



**HAIR DYEING WITHOUT HEALTH RISKS  
A FEASIBLE PROPOSITION?  
Berlin, 15 October 2009**

**Epidemiological evidence on use  
of hair dyes and cancer risks**

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# MAJOR REVIEWS 2000-2009

Correa et al. Use of hair dyes, hematopoietic neoplasms, and lymphomas: a literature review. I Leukemias and myelodysplastic syndromes. Cancer Investig 2000;18:366-80.

Nohynek et al. Toxicity and human health risk of hair dyes. Food Chem Tox 2004;42:517-43.

Huncharek & Kupelnick. Personal use of hair dyes and the risk of bladder cancer: results of a meta-analysis. Pub Health Reports 2005;120:31-8.

Takkouche et al. Personal use of hair dyes and risk of cancer. JAMA 2005;293: 2516-25

Rollison et al. Personal hair dye use and cancer: A systematic literature review and evaluation of exposure assessment in studies published since 1992. J Tox Environ Health, Part B. 2006;9:413-39.

Bolt & Golka. The debate on carcinogenicity of permanent hair dyes: new insights. Critical Rev Toxicol 2007;37:521-36.

Kelsh et al. Personal use of hair dyes and risk of bladder cancer: a meta-analysis of epidemiologic data. Cancer Causes Control 2008;19:549-58.

IARC. IARC monograph on the evaluation of carcinogenic risks to humans. Vol 99. Some aromatic amines, organic dyes, and related exposures. Lyon: International Agency for Research on Cancer (in press).

# INCONSISTENCIES

**Huncharek & Kupelnick, 2005:**

**”The present meta-analysis suggests that personal use of hair dyes is a risk factor for carcinoma of the bladder”**

**Takkouche et al., 2005:**

**”Our results indicate that, globally, there is no effect of personal hair dye use on the risk of ... bladder cancer”**

# EXPOSURE INFORMATION

## Cohort studies – women

<b>Nurses' Health Study</b>	<b>1976-2000</b>	<b>120,557</b>	<b>32%</b>	<b>Ever, permanent</b>
<b>American Cancer Society II</b>	<b>1982</b>	<b>573,369</b>	<b>32%</b>	<b>Ever, permanent</b>
<b>Shanghai Women's Health</b>	<b>1996-2000</b>	<b>73,366</b>	<b>40%</b>	<b>Past 3y, any</b>

## Case-control studies - controls

<b>NCI Bladder Cancer Study</b>	<b>1977-1978</b>			
<b>Women</b>		<b>1500</b>	<b>58%</b>	<b>Ever, any</b>
<b>Men</b>		<b>4282</b>	<b>7%</b>	<b>Ever, any</b>
<b>InterLymph</b>	<b>1988-2003</b>			
<b>Women</b>		<b>2961</b>	<b>48%</b>	<b>Ever, permanent</b>
<b>Men</b>		<b>2836</b>	<b>5%</b>	<b>Ever, permanent</b>

# **STANDARDIZATION OF EXPOSURE INFORMATION**

**InterLymph, 3 out of 4 studies used:**

- 1. Ever used any hair-coloring products**
- 2. Age at first time**
- 3. How often**
- 4. Age at last time**
- 5. What type (permanent / non-permanent)**
- 6. Color (dark, red, light)**

**Bladder cancer case-control studies in California (Gago-Dominguez et al, 2001) and in Spain (Kogevinas et al, 2006) used the same questionnaire**

**Despite same questionnaire, results may be presented differently**

# BLADDER CANCER – WOMEN

Relative risk of incident bladder cancer in  
ever hair dye use vs. non-use

Any hair dye

RR	Cohort	Case-control
>1	0	0
~1	1	9
NR	2 <sup>1,2</sup>	1
<b>Total</b>	<b>3</b>	<b>10</b>

Permanent hair dye

RR	Cohort	Case-control
>1	0	1
~1	2 <sup>1,2</sup>	4
NR	1	5
<b>Total</b>	<b>3</b>	<b>10</b>

- 1) Urinary cancer
- 2) Bladder cancer death

# BLADDER CANCER – WOMEN

Relative risk of incident bladder cancer in  
ever hair dye use vs. non-use

## Any hair dye

RR 95% CI	Cohort	Case- control
>1	0	0
~1	1	9
NR	2*	1
<b>Total</b>	<b>3</b>	<b>10</b>

