	1 [Reference]	97	1 [Reference]	1 [Reference]	116	1 [Reference]	1 [Reference]
1-99 times	92	0.94 (0.74-1.19)	0.95 (0.75-1.21)	32	1.04 (0.70-1.56)	1.06 (0.70-1.61)	35	0.79 (0.54-1.16)	0.77 (0.52-1.13)
100-199 times	60	1.12 (0.85-1.48)	1.13 (0.85-1.50)	23	1.36 (0.86-2.15)	1.48 (0.93-2.36)	28	1.12 (0.74-1.70)	1.07 (0.70-1.64)
≥200 times	67	1.17 (0.90-1.53)	1.12 (0.86-1.47)	24	1.73 (1.09-2.74)	1.85 (1.16-2.95)	25	0.96 (0.62-1.48)	0.92 (0.59-1.44)
P-value for trend [h]		.18	.29		.01	.005		.92	.92
Per 50-time increment		1.01 (0.99-1.03)	1.01 (0.99-1.03)		1.06 (1.02-1.11)	1.07 (1.03-1.12)		0.99 (0.95-1.04)	0.99 (0.94-1.04)
P-value for trend [i]		.26	.43		.005	.002		.81	.69
1976-2002									
Non-user	510	1 [Reference]	1 [Reference]	176	1 [Reference]	1 [Reference]	198	1 [Reference]	1 [Reference]
1-99 times	163	0.96 (0.81-1.15)	0.97 (0.81-1.16)	61	1.07 (0.80-1.44)	1.10 (0.82-1.48)	64	0.83 (0.63-1.10)	0.83 (0.62-1.11)
100-199 times	115	1.26 (1.03-1.55)	1.27 (1.03-1.56)	44	1.41 (1.01-1.97)	1.48 (1.06-2.08)	56	1.29 (0.95-1.74)	1.25 (0.92-1.70)
≥200 times	105	1.09 (0.89-1.35)	1.08 (0.87-1.33)	35	1.33 (0.92-1.92)	1.40 (0.96-2.03)	48	1.09 (0.79-1.50)	1.06 (0.77-1.47)
P-value for trend [h]		.13	.17		.04	.02		.25	.35
Per 50-time increment		1.01 (0.99-1.03)	1.00 (0.99-1.02)		1.03 (1.00-1.07)	1.04 (1.00-1.07)		1.01 (0.98-1.04)	1.00 (0.97-1.04)
P-value for trend [i]		.54	.64		.08	.048		.70	.80
1976-2012									
Non-user	687	1 [Reference]	1 [Reference]	256	1 [Reference]	1 [Reference]	267	1 [Reference]	1 [Reference]
1-99 times	231	0.99 (0.86-1.15)	1.00 (0.86-1.16)	89	1.06 (0.83-1.36)	1.10 (0.86-1.41)	95	0.89 (0.70-1.12)	0.89 (0.70-1.13)
100-199 times	149	1.21 (1.01-1.44)	1.20 (1.01-1.44)	58	1.31 (0.98-1.75)	1.36 (1.02-1.82)	72	1.23 (0.94-1.60)	1.21 (0.93-1.57)
≥200 times	148	1.17 (0.97-1.39)	1.15 (0.96-1.37)	46	1.24 (0.90-1.71)	1.28 (0.93-1.77)	75	1.27 (0.98-1.65)	1.24 (0.95-1.61)

P-value for trend [h]	.03	.046	.07	.04	.03	.047
Per 50-time increment	1.01 (0.99-1.02)	1.01 (0.99-1.02)	1.03 (0.99-1.06)	1.03 (1.00-1.06)	1.02 (1.00-1.04)	1.02 (0.99-1.04)
P-value for trend [i]	.24	.33	.13	.09	.11	.16

MV: multivariable; HR: hazard ratio; CI: confidence interval; BMI: body mass index

[a] Cumulative dose is the product of average frequency of use (times per year) multiplied by duration of use (years).

[b] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[c] Dark natural hair color: black and dark brown.

[d] Light natural hair color: red, blond, and light brown.

[e] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[f] Models were adjusted for age and follow-up cycle.

[g] Models were additionally adjusted for race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, alcohol intake, menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[h] *P*-value for trend was calculated using the mid-point of each category of cumulative dose in times.

[i] *P*-value for trend was calculated using cumulative dose in times as continuous.

Supplementary Table 46. Multivariable (MV)-adjusted hazard ratios (HR) and 95% confidence intervals (CI) of **overall * and specific cancer incidence and cancer-related death** among women in the NHS with any hair color according to status of personal use of permanent hair dyes, obtained from Cox models with updated covariate values (using baseline exposure information only)

Types of cancers	Ever versus non-use of permanent hair dyes						P-value for interaction
	Any hair color [a]		Dark hair color [b,d]		Light hair color [c,d]		
	No. of cases	MV-adjusted HR (95% CI)	No. of cases	MV-adjusted HR (95% CI)	No. of cases	MV-adjusted HR (95% CI)	
All cancers [*,e]	22612	0.99 (0.96-1.01)	8389	0.99 (0.94-1.04)	9417	1.01 (0.96-1.05)	.75
All solid cancers [*,e]	20805	0.98 (0.95-1.01)	7648	0.97 (0.93-1.02)	8708	1.01 (0.96-1.05)	.49
Basal cell carcinoma [e,f]	22560	1.05 (1.02-1.08)	7737	1.03 (0.98-1.08)	11334	1.06 (1.02-1.10)	.67
Cutaneous squamous cell carcinoma [e,f]	2792	0.97 (0.89-1.06)	959	1.02 (0.88-1.17)	1375	0.90 (0.80-1.01)	.12
Melanoma [e,f]	1198	0.91 (0.79-1.04)	386	0.90 (0.71-1.15)	580	0.84 (0.70-1.01)	.96
Breast cancer [e,g]	9252	1.01 (0.96-1.05)	3565	1.02 (0.95-1.10)	3902	1.03 (0.96-1.10)	.68
Breast cancer (ER+) [e,g,m]	5905	0.99 (0.93-1.05)	2388	0.99 (0.91-1.09)	2595	1.01 (0.93-1.09)	.78
Breast cancer (ER−) [e,g,m]	1521	1.01 (0.90-1.12)	610	1.07 (0.90-1.29)	649	1.03 (0.87-1.22)	.47
Breast cancer (PR+) [e,g,m]	4826	0.99 (0.93-1.05)	1933	1.00 (0.90-1.11)	2148	0.98 (0.90-1.08)	.44
Breast cancer (PR−) [e,g,m]	2379	0.99 (0.90-1.08)	977	1.01 (0.87-1.16)	1003	1.06 (0.93-1.21)	.85
Breast cancer (ER+/PR+) [e,g,m]	4634	0.99 (0.92-1.05)	1848	0.99 (0.89-1.10)	2079	0.98 (0.89-1.08)	.53
Breast cancer (ER+/PR−) [e,g,m]	1086	0.97 (0.85-1.11)	459	0.95 (0.77-1.17)	441	1.09 (0.90-1.34)	.36
Breast cancer (ER−/PR−) [e,g,m]	1287	1.00 (0.89-1.13)	517	1.07 (0.88-1.30)	561	1.05 (0.88-1.25)	.56
Ovarian cancer [e,h]	1215	1.09 (0.96-1.22)	449	1.14 (0.93-1.39)	509	1.17 (0.97-1.40)	.74
Colorectal cancer [e,i]	2394	1.06 (0.97-1.15)	858	1.09 (0.94-1.26)	991	1.09 (0.95-1.24)	.73
Bladder cancer [e,j]	596	1.13 (0.96-1.34)	227	1.12 (0.85-1.48)	260	1.19 (0.92-1.53)	.99
Kidney cancer [e]	477	0.99 (0.81-1.20)	184	0.99 (0.71-1.37)	190	1.02 (0.75-1.38)	.64
Lung cancer [e]	2623	0.96 (0.88-1.04)	908	0.84 (0.72-0.97)	1017	1.05 (0.92-1.19)	.02
Brain cancer [e]	277	0.76 (0.58-0.99)	100	1.00 (0.64-1.55)	100	0.52 (0.32-0.83)	.05
All hematopoietic cancers [e]	1807	1.04 (0.94-1.15)	741	1.12 (0.95-1.31)	709	1.00 (0.86-1.17)	.24
All non-Hodgkin lymphomas [e]	1277	0.98 (0.87-1.11)	529	1.01 (0.84-1.23)	510	0.97 (0.80-1.16)	.67
T-cell lymphoma [e]	51	1.51 (0.85-2.68)	25	1.19 (0.50-2.84)	15	1.99 (0.70-5.65)	.33

Diffuse large B-cell lymphoma [e]	190	1.10 (0.81-1.49)	76	1.11 (0.67-1.82)	79	0.87 (0.54-1.41)	.50
Follicular lymphoma [e]	204	1.17 (0.87-1.56)	83	1.36 (0.86-2.15)	87	1.05 (0.67-1.63)	.30
Chronic lymphocytic leukemia/small lymphocytic lymphoma [e]	272	0.74 (0.57-0.98)	122	0.81 (0.54-1.22)	111	0.69 (0.45-1.06)	.49
Hodgkin lymphoma [e,k]	70	1.25 (0.76-2.05)	24	3.93 (1.70-9.11)	31	0.58 (0.24-1.37)	.002
Multiple myeloma [e,k]	274	1.00 (0.78-1.30)	113	0.94 (0.62-1.43)	108	0.97 (0.65-1.46)	.95
Myeloid leukemias [e]	170	1.11 (0.81-1.53)	59	1.14 (0.66-2.00)	64	1.17 (0.70-1.96)	.93
Cancer-related death [e,l]	4860	1.00 (0.94-1.07)	1661	1.04 (0.93-1.16)	1801	1.03 (0.94-1.14)	.82

MV: multivariable; HR: hazard ratio; CI: confidence interval; ER: estrogen receptor; PR: progesterone receptor; BMI: body mass index; UV: ultraviolet; NSAIDs: nonsteroidal anti-inflammatory drugs

* Not including basal cell carcinoma and cutaneous squamous cell carcinoma.

