Statistical Research and Applications Branch, NCI, Technical Report # 2002-01

Comparison of Two Methods for Calculating Age-Conditional Probabilities of Developing Cancer

Michael P. Fay,[1] Ruth Pfeiffer,[2] Kathleen A. Cronin,[1] Chenxiong Le,[3] Eric J. Feuer[1]

[1] National Cancer Institute

6116 Executive Blvd, Suite 504, MSC 8317

Bethesda, Maryland 20892-8317, USA

[2] National Cancer Institute

6120 Executive Blvd, EPS Room 8030

Bethesda, MD 20892-7335

[3] Division Of Biometrics III, CDER, FDA

HFD-725, Rm. N250

9201 Corporate Blvd.

Rockville, MD 20850

August 22, 2002

1 Summary

This paper compares two methods of calculating age-conditional probability of developing cancer, a method by the present authors (Fay, Pfeiffer, Cronin, Le, and Feuer, 2002) and the preceding standard method described by Wun, Merrill and Feuer (1998). Section 2 writes the Wun, Merrill, and Feuer (1998) (WMF) estimator using the notation of Fay et al. (2002) and compares the two methods using Taylor approximations. Section 3 compares the two methods using both the WMF notation and the new notation introduced in Fay et al. (2002). Section 4 reproduces Table I-17

of Ries et al. (2001) but with both methods and the percent difference of our new method to the WMF method.

2 The estimator of Wun, Merrill, and Feuer (1998)

In this section we review the estimator of WMF using notation we used for our method described in Fay et al. (2002). In general we use hat notation for quantities that are estimated identical to our method and tildes for quantities that are estimated differently. WMF only consider estimating $A(x, y)$ where $x = a_i$ and $y = a_j$ for some $0 \leq i < j \leq k+1$, and they only consider the case where $a_i - a_{i-1} = 5$ for $i = 1, \ldots, k$. To start we assume that $j \leq k$ since WMF estimated the last interval differently. In addition, WMF use a hypothetical cohort of 10 million live births, so to avoid added complications we convert number alive (or alive and cancer free) in the cohort to a survival probability by dividing by 10 million. WMF assume that both $\lambda_c^*(a)$ and $\lambda_o^*(a)$ are constant within each interval $[a_i, a_{i-1})$, so that

$$\begin{aligned}
\int_{a_i}^{a_j} \lambda_c^*(u) S^*(u-) du &= \sum_{\ell=i}^{j-1} \lambda_c^*(a_\ell) \int_{a_\ell}^{a_{\ell+1}} S^*(a_\ell) \exp\{-\lambda^*(a_\ell)(u - a_\ell)\} du \\
&= \sum_{\ell=i}^{j-1} \frac{\lambda_c^*(a_\ell)}{\lambda^*(a_\ell)} S^*(a_\ell) \{1 - \exp[-\lambda^*(a_\ell)(a_{\ell+1} - a_\ell)]\} \\
&= \sum_{\ell=i}^{j-1} \{S^*(a_\ell) - S^*(a_{\ell+1})\} \frac{\lambda_c^*(a_\ell)}{\lambda_c^*(a_\ell) + \lambda_o^*(a_\ell)}
\end{aligned}$$

(Note that in Fay et al. [2002] we have not made this same assumption; we have assumed that $\lambda_c(a), \lambda_o(a)$, and $\lambda(a)$ are constant within an age interval, which does not lead to $\lambda_c^*(a)$ and $\lambda_o^*(a)$ being constant within age intervals. WMF assumed both $\lambda_c(a)$ and $\lambda_c^*(a)$ are constant over 5 year intervals, which cannot be true [see equation **??** of Fay et al. 2002], although with short intervals it may not be a bad approximation.) WMF estimate $A(a_i, a_j)$ with (see equation 8 of WMF),

