

GM-UAW Cohort Study

Prostate cancer incidence

June 11, 2020

Four analyses

1. Men still alive in 1973
2. Men still alive in 1985, excluding the 134 men who had prostate cancer before 1985
3. Men still alive in 1985, excluding the 134, weighted by probability of not dying of natural causes
4. Men still alive in 1985, excluding the 134, weighted by stabilized inverse probability with truncation at the 99th percentile of weights ($sw_i = 330$)

Follow-up ends on the date of death, prostate cancer incidence, LTFU (outcome-free at age 108.39 years), or 2015-12-31, whichever comes first.

All analyses restricted to plants 1 and 2

Summary of population characteristics in the slides to follow.

Men still alive in 1973		
Study population size (<i>N</i>)	20 996	100%
Race		
White	11 192	53%
Black	4 694	22%
Unknown	5 110	24%
Plant ^b		
Plant 1	7 834	37%
Plant 2	13 162	63%
Diagnosed with cancer by end of follow-up	4 517	22%
Years of follow-up	36.65	(31.73, 45.19)
Years at work*	15.66	(7.01, 26.29)
Year of hire	1963	(1951, 1975)
Age at hire (years)	25	(21, 33)
Year of birth	1934	(1921, 1948)
Year of first cancer diagnosis	1997	(1989, 2006)
Age at first cancer diagnosis (years)	67	(59, 74)
Cumulative exposure [#] to MWFs (mg/m ³ ·y)		
Straight	0.5	(0.18, 1.43)
Soluble	5.05	(2.32, 12.49)
Synthetic	0.4	(0.15, 1.27)

Men still alive in 1985		
Study population size (<i>N</i>)	18 342	100%
Race		
White	10 424	57%
Black	4 174	23%
Unknown	3 744	20%
Plant [‡]		
Plant 1	6 737	37%
Plant 2	11 605	63%
Diagnosed with cancer by end of follow-up	3 983	22%
Years of follow-up	38.18	(34.36, 46.3)
Years at work*	15.57	(6.87, 27.13)
Year of hire	1965	(1952, 1976)
Age at hire (years)	24	(21, 31)
Year of birth	1938	(1924, 1950)
Year of first cancer diagnosis	1999	(1992, 2007)
Age at first cancer diagnosis (years)	67	(60, 74)
Cumulative exposure [‡] to MWFs (mg/m ³ ·y)		
Straight	0.5	(0.18, 1.43)
Soluble	4.89	(2.27, 12.26)
Synthetic	0.39	(0.15, 1.26)

Men still alive in 1985		
Study population size (<i>N</i>)	18 342	100%
Race		
White	10 424	57%
Black	4 174	23%
Unknown	3 744	20%
Plant [‡]		
Plant 1	6 737	37%
Plant 2	11 605	63%
Plant 3	> 0.00	0%
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Stabilized weight

$$sw_i = \frac{1 - \bar{p}}{1 - \hat{p}_i}$$

where \hat{p}_i is the i^{th} individual's predicted probability of surviving to year 1985, and \bar{p} is the overall survival proportion i.e. $\frac{1}{n} \sum_i^n \hat{p}_i$.

Cox PH Models

- ▶ Cumulative exposure to straight, soluble, and synthetic MWFs (lagged 20 years)
- ▶ Splined calendar year
- ▶ Splined year of hire
- ▶ Race
- ▶ Plant
- ▶ Risk sets indexed by age

1. Men still alive in 1973

Covariate	level	n	HR	(95% CI)
Cumulative straight	0	753	1.00	
	> 0 to 0.322	287	1.05	(0.89, 1.24)
	> 0.322 to 1.33	287	1.02	(0.87, 1.20)
	> 1.33	287	1.08	(0.93, 1.25)
Cumulative soluble	0 to 0.05	176	1.00	
	> 0.05 to 3.78	471	1.13	(0.93, 1.36)
	> 3.78 to 13.3	483	1.09	(0.90, 1.33)
	> 13.3	484	1.29	(1.06, 1.58)
Cumulative synthetic	0	1094	1.00	
	> 0 to 0.22	174	0.96	(0.78, 1.19)
	> 0.22 to 1.05	173	0.94	(0.76, 1.15)
	> 1.05	173	1.07	(0.88, 1.30)
Race	White	961	1.00	
	Black	653	2.40	(2.13, 2.69)
Plant	1	813	1.00	
	2	801	1.02	(0.87, 1.19)
P-spline of calendar year ($df = 14.68$)		1614		
P-spline of year of hire ($df = 13.67$)		1614		