[a] Including participants whose natural hair color was black, dark brown, red, blond, or light brown, or who had missing information on natural hair color.

[b] Dark natural hair color: black and dark brown.

[c] Light natural hair color: red, blond, and light brown.

[d] Participants were excluded from stratified analyses if they had missing information on natural hair color. The number of cases among "dark hair color" and "light hair color" women does not sum to the total number of cases in "any hair color" women due to the inclusion of women with missing hair color information in the "any hair color" group.

[e] Models were adjusted for age, follow-up cycle, race, natural hair color, cumulative average BMI, BMI at age 18, smoking status, pack-years of smoking, and alcohol intake. In analyses stratified by natural hair color, models were not further adjusted for natural hair color.

[f] Models were additionally adjusted for childhood reaction to sun, lifetime blistering sunburns, number of moles on arms, and cumulative UV flux since baseline.

[g] Models were additionally adjusted for menopausal status, postmenopausal hormone use, oral contraceptive use, adolescent body size, age at menarche, age at first birth, parity, breastfeeding, first-degree family history of breast cancer, history of benign breast disease, and current mammography use.

[h] Models were additionally adjusted for menopausal status, postmenopausal hormone use, age at menarche, oral contraceptive use, and parity.

[i] Models were additionally adjusted for physical activity, menopausal status, postmenopausal hormone use, family history of colorectal cancer, history of diabetes mellitus, screening colonoscopy or sigmoidoscopy in the previous 2 years, regular use of aspirin, regular use of non-aspirin NSAIDs, multivitamin use, total calories intake, red or processed meat intake, and intake of fiber, folate, calcium, and vitamin D.

[j] Models were additionally adjusted for total fluid intake.

[k] Models were additionally adjusted for regular use of aspirin.

[l] Models were additionally adjusted for physical activity, menopausal status, postmenopausal hormone use, parity, regular use of aspirin, regular use of non-aspirin NSAIDs, multivitamin use, total calories intake, history of hypertension, history of hypercholesterolemia, and history of diabetes mellitus.

[m] Hormone receptor status was not available for all the breast cancer cases.

Supplementary Figure 1. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall cancer incidence

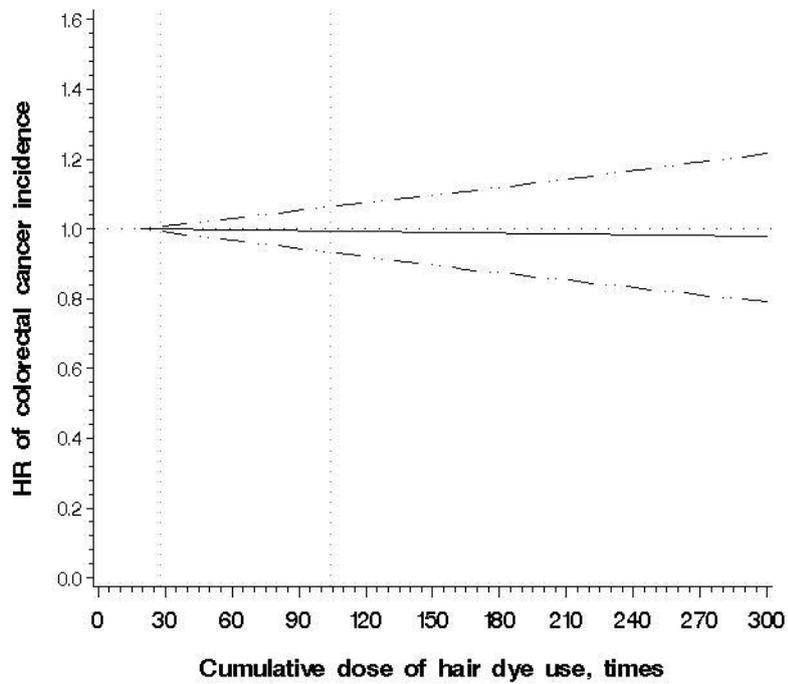Cumulative dose of hair dye use and overall cancer incidence
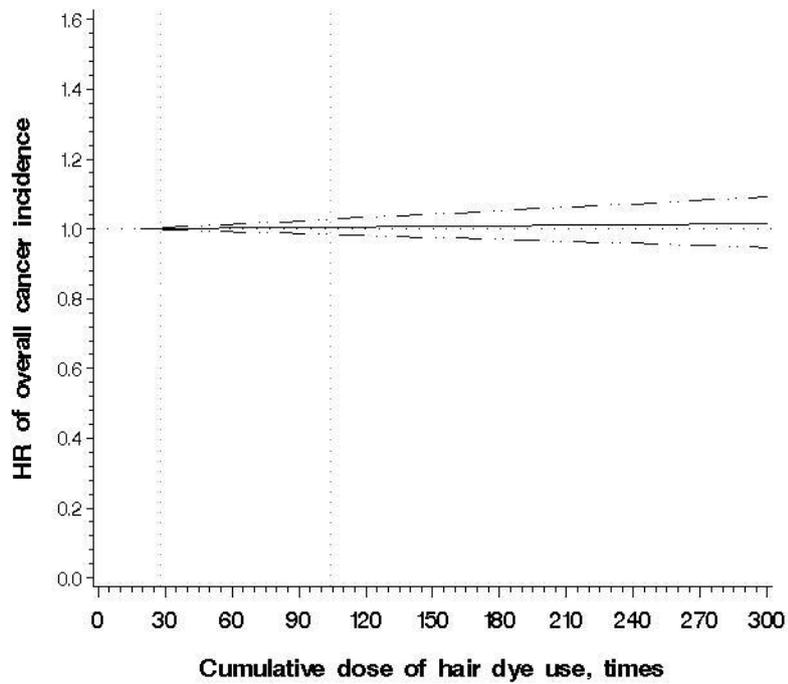
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 1.

For overall cancer incidence, no spline variable was selected and $P = .65$ for linearity.

Supplementary Figure 2. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall solid cancer incidence

Cumulative dose of hair dye use and overall solid cancer incidence
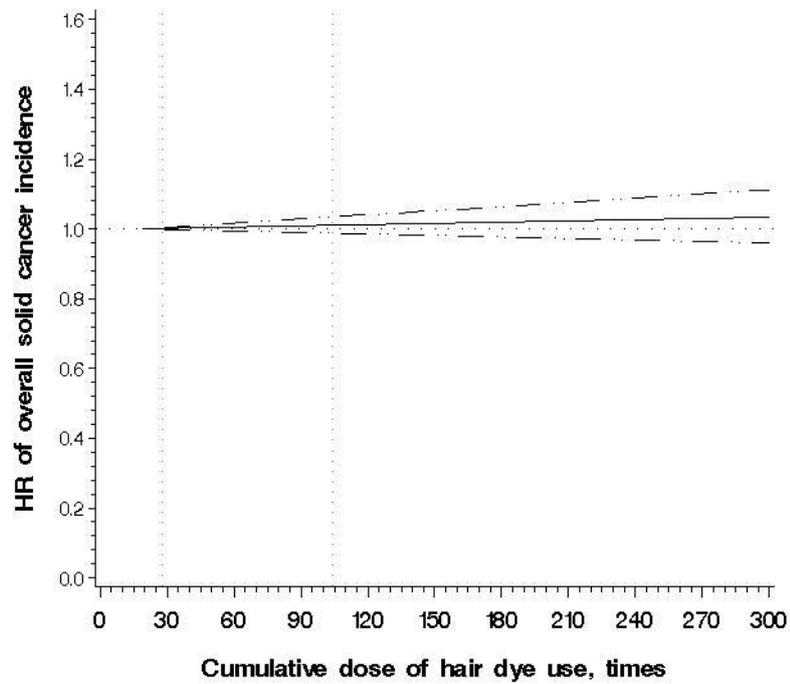
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 2.

For overall solid cancer incidence, no spline variable was selected and P = .39 for linearity.