$$\tilde{A}(a_i, a_j) = \frac{\sum_{\ell=i}^{j-1} \left\{\tilde{S}^*(a_\ell) - \tilde{S}^*(a_{\ell+1})\right\} \frac{\tilde{\lambda}_c^*(a_\ell)}{\tilde{\lambda}_c^*(a_\ell) + \hat{\lambda}_o^*(a_\ell)}}{\tilde{S}^*(a_i)}$$

where $\tilde{S}^*(a_i) = \hat{S}^*_o(a_i)\tilde{S}^*_c(a_i)$, and

$$\tilde{S}^*_c(a_i) = \exp\left\{-\int_0^{a_i} \tilde{\lambda}^*_c(u)du\right\} = \exp\left(-\sum_{h=0}^{i-1} \tilde{\lambda}^*_c(a_h)(a_{h+1}-a_h)\right) \tag{1}$$

The value $\tilde{\lambda}^*_c(a_h)$ is given by

$$\tilde{\lambda}^*_c(a_h) = \frac{-1}{a_{h+1}-a_h} \log\left(1 - \left[1 - e^{-\hat{\lambda}_c(a_h)(a_{h+1}-a_h)}\right]\frac{\hat{S}(a_h)}{\tilde{S}^*(a_h)}\right) \tag{2}$$

The motivation for $\tilde{\lambda}^*_c(a_h)$ is as follows (see p. 173 of WMF): $Pr[a_h \leq T^* < a_{h+1}, J^* = c | T \geq a_h]$ is estimated by $1 - e^{-\hat{\lambda}_c(a_h)(a_{h+1}-a_h)}$. This appears to be motivated by an estimator from a piecewise exponential survival model with a single cause of death rather than a competing risks model (see equation 9 of WMF). Then this estimate is multiplied by $\hat{S}(a_h)/\tilde{S}^*(a_h)$ to correct for the fact that the estimate was conditioned on $T \geq a_a$ not $T^* \geq a_h$. Finally, WMF solve for the expression for the rate assuming that there was a constant rate within the interval, where they again use the estimator from a piecewise exponential survival model with a single cause of death.

Even though $\tilde{A}(a_i, a_j)$ is incorrectly motivated, since it has been widely used we compare it to our method.

First we show that $\tilde{S}^*_c(a_i) \approx \hat{S}^*_c(a_i)$. Rewrite $\hat{S}^*_c(a_i)$ as

$$\hat{S}^*_c(a_i) = 1 - \sum_{j=0}^{i-1} \frac{\hat{\lambda}_c(a_j)}{\hat{\lambda}_d(a_j)}\left(1 - e^{-\hat{\lambda}_d(a_j)(a_{j+1}-a_j)}\right)\hat{S}_d(a_j) \tag{3}$$

We now rewrite $\tilde{S}^*_c(a_i)$ in a similar form. Starting with equation 1 and then substituting the expression in equation 2, we get,

$$\begin{aligned}
\tilde{S}^*_c(a_i) &= \exp\left(-\sum_{h=0}^{i-1} \tilde{\lambda}^*_c(a_h)(a_{h+1}-a_h)\right) \\
&= \tilde{S}^*_c(a_{i-1}) \exp\left(-\tilde{\lambda}^*_c(a_{i-1})(a_i - a_{i-1})\right) \\
&= \tilde{S}^*_c(a_{i-1})\left(1 - \left[1 - e^{-\hat{\lambda}_c(a_{i-1})(a_i-a_{i-1})}\right]\frac{\hat{S}(a_{i-1})}{\tilde{S}^*(a_{i-1})}\right) \\
&= \tilde{S}^*_c(a_{i-1}) - \left[1 - e^{-\hat{\lambda}_c(a_{i-1})(a_i-a_{i-1})}\right]\hat{S}_d(a_{i-1})
\end{aligned} \tag{4}$$

where the last step uses the fact that $\hat{S}(a)/\tilde{S}^*(a) = \hat{S}_d(a)/\tilde{S}_c^*(a)$ for all a. On the right-hand side of equation 4 we can replace $\tilde{S}_c^*(a_{i-1})$ with the entire right-hand side of equation 4 after decreasing the i indeces by one. We repeatedly do this, and noting that $\tilde{S}_c^*(a_0) = 1$ we get

$$\tilde{S}_c^*(a_i) \;=\; 1 - \sum_{j=0}^{i-1} \; 1 - e^{-\hat{\lambda}_c(a_j)(a_{j+1}-a_j)} \;\; \hat{S}_d(a_j) \tag{5}$$