2. Men still alive in 1985

Covariate	level	n	HR	(95% CI)
Cumulative straight	0	672	1.00	
	> 0 to 0.322	274	1.08	(0.91, 1.28)
	> 0.322 to 1.33	261	1.03	(0.87, 1.22)
	> 1.33	273	1.11	(0.96, 1.30)
Cumulative soluble	0 to 0.05	155	1.00	
	> 0.05 to 3.78	449	1.10	(0.90, 1.34)
	> 3.78 to 13.3	428	1.03	(0.84, 1.26)
	> 13.3	448	1.25	(1.01, 1.55)
Cumulative synthetic	0	990	1.00	
	> 0 to 0.22	171	0.99	(0.80, 1.23)
	> 0.22 to 1.05	160	0.93	(0.75, 1.16)
	> 1.05	159	1.05	(0.86, 1.29)
Race	White	875	1.00	
	Black	605	2.40	(2.12, 2.70)
Plant	1	745	1.00	
	2	735	1.01	(0.85, 1.19)
P-spline of calendar year ($df = 16.99$)		1480		
P-spline of year of hire ($df = 14.85$)		1480		

3. Men still alive in 1985, weighted by probability of not being dead due to natural causes in 1985

Covariate	level	n	HR	(95% CI)
Cumulative straight	0	672	1.00	
	> 0 to 0.322	274	1.09	(0.92, 1.30)
	> 0.322 to 1.33	261	1.06	(0.89, 1.25)
	> 1.33	273	1.10	(0.95, 1.29)
Cumulative soluble	0 to 0.05	155	1.00	
	> 0.05 to 3.78	449	1.10	(0.90, 1.35)
	> 3.78 to 13.3	428	1.01	(0.82, 1.25)
	> 13.3	448	1.24	(1.00, 1.55)
Cumulative synthetic	0	990	1.00	
	> 0 to 0.22	171	0.97	(0.78, 1.22)
	> 0.22 to 1.05	160	0.94	(0.76, 1.16)
	> 1.05	159	1.05	(0.85, 1.28)
Race	White	875	1.00	
	Black	605	2.43	(2.14, 2.75)
Plant	1	745	1.00	
	2	735	0.98	(0.83, 1.16)
P-spline of calendar year ($df = 16.99$)		1480		
P-spline of year of hire ($df = 14.78$)		1480		

4. Men still alive in 1985, weighted by the stabilized inverse probability with truncation

Covariate	level	n	HR	(95% CI)
Cumulative straight	0	672	1.00	
	> 0 to 0.322	274	1.64	(1.12, 2.41)
	> 0.322 to 1.33	261	1.39	(0.94, 2.06)
	> 1.33	273	1.23	(0.81, 1.87)
Cumulative soluble	0 to 0.05	155	1.00	
	> 0.05 to 3.78	449	1.50	(0.88, 2.55)
	> 3.78 to 13.3	428	1.51	(0.83, 2.74)
	> 13.3	448	1.80	(0.99, 3.29)
Cumulative synthetic	0	990	1.00	
	> 0 to 0.22	171	0.71	(0.43, 1.19)
	> 0.22 to 1.05	160	0.66	(0.40, 1.07)
	> 1.05	159	0.71	(0.43, 1.18)
Race	White	875	1.00	
	Black	605	2.25	(1.64, 3.10)
Plant	1	745	1.00	
	2	735	1.04	(0.66, 1.61)
P-spline of calendar year ($df = 16.98$)		1480		
P-spline of year of hire ($df = 15.71$)		1480		

Results by MWF type

Cumulative straight	1973		1985		1985, weighted		1985, s. weight	
	n	HR	n	HR	n	HR	n	HR
0	753	1.00	672	1.00	672	1.00	672	1.00
> 0 to 0.322	287	1.05	274	1.08	274	1.09	274	1.64
> 0.322 to 1.33	287	1.02	261	1.03	261	1.06	261	1.39
> 1.33	287	1.08	273	1.11	273	1.10	273	1.23

Cumulative soluble	1973		1985		1985, weighted		1985, s. weight	
	n	HR	n	HR	n	HR	n	HR
0 to 0.05	176	1.00	155	1.00	155	1.00	155	1.00
> 0.05 to 3.78	471	1.13	449	1.10	449	1.10	449	1.50
> 3.78 to 13.3	483	1.09	428	1.03	428	1.01	428	1.51
> 13.3	484	1.29	448	1.25	448	1.24	448	1.80

Cumulative synthetic	1973		1985		1985, weighted		1985, s. weight	
	n	HR	n	HR	n	HR	n	HR
0	1094	1.00	990	1.00	990	1.00	990	1.00
> 0 to 0.22	174	0.96	171	0.99	171	0.97	171	0.71
> 0.22 to 1.05	173	0.94	160	0.93	160	0.94	160	0.66
> 1.05	173	1.07	159	1.05	159	1.05	159	0.71