Supplementary Figure 3. Dose-response relationship between cumulative dose of personal permanent hair dye use and basal cell carcinoma incidence

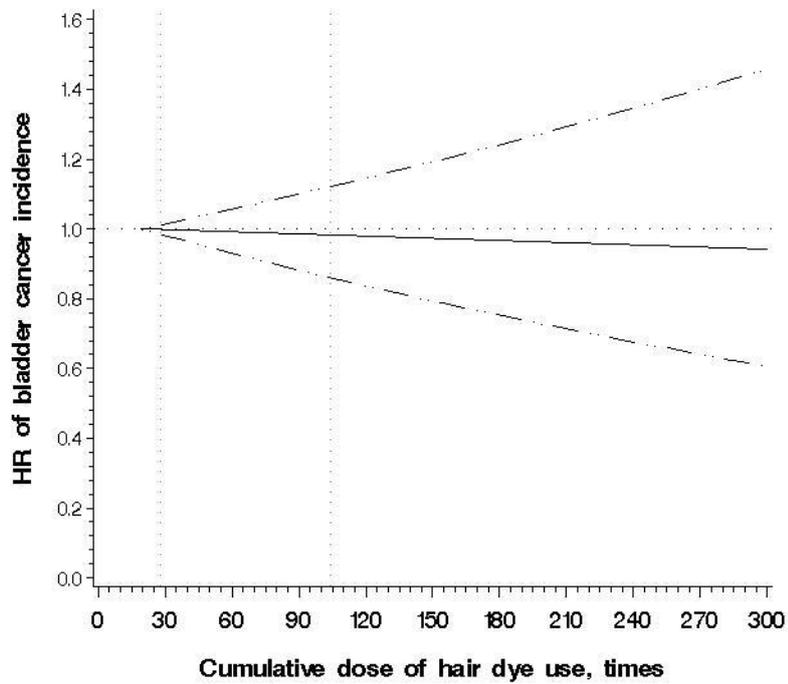## Cumulative dose of hair dye use and basal cell carcinoma incidence
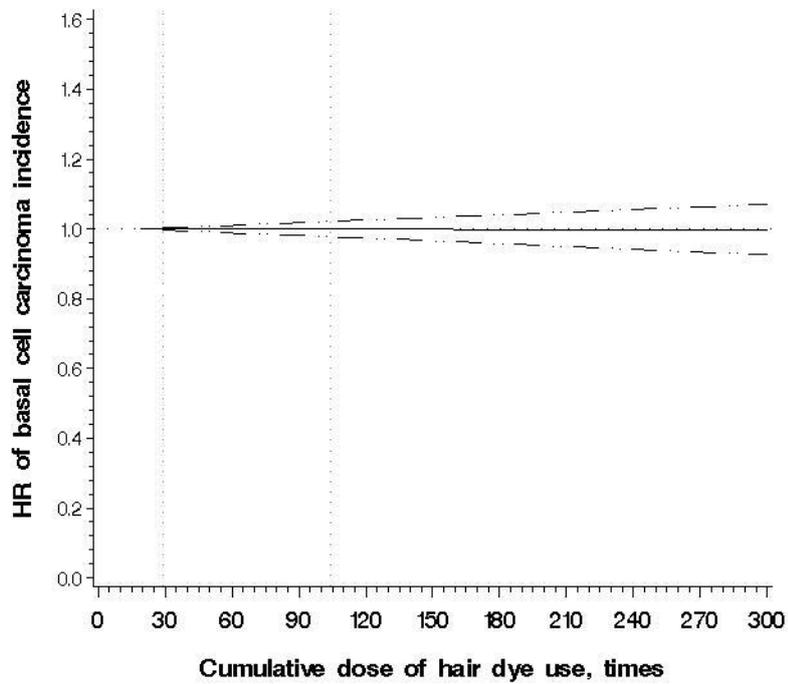
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 3.

For basal cell carcinoma incidence, no spline variable was selected and $P = .90$ for linearity.

Supplementary Figure 4. Dose-response relationship between cumulative dose of personal permanent hair dye use and cutaneous squamous cell carcinoma incidence

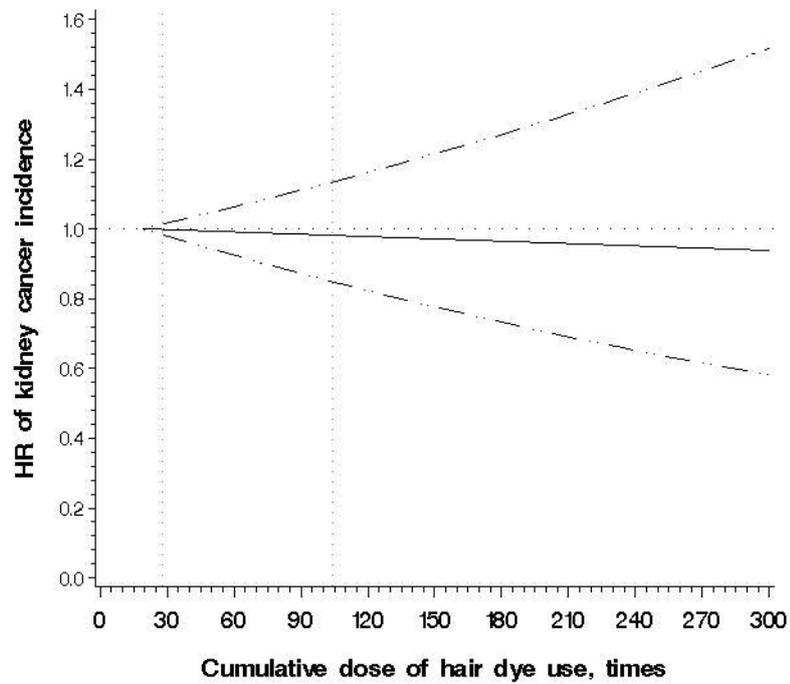Cumulative dose of hair dye use and cutaneous squamous cell carcinoma incidence
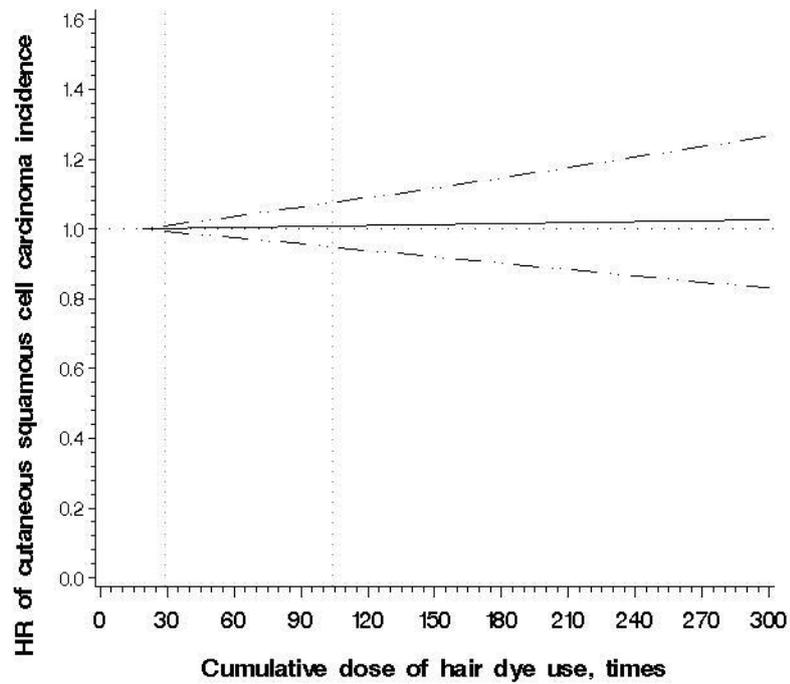
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 4.

For cutaneous squamous cell carcinoma incidence, no spline variable was selected and $P = .81$ for linearity.

Supplementary Figure 5. Dose-response relationship between cumulative dose of personal permanent hair dye use and melanoma incidence

Cumulative dose of hair dye use and melanoma incidence
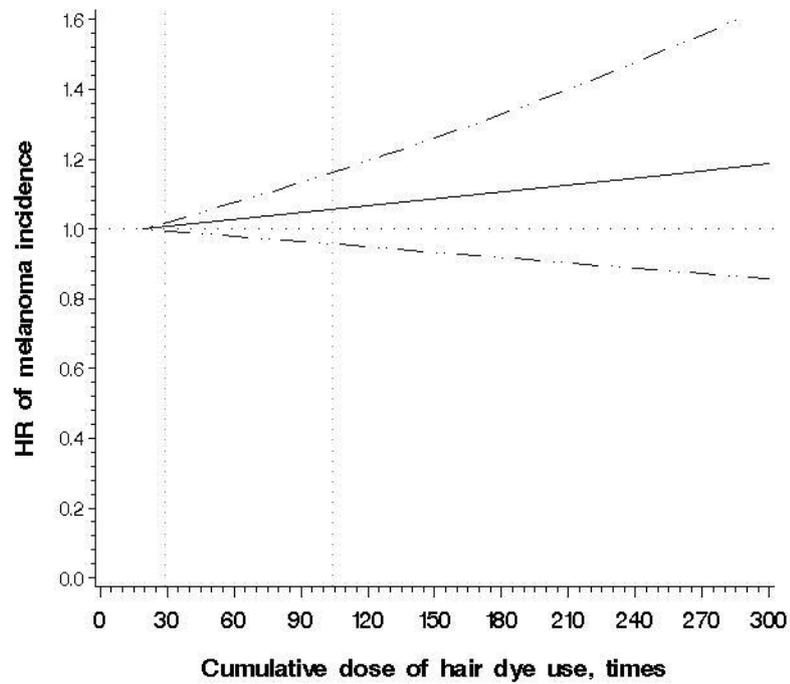
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 5.