We use the following Taylor series approximation repeatedly in what follows,

$$1 - e^{-x} \approx x \quad \text{for small } x. \tag{6}$$

With this approximation, we now show that our estimator $\hat{S}_c^*$ and $\tilde{S}_c^*$ are approximately equal.

$$\begin{aligned} \hat{S}_c^*(a_i) &\approx 1 - \sum_{j=0}^{i-1} \frac{\hat{\lambda}_c(a_j)}{\hat{\lambda}_d(a_j)} \;\; \hat{\lambda}_d(a_j)(a_{j+1} - a_j) \;\; \hat{S}_d(a_j) \\ &\approx 1 - \sum_{j=0}^{i-1} \; 1 - e^{-\hat{\lambda}_c(a_j)(a_{j+1}-a_j)} \;\; \hat{S}_d(a_j) = \tilde{S}_c^*(a_i) \end{aligned}$$

Thus, the denominators of the two estimators of $A(a_i, a_j)$ are approximately equal.

Now consider the numberators. For $x = a_i$ and $y = a_j$ our estimator of the numerator is

$$\hat{N}(a_i, a_j) = \sum_{h=1}^{j-1} \hat{\lambda}_c(a_h)\hat{S}(a_h)\phi(\hat{\lambda}(a_h), h)$$

which can be approximated using expression 6 by

$$\hat{N}(a_i, a_j) \approx \sum_{h=1}^{j-1} \hat{\lambda}_c(a_h)\hat{S}(a_h)(a_{h+1} - a_h)$$

Now we write the numerator of $\tilde{A}(a_i, a_j)$,

$$\begin{aligned} \tilde{N}(a_i, a_j) &= \sum_{h=i}^{j-1} \; \tilde{S}^*(a_h) - \tilde{S}^*(a_{h+1}) \;\; \frac{\tilde{\lambda}_c^*(a_h)}{\tilde{\lambda}_c^*(a_h) + \hat{\lambda}_o^*(a_h)} \\ &= \sum_{h=i}^{j-1} \tilde{S}^*(a_h) \;\; 1 - \exp\left[-\left(\tilde{\lambda}_c^*(a_h) + \hat{\lambda}_o^*(a_h)\right)(a_{h+1} - a_h)\right]\Big\} \frac{\tilde{\lambda}_c^*(a_h)}{\tilde{\lambda}_c^*(a_h) + \hat{\lambda}_o^*(a_h)} \end{aligned}$$

Repeatedly using expression 6 we can show that the two numerators are approximately equal:

$$
\begin{aligned}
\tilde{N}(a_i, a_j) &\approx \sum_{h=i}^{j-1} \tilde{S}^*(a_h)\,(a_{h+1} - a_h)\,\tilde{\lambda}_c^*(a_h) \\
&= \sum_{h=i}^{j-1} \tilde{S}^*(a_h) \left(-\log \left(1 - \left[1 - e^{-\hat{\Lambda}_c(a_h)(a_{h+1}-a_h)}\right] \frac{\hat{S}(a_h)}{\tilde{S}^*(a_h)} \right) \right) \\
&\approx \sum_{h=i}^{j-1} \tilde{S}^*(a_h) \left(1 - \left(1 - \left[1 - e^{-\hat{\Lambda}_c(a_h)(a_{h+1}-a_h)}\right] \frac{\hat{S}(a_h)}{\tilde{S}^*(a_h)} \right) \right) \\
&\approx \sum_{h=i}^{j-1} \left[1 - e^{-\hat{\Lambda}_c(a_h)(a_{h+1}-a_h)}\right] \hat{S}(a_h) \\
&\approx \sum_{h=i}^{j-1} \hat{\lambda}_c(a_h)(a_{h+1} - a_h)\hat{S}(a_h)
\end{aligned}
$$

Thus, the numerators of the two methods are approximately equal.