## Permanent hair dye

RR 95% CI	Cohort	Case- control
>1	0	1
~1	2*	4
NR	1	5
<b>Total</b>	<b>3</b>	<b>10</b>

- 1) Urinary cancer
- 2) Bladder cancer death

# BLADDER CANCER – WOMEN

Relative risk of incident bladder cancer in  
hair dye users vs. non-users stratified by genotype

	Gago-Dominguez*	Kogeninas**
NAT1*10	2.1 (0.7-6.1)	2.9 (0.7-11.6)
Non-NAT1*10	1.8 (0.8-4.1)	0.6 (0.2-1.6)
NAT2 slow	3.1 (1.1-9.4)	0.6 (0.3-1.4)
NAT2 rapid	1.5 (0.6-3.6)	0.9 (0.3-2.6)
GSTM1 null	1.6 (0.6-4.2)	1.3 (0.6-3.0)
GSTM1 positive	1.9 (0.8-4.7)	0.4 (0.1-1.1)
GSTT1 null	0.8 (0.2-3.7)	0.7 (0.3-1.3)
GSTT1 positive	1.8 (0.8-3.8)	1.4 (0.3-6.9)
GSTP1 any val	2.0 (0.9-4.5)	0.8 (0.3-1.8)
GSTP1 ile/ile	1.4 (0.4-4.5)	0.9 (0.3-2.2)
CYP1A2 slow	3.0 (1.1-8.3)	0.4 (0.2-1.1)
CYP1A2 rapid	1.3 (0.5-3.3)	1.4 (0.5-4.2)

\*100+ times over lifetime, \*\* 10+ times over lifetime



# BLADDER CANCER – WOMEN

Relative risk of incident bladder cancer in hair dye users vs. non-users stratified by genotype

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\*100+ times over lifetime, \*\* 10+ times over lifetime



**Gago-Dominguez et al, 2003:**

**”We have provided additional evidence in support of a causal association between permanent hair dye use and bladder cancer risk. Our results implicate arylamines contained in hair dye solutions as the putative carcinogenic substances ... [as]... arylamine activation and detoxification pathways substantially modify the overall relationship.”**