For melanoma incidence, no spline variable was selected and *P* = .31 for linearity.

Supplementary Figure 6. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall breast cancer incidence

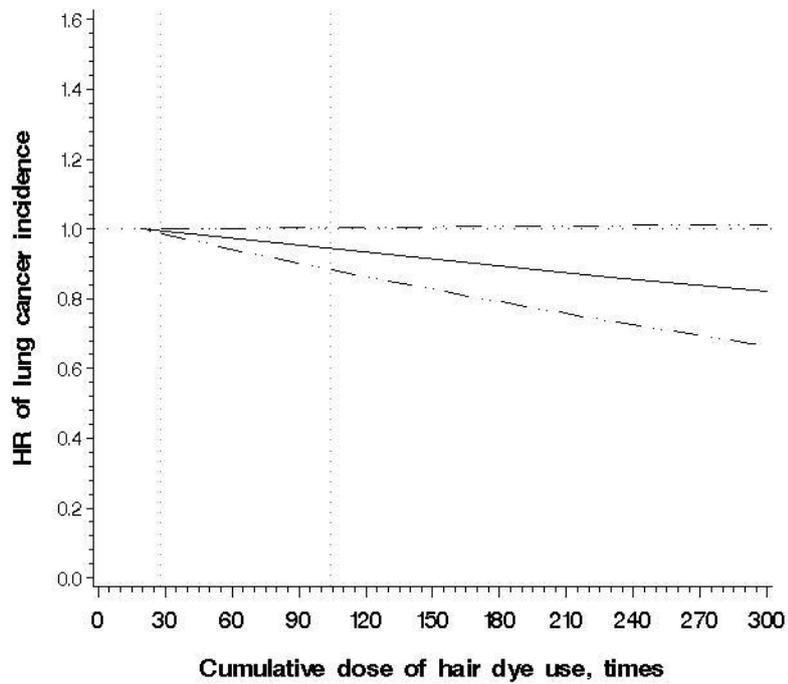## Cumulative dose of hair dye use and breast cancer incidence
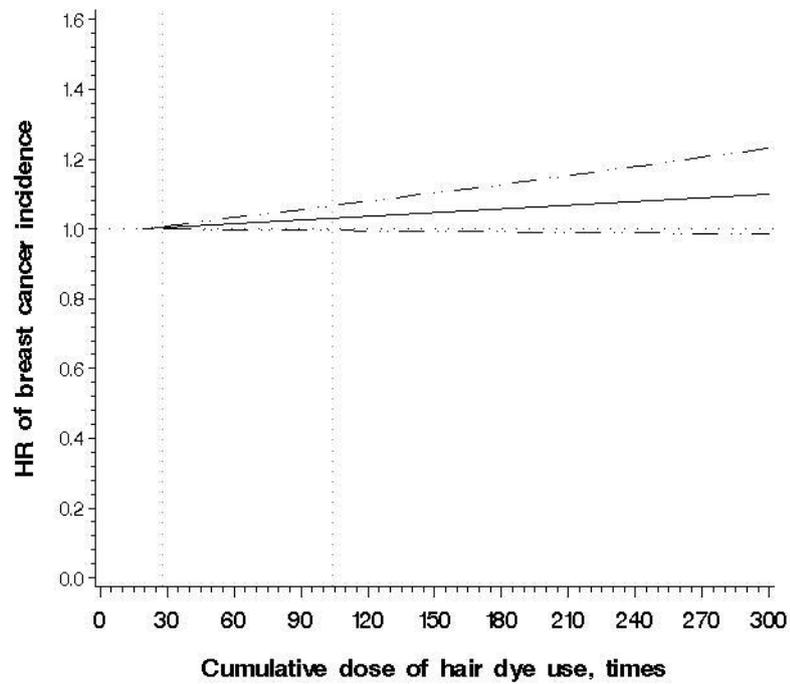
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 6.

For overall breast cancer incidence, no spline variable was selected and $P = .09$ for linearity.

Supplementary Figure 7. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER+) incidence

Cumulative dose of hair dye use and breast cancer (ER+) incidence
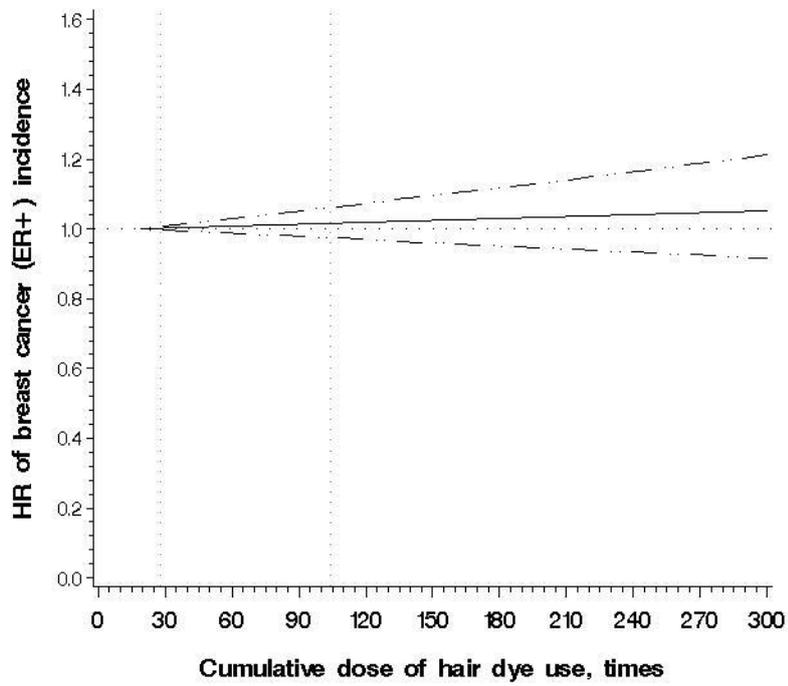
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 7.

For breast cancer (ER+), no spline variable was selected and $P = .47$ for linearity.

Supplementary Figure 8. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER−) incidence

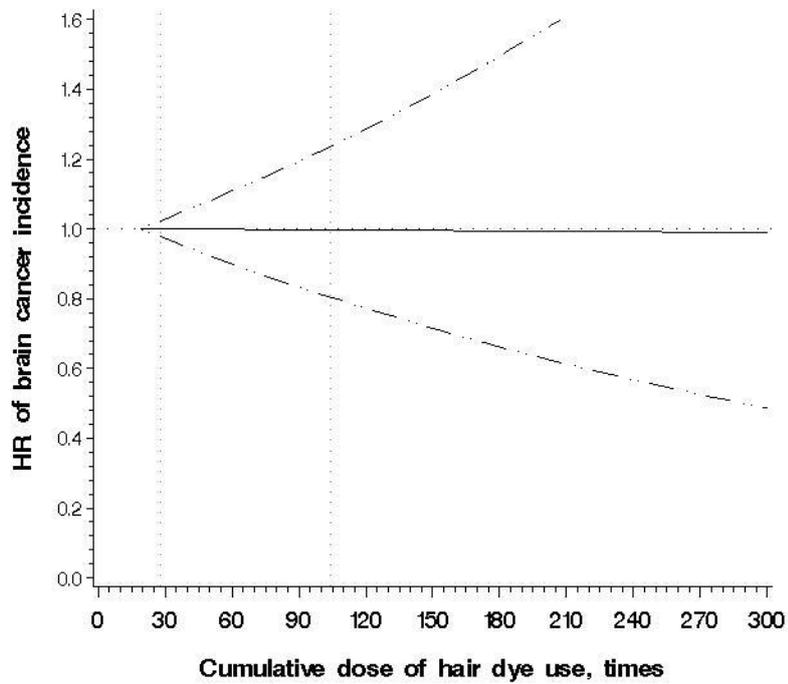**Cumulative dose of hair dye use and breast cancer (ER−) incidence**
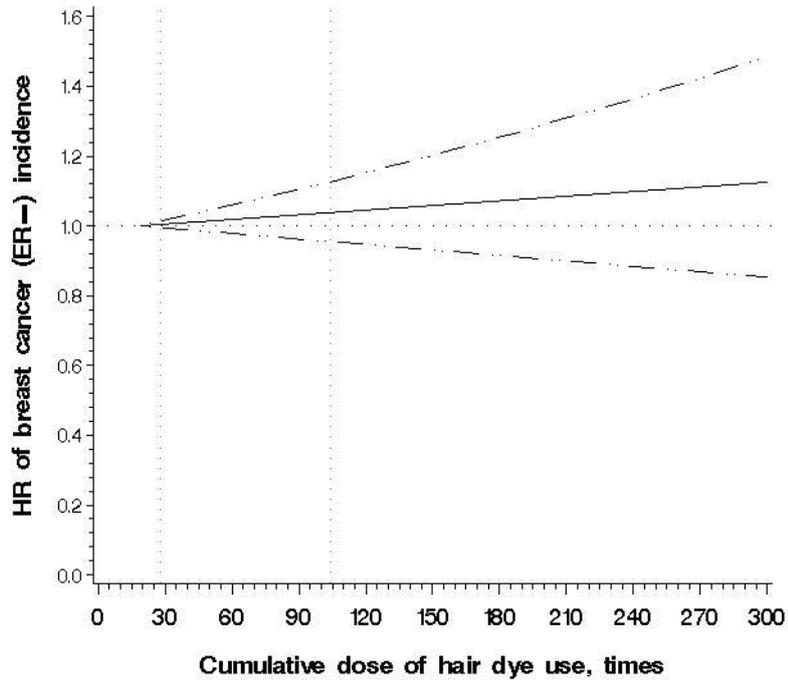
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 8.