Finally we list the WMF estimator when $y = a_{k+1} = \infty$, which we also believe is incorrectly motivated,

$$
\tilde{A}(a_i, a_{k+1}) = \frac{\left[\sum_{\ell=i}^{k-1} \left(\tilde{S}^*(a_\ell) - \tilde{S}^*(a_{\ell+1}) \right) \left(\frac{\tilde{\Lambda}_c(a_\ell)}{\tilde{\Lambda}_c(a_\ell) + \hat{\Lambda}_o(a_\ell)} \right) \right] + \frac{\hat{S}(a_k)\hat{\Lambda}_c(a_k)}{\hat{\Lambda}(a_k)}}{\tilde{S}^*(a_i)}
$$

For a comparison of the two methods which shows the notation of WMF see Section 3.

3 Comparison of Fay et al., 2002 method to that of Wun et al., 1998 using WMF Notation

We first simplify some values given in Wun, et al. (1998) in their own notation. Then we compare notations.

3.1 Simplification of some Values in Wun, et al. (1998)

3.1.1 Simplify a_{95+}

Let us simplify Wun, Merrill, and Feuer (1998)'s value for a_{95+} (all in their notation),

$$
a_{95+} = \frac{({}^0\ell_{95+})({}^0r_{95+})}{{}^0r_{95+} + ({}^0m^0_{95+})} = \frac{{}^0\ell_{95+}\left(\frac{w}{1-w}\right)({}^0m^0_{95+})}{\left(\frac{w}{1-w}\right)({}^0m^0_{95+}) + ({}^0m^0_{95+})}
$$

$$= \quad {}^0\ell_{95+} w = \frac{{}^0\ell_{95+}\ell_{95+} r_{95+}}{m_{95+}({}^0\ell_{95+})} = \frac{\ell_{95+} r_{95+}}{m_{95+}}.$$

3.1.2 Simplify ${}^0\ell_x$

Wun, Merrill, and Feuer (1998) defined ${}^0\ell_x$ recursively. Here we write it as a single expression,

$${}^0\ell_{5j} = ({}^0\ell_0) \exp\left(-5 \sum_{i=0}^{j-1} \left[({}_5m^0_{5i}) + ({}^0_5r_{5i})\right]\right),$$

where $({}^0_5m^0_{5i}) = ({}_5m^0_{5i})$ is assumed (p. 174, Wun, *et al* 1998). Similarly,

$$\ell_{5j} = \ell_0 \exp\left(-5 \sum_{i=0}^{j-1} ({}_5m_{5i})\right).$$

Now,

$$\begin{aligned}
\exp\left(-5 \sum_{i=0}^{j} ({}^0_5r_{5i})\right) &= \exp\left(-5 \sum_{i=0}^{j-1} ({}^0_5r_{5i})\right)\left(1 - ({}^0_5g_{5j})\right) \\
&= \exp\left(-5 \sum_{i=0}^{j-1} ({}^0_5r_{5i})\right) - \exp\left(-5 \sum_{i=0}^{j-1} ({}^0_5r_{5i})\right)({}_5g_{5j}) \frac{\ell_0 \exp\left(-5 \sum_{i=0}^{j-1} ({}_5m_{5i})\right)}{({}^0\ell_0) \exp\left(-5 \sum_{i=0}^{j-1} \left[({}_5m^0_{5i}) + ({}^0_5r_{5i})\right]\right)} \\
&= \exp\left(-5 \sum_{i=0}^{j-1} ({}^0_5r_{5i})\right) - ({}_5g_{5j}) \exp\left(-5 \sum_{i=0}^{j-1} \left[({}_5m_{5i}) - ({}_5m^0_{5i})\right]\right) \\
&\vdots \\
&= 1 - \sum_{h=0}^{j} ({}_5g_{5h}) \exp\left(-5 \sum_{i=0}^{h-1} \left[({}_5m_{5i}) - ({}_5m^0_{5i})\right]\right)
\end{aligned}$$

where the last step comes from recursively applying the previous equation.

