

Supplement 1: Hair dye and straightener exposure and all breast cancer incidence by menopausal status, Sister Study 2003-2009.

	Premenopausal Breast Cancer			Postmenopausal Breast Cancer		
	Person-Years	Events	Adjusted HR (95% CI)	Person-Years	Events	Adjusted HR (95% CI)
		519			2,270	
Permanent hair dye						
Personal use in the 12 months before enrollment						
No use†	32,593	199	Ref	140,084	1,035	Ref
Any use	46,652	320	1.12 (0.94,1.34)	165,519	1,234	1.08 (0.99,1.18)
<4 times per year	24,504	164	1.14 (0.92,1.40)	65,030	467	1.06 (0.95,1.19)
Every 5-8 weeks, 1+ per month	22,148	156	1.11 (0.90,1.37)	100,489	767	1.09 (0.99,1.20)
			<i>p for trend</i>			0.3
Dye color						
None	32,593	199	Ref	140,084	1,035	Ref
Light colors only	17,697	142	1.30 (1.04, 1.62)	74,746	570	1.08 (0.98, 1.20)
Dark colors only	22,094	149	1.11 (0.89, 1.37)	72,375	530	1.07 (0.67, 1.20)
Light and dark colors	6,332	27	0.70 (0.47, 1.05)	16,584	117	1.06 (0.88, 1.29)
Years of personal use						
None	27,578	169	Ref	106,988	795	Ref
< 5	18,257	126	1.17 (0.93,1.47)	45,410	331	1.05 (0.92,1.19)
5 or more	32,748	220	1.09 (0.89,1.34)	148,770	1,116	1.04 (0.95,1.14)
Applied to others						
No use†	71,136	480	Ref	285,315	2,121	Ref
Any use	8,108	39	0.76 (0.54,1.06)	20,288	148	1.08 (0.91,1.28)
<4 times per year	7,202	31	0.68 (0.47,0.99)	16,667	128	1.15 (0.96,1.38)
Every 5-8 weeks, 1+ per month	906	8	1.32 (0.65,2.68)	3,621	20	0.78 (0.50,1.21)
			<i>p for trend</i>			0.3
Semi-permanent dye						
Personal use in the 12 months before enrollment						
No use†	62,323	413	Ref	251,664	1,895	Ref
Any use	16,922	106	0.96 (0.77,1.19)	53,939	374	0.96 (0.86,1.07)
<4 times per year	11,989	75	0.97 (0.76,1.24)	30,770	218	1.00 (0.87,1.15)
Every 5-8 weeks, 1+ per month	4,828	31	0.93 (0.64, 1.34)	23,169	156	0.91 (0.77,1.07)
			<i>p for trend</i>			0.7
Dye color						
None	62,323	413	Ref	251,664	1,895	Ref
Light colors only	3,854	33	1.30 (0.91, 1.86)	16,921	111	0.88 (0.72,1.06)
Dark colors only	10,973	60	0.84 (0.64, 1.10)	31,075	221	1.00 (0.87, 1.15)
Light and dark colors	1,060	5	--	2,805	15	0.76 (0.46, 1.26)
Years of personal use						
None	55,149	367	Ref	214,774	1,656	Ref
< 5	13,920	76	0.84 (0.65,1.07)	40,399	279	0.92 (0.81,1.04)
5 or more	9,074	68	1.13 (0.87,1.47)	43,311	286	0.85 (0.75,0.96)
Applied to others						
No use†	75,544	494	Ref	296,614	2,189	Ref
Any use	3,700	25	1.11 (0.74,1.67)	8,989	80	1.35 (1.08,1.69)
<4 times per year	3,251	19	0.97 (0.61,1.54)	7,508	69	1.41 (1.10,1.79)
Every 5-8 weeks, 1+ per month	449	6	2.11 (0.94,4.73)	1,481	11	1.07 (0.59,1.94)
			<i>p for trend</i>			0.3
Temporary dyes (rinses)						
Personal use in the 12 months before enrollment						
No use	73,245	482	Ref	282,176	2,087	Ref
Any use	6,000	37	0.96 (0.68,1.36)	23,427	182	1.06 (0.91,1.24)
Chemical straighteners						
Personal use in the 12 months before enrollment						
No use†	68,350	453	Ref	281,840	2,085	Ref
Any use	10,895	66	1.05 (0.75,1.46)	23,763	184	1.26 (1.02,1.55)
<4 times per year	4,813	33	1.15 (0.77,1.70)	11,412	73	1.05 (0.80,1.37)
Every 5-8 weeks, 1+ per month	6,082	33	0.93 (0.30,1.44)	12,351	111	1.51 (1.17,1.94)
			<i>p for trend</i>			0.9
Applied to others						
No use†	75,525	495	Ref	299,212	2,216	Ref

Any use	3,720	24	1.18 (0.75,1.84)	6,391	53	1.34 (0.99,1.79)
<4 times per year	2,675	19	1.29 (0.79,2.10)	4,877	42	1.39 (1.00,1.92)
Every 5-8 weeks, 1+ per month	1,045	5	--	1,513	11	1.16 (0.64, 2.13)
			<i>p for trend</i>			0.1

*models adjusted for age, race, education, ever oral contraceptive use (OC), parity, age at first birth, smoking status, BMI, age at menarche
†For hazard ratio estimates associated with personal use in the 12 months before enrollment and application to others in the 12 months before enrollment, “No use” is the referent category for “Any use”. For frequency of use, “No use” is also the referent category for “<4 times per year” and “Every 5 weeks, 1+month” and the p for trend is provided.