For breast cancer (ER−), no spline variable was selected and $P = .41$ for linearity.

Supplementary Figure 9. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (PR+) incidence

Cumulative dose of hair dye use and breast cancer (PR+) incidence
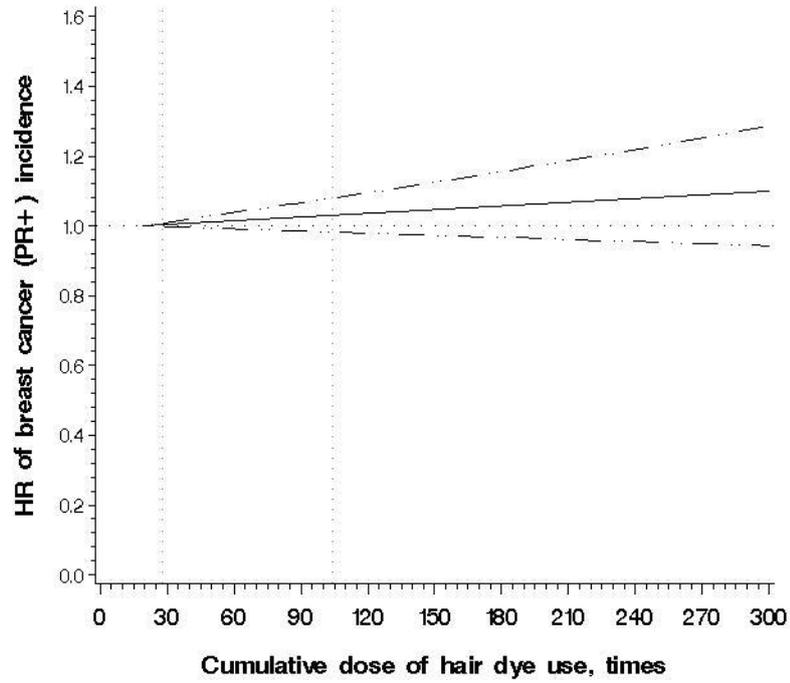
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 9.

For breast cancer (PR+) incidence, no spline variable was selected and $P = .23$ for linearity.

Supplementary Figure 10. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (PR−) incidence

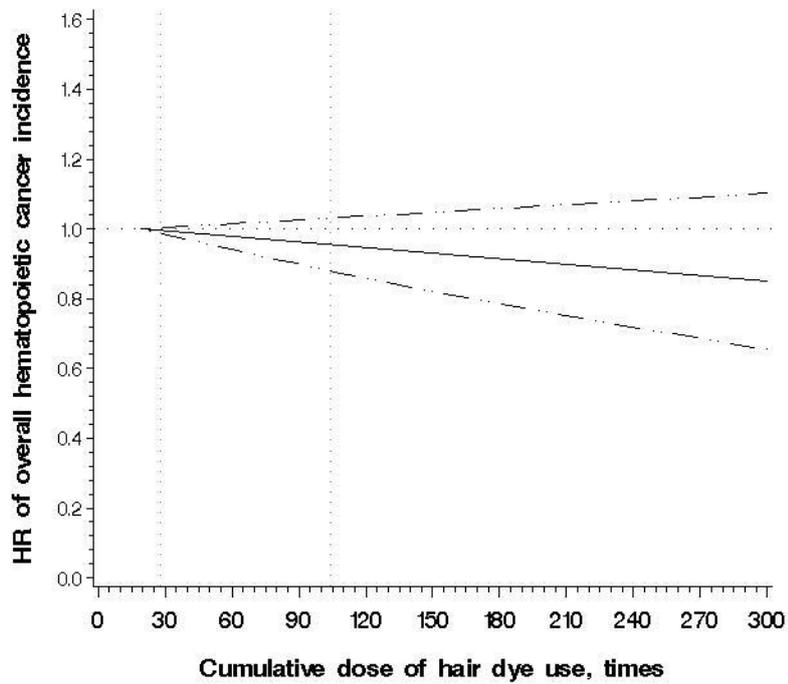Cumulative dose of hair dye use and breast cancer (PR−) incidence
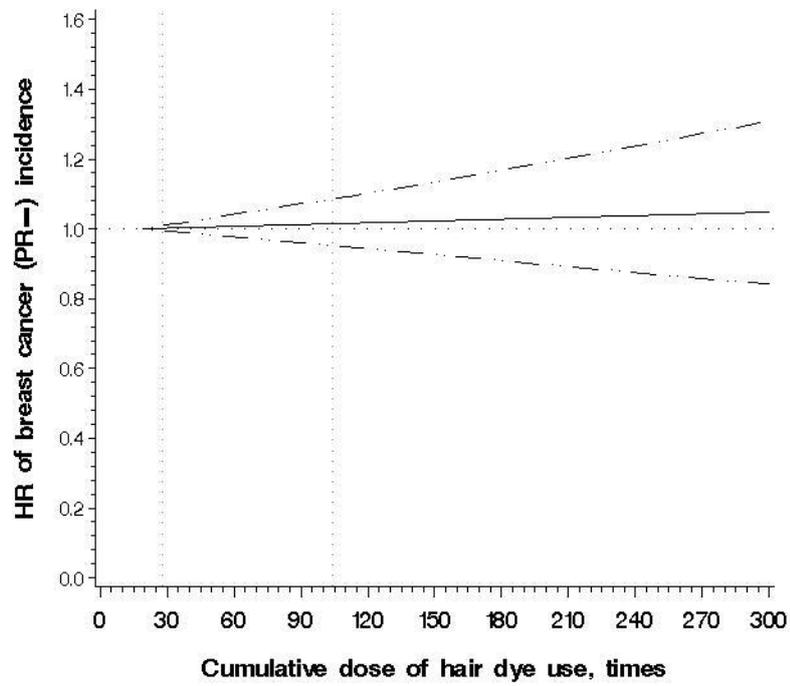
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 10.

For breast cancer (PR−) incidence, no spline variable was selected and *P* = .67 for linearity.

Supplementary Figure 11. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER+/PR+) incidence

Cumulative dose of hair dye use and breast cancer (ER+/PR+) incidence
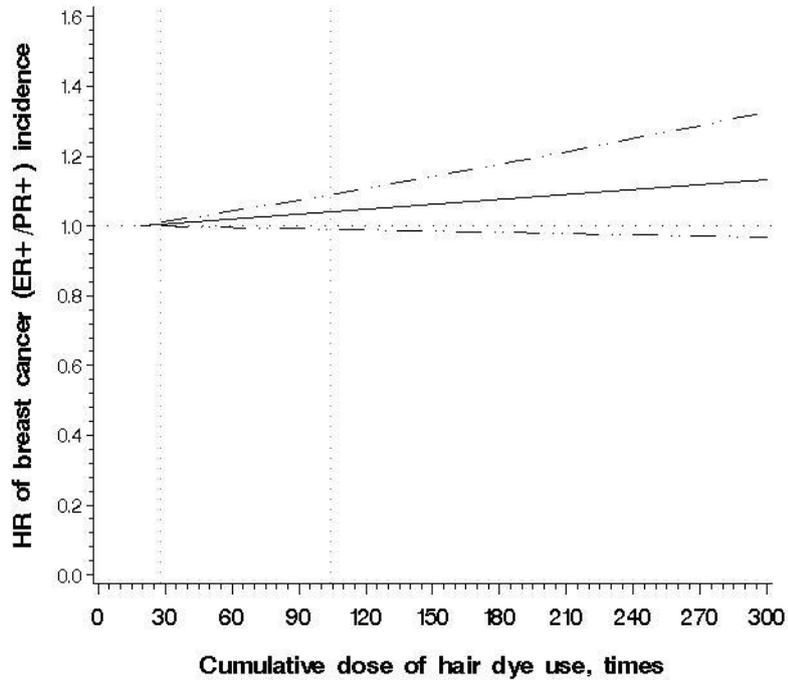
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 11.