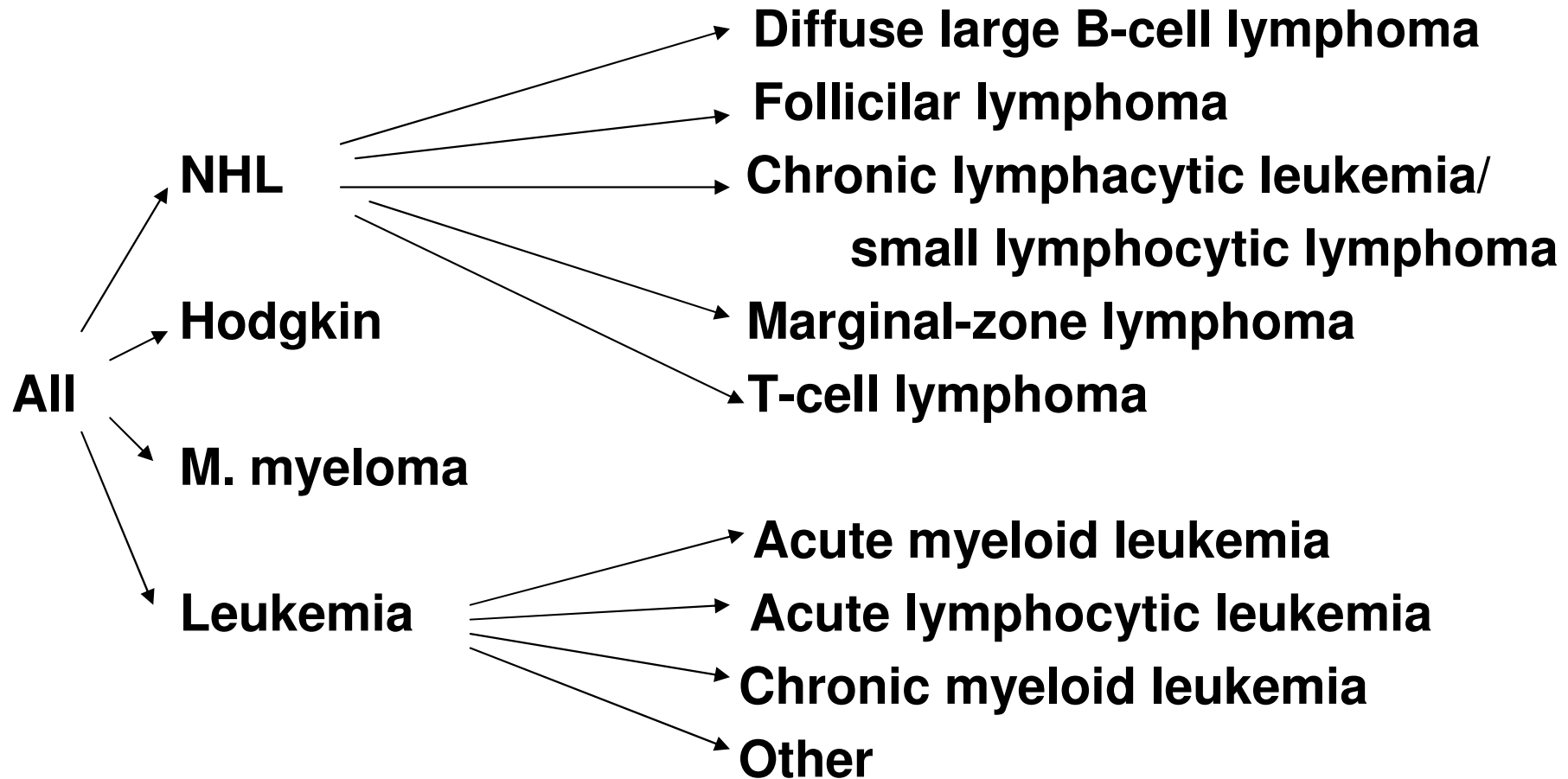
**Kogevinas et al, 2006:**

**”Results of our study do not support an association between hair dye use and bladder cancer risk.”**

# HEMATOPOIETIC NEOPLASMS

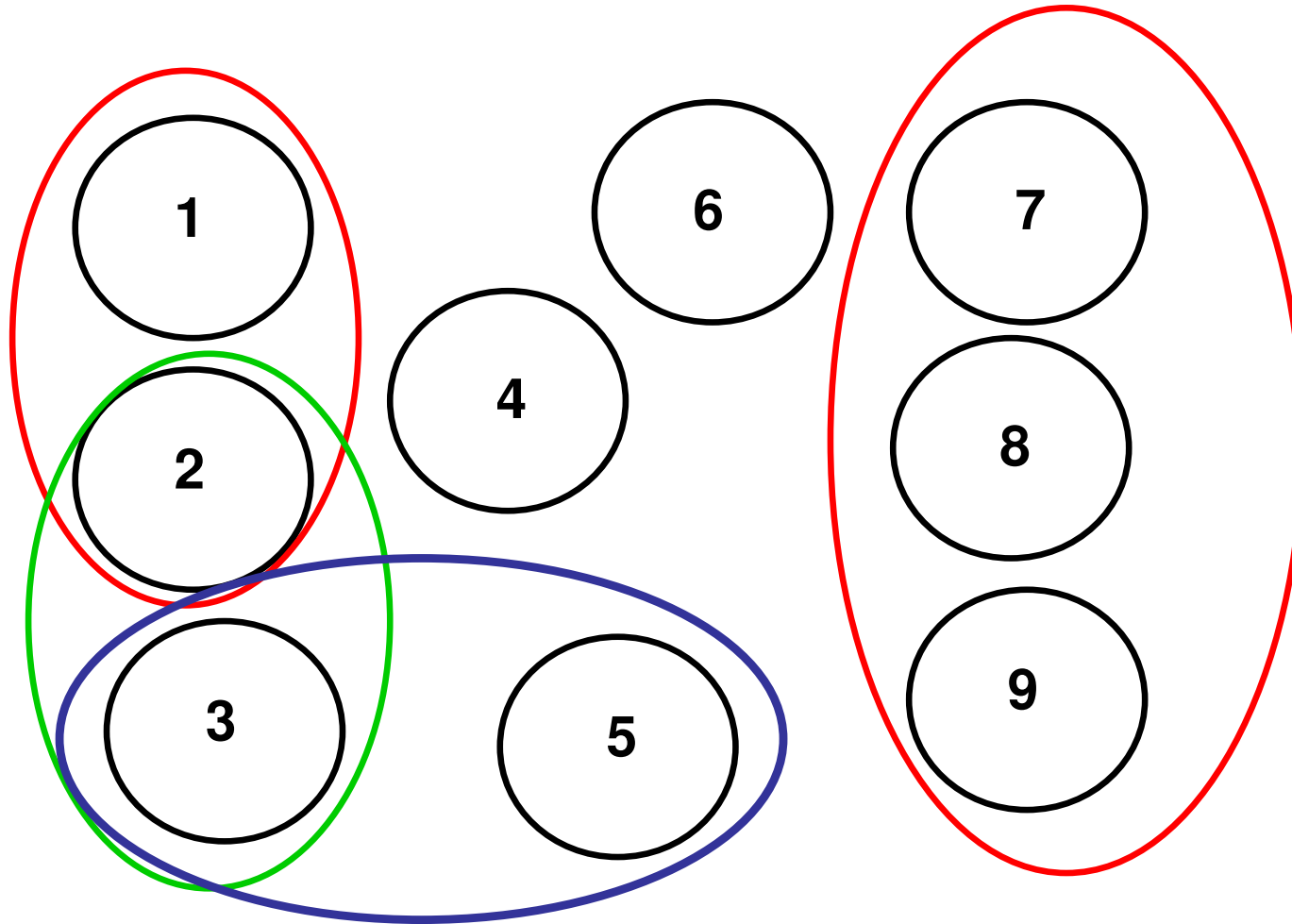
**Classic classification**

**Detailed classification**



# HEMATOPOIETIC NEOPLASMS

Overlap in original data between published papers



# HEMATOPOIETIC NEOPLASMS

## Cohort studies

	<b>Nurses' Health Permanent, ever</b>	<b>ACS II Permanent, ever</b>	<b>Shanghai Any, past 3y</b>
<b>All</b>	<b>0.9 (0.7-1.2)</b>	<b>1.1 (1.0-1.2)</b>	<b>0.89 (0.59-1.35)</b>
<b>NHL</b>	<b>1.1 (0.8-1.6)</b>	<b>1.1 (1.0-1.3)</b>	<b>1.09 (0.61-1.92)</b>
<b>Hodgkin</b>	<b>0.9 (0.4-2.1)</b>	<b>NR</b>	<b>NR</b>
<b>M. Myeloma</b>	<b>0.4 (0.2-0.9)</b>	<b>1.0 (0.8-1.3)</b>	<b>0.84 (0.31-2.27)</b>
<b>Leukemia</b>	<b>0.6 (0.3-1.5)*</b>	<b>1.1 (0.9-1.3)</b>	<b>0.68 (0.31-1.51)</b>
	<b>0.8 (0.3-1.9)**</b>		

\*Chronic lymphocytic leukemia, \*\*Other leukemias

# HEMATOPOIETIC NEOPLASMS

"Old" NCI case-control studies

**Cantor et al, 1988**

**Iowa+Minnesota 1980-3 Men**

**Ever, hair tints/coloring  
products**

**NHL 2.0 (1.3-3.0)**

**Leukemia 1.8 (1.1-2.7)**

**Zahm et al, 1992**

**Nebraska 1983-6 Women+men**

**Ever, permanent**

**Women, NHL 1.7 (1.1-2.8)**

**Women, Hodgkin 3.0 (1.1-7.9)**

**Women, MM 2.8 (1.1-1.7)**

**Women, CLL 0.8 (0.1-4.0)**

**Men, NHL 0 case**

**Men Hodgkin 1 case**

**Men, MM 1 case**

**Men CII 0 case**

**"If causal ... use of hair coloring  
products would account for 35%  
of NHL in exposed women and  
20% in all women"**