Supplement 2: Hair dye and straightener exposures and incident invasive breast cancer by estrogen receptor status, Sister Study 2003-2009.

	Person-Years	ER + Invasive Breast Cancer		ER – Invasive Breast Cancer	
		Events	A HR (95% CI)	Events	A HR (95% CI)
		1,600		292	
Permanent hair dye					
Personal use in the 12 months before enrollment					
No use [†]	173,214	732	Ref	121	Ref
Any use	213,126	868	1.02 (0.92,1.13)	171	1.18 (0.93,1.50)
<4 times per year	89,932	338	1.00 (0.87,1.14)	80	1.31 (0.99,1.75)
Every 5-8 weeks, 1+ per month	121,194	530	1.04 (0.93,1.16)	91	1.08 (0.82,1.43)
			<i>p for trend</i>		0.5
Dye color					
None	173,214	732	Ref	121	Ref
Light colors only	92,847	410	1.06 (0.94, 1.20)	75	1.19 (0.89, 1.60)
Dark colors only	94,909	371	1.01 (0.89, 1.15)	78	1.20 (0.90, 1.60)
Light and dark colors	23,010	77	0.86 (0.68, 1.09)	15	0.99 (0.58, 1.70)
Years of personal use					
None	135,033	551	Ref	93	Ref
< 5	63,995	248	1.06 (0.91,1.23)	55	1.27 (0.10,1.78)
5 or more	182,209	777	1.05 (0.94,1.17)	143	1.15 (0.88,1.50)
Applied to others					
No use [†]	357,755	1,503	Ref	265	Ref
Any use	28,585	97	0.92 (0.74,1.13)	27	1.34 (0.89,2.01)
<4 times per year	24,013	82	0.93 (0.74, 1.17)	23	1.37 (0.88,2.12)
Every 5-8 weeks, 1+ per month	4,573	15	0.85 (0.51,1.41)	4	--
			<i>p for trend</i>		0.4
Semi-permanent dye					
Personal use in the 12 months before enrollment					
No use [†]	315,175	1,356	Ref	235	Ref
Any use	71,166	244	0.87 (0.76,1.00)	57	1.05 (0.78,1.40)
<4 times per year	43,033	152	0.93 (0.78,1.10)	36	1.10 (0.77,1.57)
Every 5-8 weeks, 1+ per month	28,133	92	0.78 (0.63, 0.97)	21	0.97 (0.62,1.52)
			<i>p for trend</i>		0.9
Dye color					
None	315,175	1,356	Ref	235	Ref
Light colors only	20,860	76	0.84 (0.67, 1.06)	18	1.16 (0.72, 1.87)
Dark colors only	42,236	136	0.85 (0.71, 1.02)	32	0.98 (0.67, 1.42)
Light and dark colors	3,869	12	0.80 (0.45, 1.42)	4	--
Years of personal use					
None	270,994	1,188	Ref	200	Ref
< 5	54,574	182	0.82 (0.70,0.95)	46	1.13 (0.82,1.56)
5 or more	52,540	197	0.87 (0.75,1.01)	43	1.07 (0.76,1.49)
Applied to others					
No use [†]	373,616	1,544	Ref	278	Ref
Any use	12,725	56	1.27 (0.97,1.67)	14	1.52 (0.88,2.62)
<4 times per year	10,795	48	1.30 (0.97,1.74)	12	1.53 (0.85,2.75)
Every 5-8 weeks, 1+ per month	1,930	8	1.15 (0.57,2.30)	2	--
			<i>p for trend</i>		0.1
Temporary dyes (rinses)					
Personal use in the 12 months before enrollment					
No use	356,835	1,480	Ref	263	Ref
Any use	29,506	120	1.09 (0.90,1.32)	29	1.24 (0.83,1.84)
Chemical straighteners					
Personal use in the 12 months before enrollment					
No use [†]	351,503	1,503	Ref	260	Ref
Any use	34,837	97	0.99 (0.76,1.29)	32	1.08 (0.64, 1.82)
<4 times per year	16,279	43	0.90 (0.64, 1.25)	13	0.98 (0.51,1.87)
Every 5-8 weeks, 1+ per month	18,558	54	1.11 (0.80,1.55)	19	1.19 (0.64,2.21)
			<i>p for trend</i>		0.6
Applied to others					
No use [†]	376,149	1,574	Ref	279	Ref

Any use	10,192	26	0.98 (0.65,1.48)	13	1.65 (0.89,3.08)
<4 times per year	7,619	21	1.06 (0.68, 1.66)	10	1.69 (0.85,3.36)
Every 5-8 weeks, 1+ per month	2,573	5	--	3	--

*models adjusted for age, race, education, ever oral contraceptive use (OC), parity, age at first birth, smoking status, BMI, age at menarche
†For hazard ratio estimates associated with personal use in the 12 months before enrollment and application to others in the 12 months before enrollment, “No use” is the referent category for “Any use”. For frequency of use, “No use” is also the referent category for “<4 times per year” and “Every 5 weeks, 1+month” and the p for trend is provided.