For breast cancer (ER+/PR+) incidence, no spline variable was selected and $P = .12$ for linearity.

Supplementary Figure 12. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER+/PR−) incidence

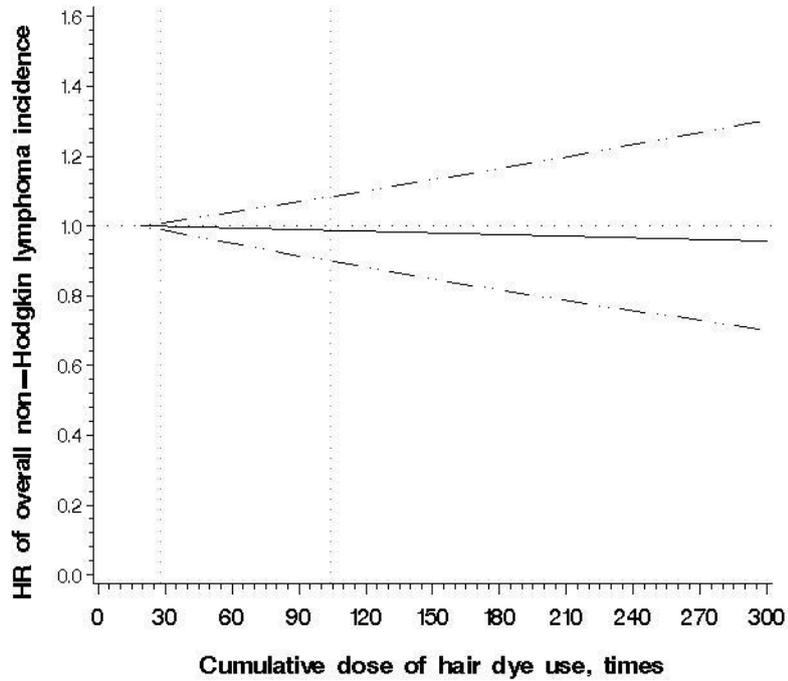Cumulative dose of hair dye use and breast cancer (ER+/PR−) incidence
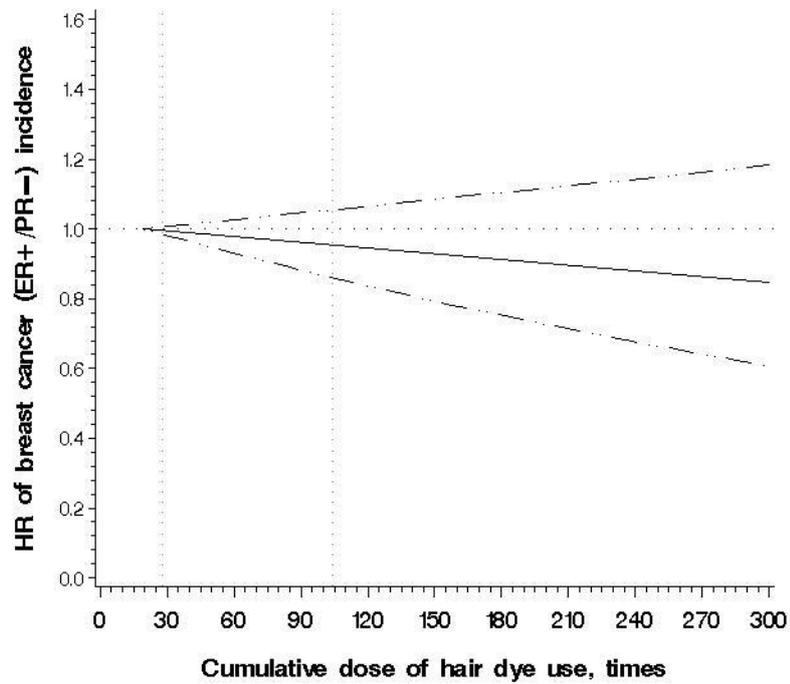
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 12.

For breast cancer (ER+/PR−) incidence, no spline variable was selected and *P* = .33 for linearity.

Supplementary Figure 13. Dose-response relationship between cumulative dose of personal permanent hair dye use and breast cancer (ER−/PR−) incidence

Cumulative dose of hair dye use and breast cancer (ER−/PR−) incidence
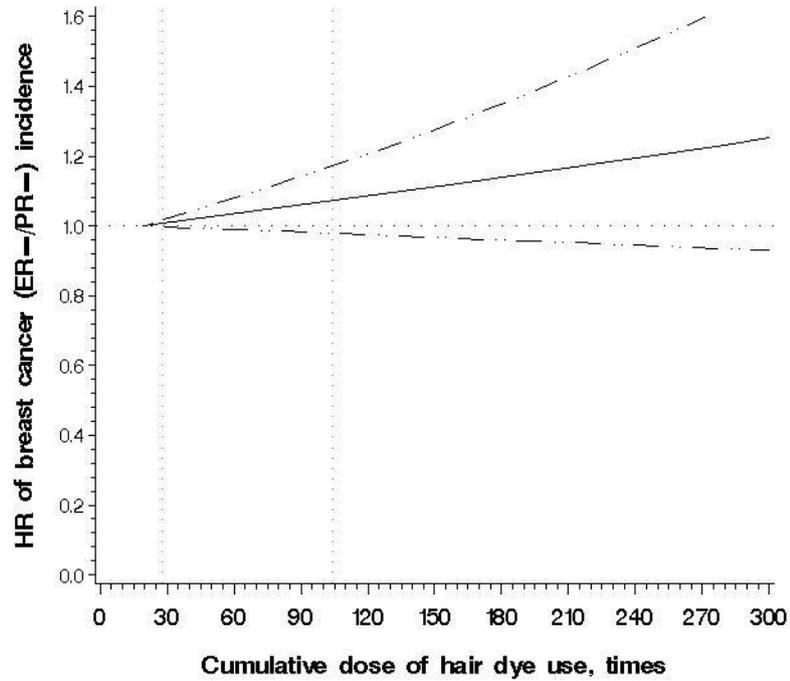
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 13.

For breast cancer (ER−/PR−) incidence, no spline variable was selected and $P = .14$ for linearity.

Supplementary Figure 14. Dose-response relationship between cumulative dose of personal permanent hair dye use and ovarian cancer incidence

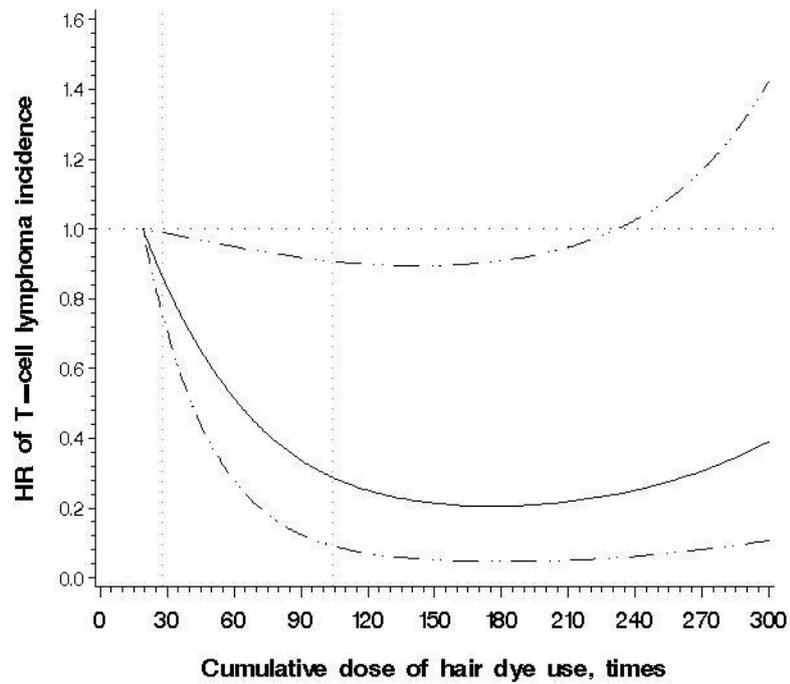## Cumulative dose of hair dye use and ovarian cancer incidence
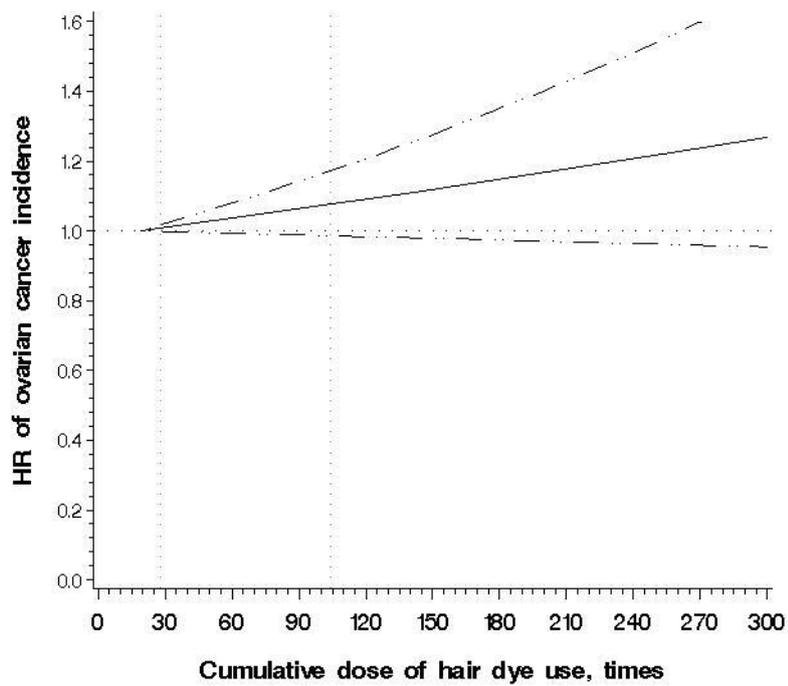
Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 14.