# HEMATOPOIETIC NEOPLASMS

Takkouche et al, Meta-analysis of 40 studies, 2005

	Use	RR (95% CI)
All hemetopoietic	Permanent only	1.14 (0.99-1.29)
	200+ lifetime	1.12 (0.98-1.28)
NHL	Permanent only	1.13 (0.99-1.29)
	200+ lifetime	1.07 (0.90-1.28)
Hodgkin	Permanent only	1.41 (0.72-2.77)
Multiple myeloma	Permanent only	1.10 (0.62-1.95)
Leukemia	Permanent only	1.12 (0.86-1.46)

**”There is a borderline effect for hematopoietic cancers. However, the evidence of a causal effect is too weak to represent a major public health concern.”**

# HEMATOPOIETIC NEOPLASMS

## Discussion of the Takkouche et al, Meta-analysis

**Zahm & Fraumeni, 2005:**

**”By limiting the review to the ”lowest common denominator”, valuable information is lost. Of particular note are studies that have reported significantly elevated risks of non-Hodgkin lymphoma (NHL) associated with increasing duration of use, use of dark colors, and use before 1980.”**

**Dark, permanent, 25+y, <1980:**

**2.1 (1.0-4.0)**

**Brown, Dark, Red:**

**2.0; 4.1; 3.0**

**Black, permanent:**

**2.1**

**Takkouche et al, 2005:**

**Dark, permanent, 25+, <1980:**

**2.1 (1.0-4.0)**

**Brown:**

**2.0 (1.0-3.8)**

**Dark:**

**4.1 (0.9-18.8)**

**Red:**

**3.0 (0.5-16.8)**

**Black, permanent:**

**2.1 (0.7-6.7)**



# HEMATOPOIETIC NEOPLASMS

Zhang et al, 2008, Pooled analysis of 4 NHL case-control studies

Hair dye		Use <1980	Use $\geq$ 1980
Permanent	All NHL	1.2 (1.0-1.4)	0.9 (0.8-1.1)
	Follicular I.	1.4 (1.1-1.9)	1.3 (1.0-1.8)
	CLL/SLL	1.5 (1.1-2.0)	1.1 (0.7-1.6)
Permanent dark	Follicular I.	1.4 (1.0-1.9)	1.5 (1.1-2.0)
	CLL/SLL	1.5 (1.0-2.2)	1.1 (0.7-1.8)
Permanent light	Follicular I.	1.6 (1.2-2.2)	1.2 (0.8-1.8)
	CLL/SLL	1.5 (1.0-2.2)	0.9 (0.5-1.7)

**”These results indicate that personal hair-dye use may play a role in risks of FL and CLL/SLL in women who started use before 1980 and that increased risk of FL among women who started use during or after 1980 cannot be excluded.”**

# HEMATOPOIETIC NEOPLASMS

Leukemia, 2 largest case-control studies

**Melé et al, 1994:**

**Italy, 1986-1990**

**Acute myeloid leukemia**

**Acute lymphocytic leukemia**

**Refractory anemia with excess of blasts**

**Chronic myeloid leukemia**

**Ever use of hair dyes:**

**Men, AML: 1.2 (0.4-4.0)**

**Women, AML: 1.0 (0.7-1.3)**

**Data analysed by color, frequency of use, and duration of use. Not a single RR significantly different from 1**

**Rauscher et al, 2004:**

**United States + Canada, 1986-1989**

**Adult acute leukemia**

**Ever use of hair dyes: 1.3 (0.99-1.8)**

**Selected other results:**

**Permanet dye: 1.5 (1.0-2.2)**

**”, ≥15y: 1.9 (1.1-3.6)**

**”, dark: 1.6 (0.78-3.2)**

**”, light: 1.8 (1.1-3.1)**

# TO SUM UP

- **Bladder cancer: Maybe excess risk in some genetically susceptible individuals but so far no consistent data**
- **NHL: Use before 1980 may have played a role in risks of FL and CLL/SLL, weak evidence for use after 1980**
- **Leukemia: Some indications from one study not confirmed in an other study**
- **Other cancer sites: No consistent pattern**

# **IARC 2008 EVALUATION**

**The Working Group considered the epidemiological evidence inadequate, and concluded that personal use of hair colourants is "not classifiable as to its carcinogenicity in humans" (Group 3).**

**Baan et al. Lancet Oncol 2008;9:322-3.**

# THANK YOU



**University of Copenhagen, Old Municipality Hospital**