3.2 Comparison of Notations

Wun, Merrill, and Feuer (1998) only consider the case where ages are divided into 19 five year intervals, i.e., $a_0 = 0, a_1 = 5, a_2 = 10, \ldots, a_k = 95$.

First we compare notations for $i = 1, \ldots, k-1$ in Table 1 (see page 7). (The last category is handled differently in Wun, Merrill and Feuer (1998).)

Table 1: Comparison of Notations for $i = 1, \ldots, k-1$

Fay et al. (2002) Notation	Wun, et al. (1998) Notation
c_i	${}_5C_{5i}$
d_i	$({}_5D_{5i}) - ({}_5D^0_{5i})$
o_i	${}_5D^0_{5i}$
$n_i^{(c)} = n_i^{(d)} = n_i^{(o)}$	${}_5L_{5i}$
$\hat{\lambda}_c(a_i)$	${}_5r_{5i}$
$\hat{\lambda}(a_i)$	${}_5m_{5i}$
$\hat{\lambda}_o(a_i)$	${}_5m^0_{5i}$
$\lambda^*_o(a_i)$	${}^0_5m^0_{5i}$
$1 - \exp\left(-\hat{\lambda}_c(a_i)(a_{i+1} - a_i)\right)$	${}_5g_{5i}$
$1 - \exp\left(-\hat{\lambda}(a_i)(a_{i+1} - a_i)\right)$	${}_5q_{5i}$
$\hat{S}(a_i)$	$\frac{\ell_{5i}}{\ell_0}$
$\hat{S}^*(a_i)$	$\frac{{}^0\ell_{5i}}{{}^0\ell_0}$
$\tilde{\lambda}^*_c(a_i)$	${}^0_5r_{5i}$
$\frac{\left(\tilde{S}\ (a_i) - \tilde{S}\ (a_{i+1})\right)\tilde{}\ _c(a_i)}{\tilde{}\ _c(a_i) + \hat{}\ _o(a_i)}$	${}_5a_{5i}$

Using results from Section 3.1.2 we can write

	Fay et al. (2002) Notation	Wun, et al. (1998) Notation
$\hat{S}^*_o(a_j)$	$\left(1 - \sum_{i=0}^{j-1}\left[1 - \exp\left(-\hat{\lambda}_c(a_i)(a_{i+1} - a_i)\right)\right]\hat{S}_d(a_i)\right)$	$\frac{{}^0\ell_{5j}}{{}^0\ell_0}$

For the last category, Wun et al. (1998) does not use the left subscript, so that

Fay et al. (2002) Notation	Wun, et al. (1998) Notation
c_k	C_{95+}

and the other notations are similar. The only substantial difference is in estimating ${}^0r_{95+}$ and a_{95+} in Wun et al. (1998). We do not give the Fay *et al.* (2002) notation for ${}^0r_{95+}$ since our interest is primarily in a_{95+}.

This notation is given by (see Section 3.1.1),

Fay et al. (2002) Notation	Wun, et al. (1998) Notation
$\frac{\hat{S}(a_k)\hat{\lambda}_c(a_k)}{\hat{\lambda}(a_k)}$	a_{95+}

4 Data Examples Comparing the Methods

We study the application to Table I-17 of the Cancer Statistics Review, 1973-1998 (Ries et al., 2001), that lists the lifetime risk of developing 30 different cancer categories for different sexes and races. In Table 2 (pages 9-11) we reproduce Table I-17 but with the new estimator of Fay et al. (2002) and the percent difference between the two methods listed also. Note that in every case the percent difference is less than 2 percent.