For ovarian cancer incidence, no spline variable was selected and $P = .11$ for linearity.

Supplementary Figure 15. Dose-response relationship between cumulative dose of personal permanent hair dye use and colorectal cancer incidence

Cumulative dose of hair dye use and colorectal cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 15.

For colorectal cancer incidence, no spline variable was selected and $P = .85$ for linearity.

Supplementary Figure 16. Dose-response relationship between cumulative dose of personal permanent hair dye use and bladder cancer incidence

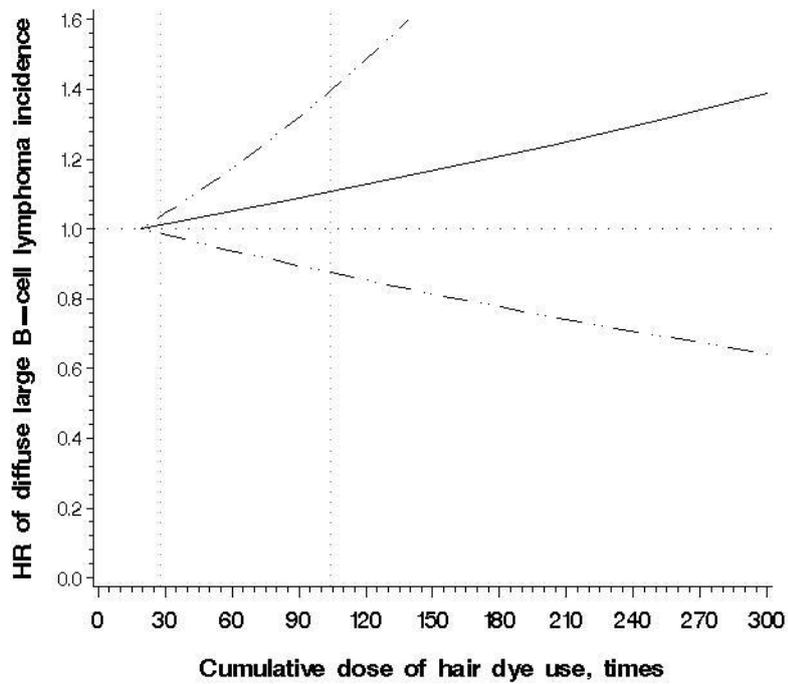Cumulative dose of hair dye use and bladder cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 16.

For bladder cancer incidence, no spline variable was selected and $P = .79$ for linearity.

Supplementary Figure 17. Dose-response relationship between cumulative dose of personal permanent hair dye use and kidney cancer incidence

Cumulative dose of hair dye use and kidney cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 17.

For kidney cancer incidence, no spline variable was selected and $P = .80$ for linearity.

Supplementary Figure 18. Dose-response relationship between cumulative dose of personal permanent hair dye use and lung cancer incidence

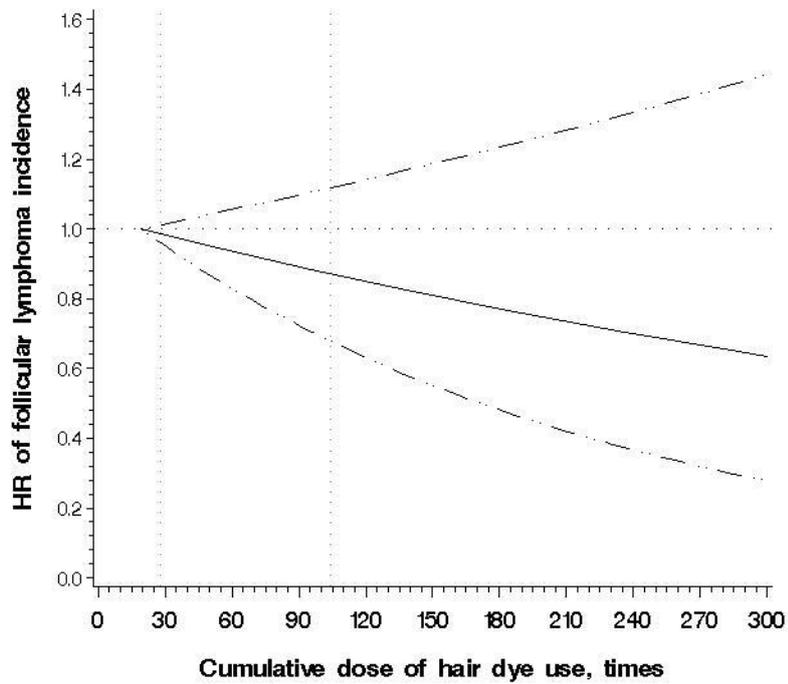Cumulative dose of hair dye use and lung cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 18.

For lung cancer incidence, no spline variable was selected and $P = .06$ for linearity.

Supplementary Figure 19. Dose-response relationship between cumulative dose of personal permanent hair dye use and brain cancer incidence
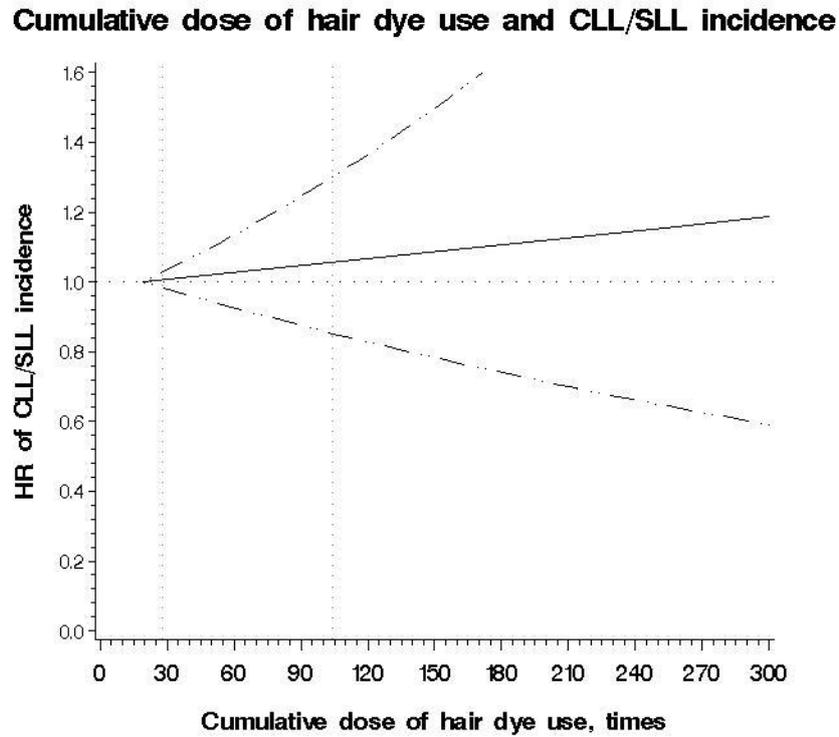

Cumulative dose of hair dye use and brain cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 19.

For brain cancer incidence, no spline variable was selected and $P = .98$ for linearity.

Supplementary Figure 20. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall hematopoietic cancer incidence

Cumulative dose of hair dye use and overall hematopoietic cancer incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 20.

For overall hematopoietic cancer incidence, no spline variable was selected and $P = .22$ for linearity.

Supplementary Figure 21. Dose-response relationship between cumulative dose of personal permanent hair dye use and overall non-Hodgkin lymphoma incidence

Cumulative dose of hair dye use and overall non—Hodgkin lymphoma incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 21.

For overall non-Hodgkin lymphoma incidence, no spline variable was selected and $P = .78$ for linearity.

Supplementary Figure 22. Dose-response relationship between cumulative dose of personal permanent hair dye use and T-cell lymphoma incidence

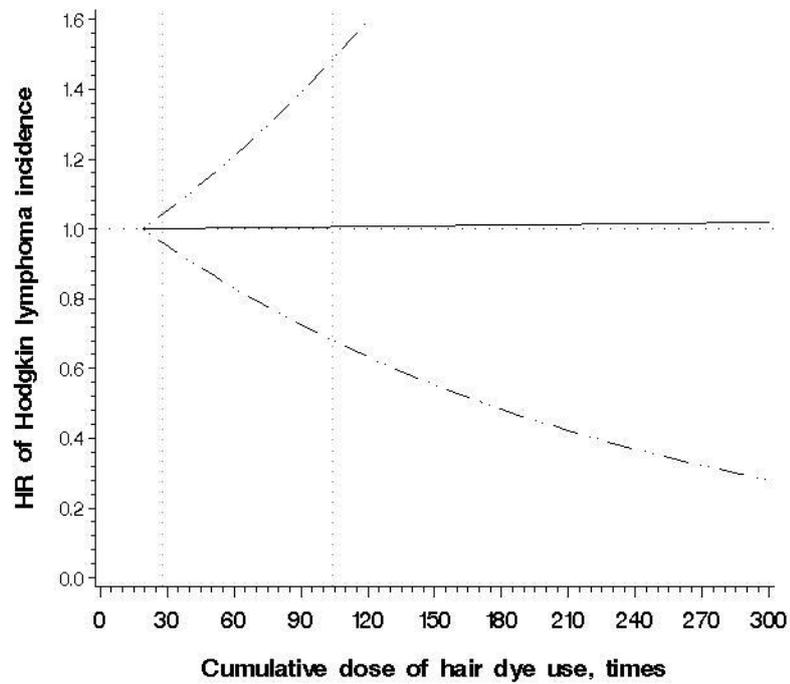**Cumulative dose of hair dye use and T—cell lymphoma incidence**

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 22.

For T-cell lymphoma incidence, there was a nonlinear relationship with $P = .04$ for nonlinearity and $P = .10$ for the overall significance.

Supplementary Figure 23. Dose-response relationship between cumulative dose of personal permanent hair dye use and diffuse large B-cell lymphoma incidence

Cumulative dose of hair dye use and diffuse large B—cell lymphoma incidence
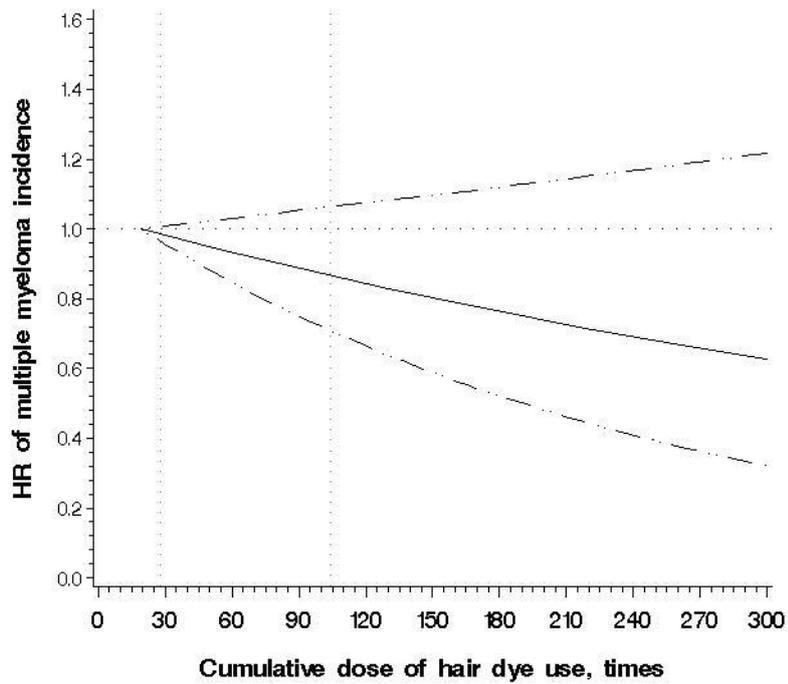

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 23.

For diffuse large B-cell lymphoma incidence, no spline variable was selected and $P = .41$ for linearity.

Supplementary Figure 24. Dose-response relationship between cumulative dose of personal permanent hair dye use and follicular lymphoma incidence

Cumulative dose of hair dye use and follicular lymphoma incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 24.

For follicular lymphoma incidence, no spline variable was selected and $P = .27$ for linearity.

Supplementary Figure 25. Dose-response relationship between cumulative dose of personal permanent hair dye use and chronic lymphocytic leukemia/small lymphocytic lymphoma incidence

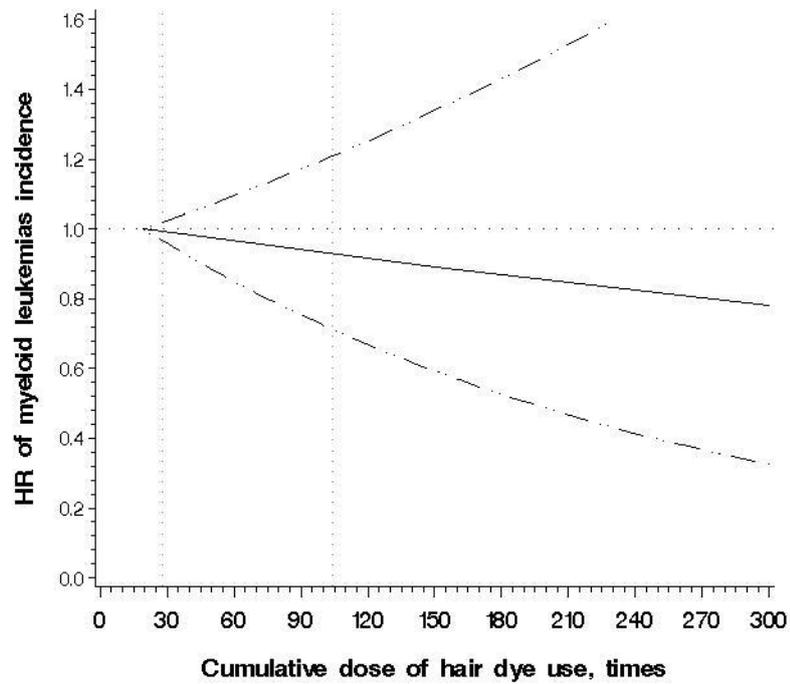Cumulative dose of hair dye use and CLL/SLL incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 25.

For chronic lymphocytic leukemia/small lymphocytic lymphoma incidence, no spline variable was selected and P = .63 for linearity.

Supplementary Figure 26. Dose-response relationship between cumulative dose of personal permanent hair dye use and Hodgkin lymphoma incidence

Cumulative dose of hair dye use and Hodgkin lymphoma incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 26.

For Hodgkin lymphoma incidence, no spline variable was selected and $P = .98$ for linearity.

Supplementary Figure 27. Dose-response relationship between cumulative dose of personal permanent hair dye use and multiple myeloma incidence

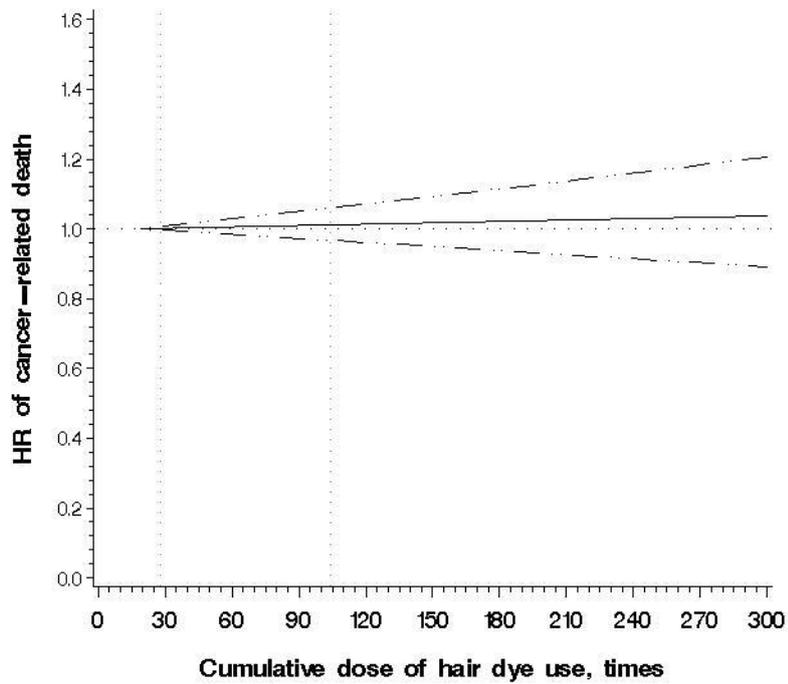### Cumulative dose of hair dye use and multiple myeloma incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 27.

For multiple myeloma incidence, no spline variable was selected and $P = .16$ for linearity.

Supplementary Figure 28. Dose-response relationship between cumulative dose of personal permanent hair dye use and myeloid leukemia incidence

Cumulative dose of hair dye use and myeloid leukemias incidence

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 28.

For myeloid leukemia incidence, no spline variable was selected and $P = .57$ for linearity.

Supplementary Figure 29. Dose-response relationship between cumulative dose of personal permanent hair dye use and cancer-related death

Cumulative dose of hair dye use and cancer—related death

Dashed lines represent the 95% confidence intervals (CIs) of the hazard ratio (HR). Multivariable model was adjusted for the same set of covariates as in Tables 2-5 and Supplementary Table 29.

For cancer-related death, no spline variable was selected and $P = .64$ for linearity.