References

Fay, M.P., Pfeiffer, R., Cronin, K.A., Le, C.,Feuer, E.J. (2002). Age-Conditional Probabilities of Developing Cancer. (To appear in *Statistics in Medicine*).

Ries, L.A.G., Eisner, M.P., Kosary, C.L., Hankey, B.F., Miller, B.A., Clegg, L., Edwards, B.K. (eds.) (2001). *SEER Cancer Statistics Review, 1973-1998,* National Cancer Institute. Bethesda, MD. (available at http://seer.cancer.gov/Publications/).

Wun, L-M, Merrill, R.M., and Feuer, E.J. (1998). Estimating lifetime and age-conditional probabilities of developing cancer. *Lifetime Data Analysis* **4,** 169-186.

Table 2: Lifetime Risk (percent) of Being Diagnosed with Cancer by Site, Race and Sex. 11 SEER Areas, 1996-1998. (Compare to Ries, et al. 2001, Table I-17). Each cell has 3 values: New method, WMF method, and percent difference= $100(new - WMF)/WMF$.

	All Races		Whites		Blacks	
Site	Males	Females	Males	Females	Males	Females
All Sites	44.17	38.65	43.92	39.53	41.17	32.55
	43.39	38.25	43.18	39.12	40.41	32.29
	1.78	1.05	1.70	1.06	1.88	0.81
Invasive and In Situ	45.67	41.93	45.46	42.89	41.97	34.84
	44.82	41.42	44.64	42.36	41.16	34.51
	1.90	1.23	1.83	1.25	1.97	0.96
Oral cavity and Pharynx	1.46	0.71	1.45	0.72	1.42	0.59
	1.45	0.71	1.45	0.72	1.42	0.59
	0.08	0.03	0.08	0.03	0.08	0.03
Esophagus	0.72	0.26	0.71	0.25	0.87	0.41
	0.72	0.26	0.71	0.25	0.87	0.41
	0.00	0.00	0.00	0.00	0.01	0.00
Stomach	1.27	0.77	1.10	0.63	1.45	1.08
	1.27	0.77	1.10	0.63	1.45	1.08
	0.05	0.03	0.04	0.02	0.07	0.05
Colon and Rectum	5.97	5.65	6.03	5.66	4.75	5.32
	5.95	5.63	6.00	5.64	4.73	5.31
	0.40	0.31	0.40	0.32	0.33	0.26
Invasive and In Situ	6.31	5.92	6.36	5.92	5.04	5.62
	6.28	5.90	6.34	5.90	5.02	5.61
	0.43	0.34	0.44	0.34	0.37	0.29
Liver and Intrahepatic bile duct	0.80	0.40	0.65	0.33	0.68	0.38
	0.80	0.40	0.65	0.33	0.68	0.38
	0.00	0.00	0.00	0.00	0.00	0.00
Pancreas	1.20	1.26	1.19	1.22	1.23	1.53
	1.20	1.26	1.19	1.22	1.23	1.53
	0.01	0.00	0.00	0.00	0.01	-0.01
Larynx	0.67	0.17	0.67	0.17	0.83	0.23
	0.67	0.17	0.67	0.17	0.83	0.23
	0.04	0.00	0.04	0.00	0.06	0.00
Invasive and In Situ	0.73	0.18	0.73	0.19	0.88	0.24
	0.73	0.18	0.73	0.19	0.88	0.24
	0.04	0.05	0.05	0.00	0.06	0.04
Lung and Bronchus	7.86	5.76	7.84	6.05	8.49	5.07
	7.85	5.75	7.83	6.04	8.47	5.06
	0.14	0.10	0.13	0.11	0.16	0.08

Table 2: (continued) Lifetime Risk (percent) of Being Diagnosed with Cancer by Site, Race and Sex. 11 SEER Areas, 1996-1998. (Compare to Ries, et al. 2001, Table I-17). Each cell has 3 values: New method, WMF method, and percent difference= $100(new - WMF)/WMF$.

	All Races		Whites		Blacks	
Site	Males	Females	Males	Females	Males	Females
Melanomas of skin	1.72	1.22	1.98	1.40	0.11	0.08
	1.72	1.22	1.97	1.40	0.11	0.08
	0.10	0.05	0.11	0.05	0.00	0.00
Invasive and In Situ	2.63	1.84	2.95	2.08	0.15	0.12
	2.62	1.84	2.95	2.08	0.15	0.12
	0.18	0.08	0.19	0.09	0.00	0.00
Breast	0.11	13.32	0.12	13.92	0.12	10.19
	0.11	13.24	0.12	13.83	0.11	10.14
	0.00	0.63	0.08	0.66	0.09	0.45
Invasive and In Situ	0.13	15.54	0.13	16.19	0.13	11.94
	0.13	15.42	0.13	16.07	0.13	11.87
	0.00	0.76	0.00	0.80	0.00	0.57
Cervix uteri	-	0.85	-	0.78	-	1.07
	-	0.85	-	0.78	-	1.07
	-	0.02	-	0.03	-	0.04
Corpus and Uterus, NOS	-	2.70	-	2.87	-	1.76
	-	2.69	-	2.87	-	1.75
	-	0.15	-	0.17	-	0.10
Invasive and In Situ	-	2.75	-	2.93	-	1.78
	-	2.74	-	2.93	-	1.78
	-	0.16	-	0.17	-	0.10
Ovary	-	1.71	-	1.82	-	1.05
	-	1.71	-	1.82	-	1.05
	-	0.03	-	0.03	-	0.02
Prostate	16.26	-	15.75	-	18.62	-
	16.03	-	15.53	-	18.26	-
	1.48	-	1.41	-	1.97	-
Testis	0.35	-	0.41	-	0.08	-
	0.35	-	0.41	-	0.08	-
	0.00	-	0.02	-	0.00	-
Urinary bladder(Invasive and In Situ)	3.43	1.13	3.80	1.21	1.30	0.75
	3.42	1.13	3.79	1.20	1.30	0.75
	0.32	0.07	0.35	0.08	0.14	0.05
Kidney and Renal pelvis	1.39	0.83	1.44	0.86	1.14	0.80
	1.39	0.83	1.44	0.86	1.14	0.80
	0.07	0.04	0.08	0.04	0.08	0.04

Table 2: (continued) Lifetime Risk (percent) of Being Diagnosed with Cancer by Site, Race and Sex. 11 SEER Areas, 1996-1998. (Compare to Ries, et al. 2001, Table I-17). Each cell has 3 values: New method, WMF method, and percent difference= $100(new - WMF)/WMF$.

	All Races		Whites		Blacks	
Site	Males	Females	Males	Females	Males	Females
Brain and Other nervous system	0.65	0.53	0.72	0.59	0.31	0.30
	0.65	0.53	0.72	0.59	0.31	0.30
	0.02	0.00	0.01	0.00	0.03	0.00
Thyroid	0.28	0.77	0.29	0.79	0.12	0.40
	0.28	0.77	0.29	0.79	0.12	0.40
	0.00	0.03	0.00	0.04	0.00	0.02
Hodgkin's disease	0.23	0.20	0.26	0.22	0.18	0.15
	0.23	0.20	0.26	0.22	0.18	0.15
	0.00	0.00	0.00	0.05	0.00	0.00
Non-Hodgkin's lymphomas	2.10	1.76	2.21	1.84	1.28	1.05
	2.10	1.76	2.20	1.84	1.28	1.05
	0.08	0.06	0.08	0.05	0.04	0.04
Multiple myeloma	0.66	0.55	0.64	0.51	0.87	0.99
	0.66	0.55	0.64	0.51	0.87	0.99
	0.02	0.00	0.02	0.02	0.02	0.02
Leukemias	1.42	1.05	1.50	1.10	0.87	0.71
	1.42	1.05	1.50	1.10	0.87	0.71
	0.04	0.02	0.03	0.01	0.02	0.01