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BACKGROUND

In 2004, brain cancer accounted for 1.5% of all cancers in males and 1.3% in females in NSW. Since the 1980s brain cancer incidence rates per 100,000 have increased mainly in those aged 65 years and older at diagnosis. The most recent unadjusted five-year relative survival in NSW experienced in cases diagnosed with brain cancer between 1999 to 2003 and followed to the end of 2004 was 20%.

There are very few known risk factors for brain cancer. One established risk factor is radiation to the head, usually received for treatment of other cancers. This is most commonly observed in people who received irradiation as part of leukaemia treatment during childhood. Congenital abnormalities, the side effects of cancer treatment, immunosuppressive therapy or HIV infection are also at increased risk of brain cancer. More recently mobile phone usage has been considered a risk factor; however no studies have confirmed this.

AIM

The aim of the study was to use the data available with the Central Cancer Registry to investigate:

- How survival varies by period of diagnosis and histological type while controlling for covariates of age, sex, socioeconomic status, Accessibility/Remoteness Index of Australia (ARIA), urban and rural Area Health Service, country of birth and period of diagnosis.
- Where possible, to consider whether different histological types of brain cancer can be grouped and used as a proxy for grade.

METHODS

All NSW cases of brain cancer diagnosed between 1980 and 2003, followed to the end of 2004, were included. Unadjusted cause-specific-analysis was undertaken using Kaplan Meier survival. Survival was adjusted for covariates by using Cox proportional hazards regression modelling. All analyses were undertaken using SAS version 9.1.

RESULTS

There were 8,724 brain cancers diagnosed in NSW between 1980 and 2003. The majority were glioblastoma (42%) followed by astrocytoma nos (21%), glioma malignant (11%) and oligodendroglioma 5%. The remaining histological types each accounted for 2% or less of the total brain cancers.

Unadjusted survival by period of diagnosis for the period 1980–2003 indicated that five-year relative survival from brain cancer had remained constant. Five-year relative survival for brain cancer for the period 1999–2003 declined dramatically with age:

- 15-44 year olds at 55.3%
- 55-64 year olds at 7.7%
- 75 and older at 4.4%

Unadjusted survival differences by age are strongly influenced by the histological type of brain cancer for example glioblastoma also increases with age at diagnosis hence the importance of considering histological type of cancer.

There was considerable difference in survival from brain cancer by histological type (Figure 1). Five-year survival for:

- glioblastoma was 3%
- oligodendroglioma and medulloblastoma was 61%.

The covariates of (ARIA), urban and rural Area Health Service were included in the model initially but were removed because they were not significant. The final model included only histologically verified brain cancers diagnosed between 1980 and 2003. Controlling for all factors, the likelihood of dying of brain cancer was increased with age at diagnosis with the risk of death nine times higher in the oldest age group compared to the youngest age group. The risk was lower for all histological types compared to glioblastoma and was lower in people born in English speaking and non-English speaking countries compared to Australian-born (Table I). The risk of death also declined by period of diagnosis with a 22% reduction in the hazard ratio in those diagnosed in 1999–2003 compared to the earliest time period 1980–1983.

Figure 1 Unadjusted survival of agreed histological groupings that reflect grade of cancer – advice received from the Neuro-oncology working party

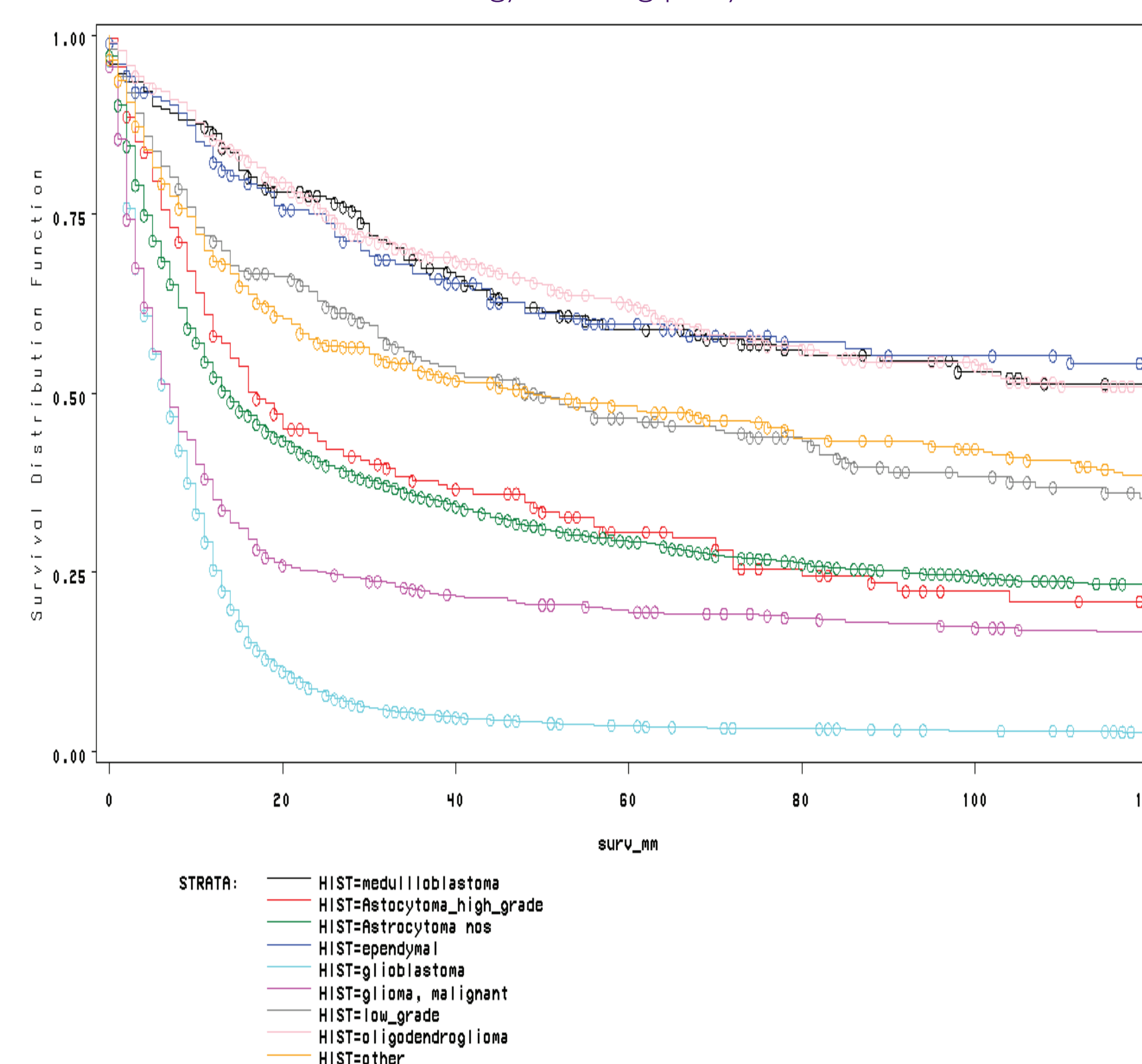


Table I Brain cancer in NSW 1980–2003 proportional hazards regression modelling – histologically verified only

covariates	Hazard ratio	Hazard ratio Lower CI	Hazard ratio Upper CI	Pvalue
0-39	1.00			
40-49	1.90	1.72	2.09	<.0001
50-59	2.94	2.69	3.21	<.0001
60-69	4.19	3.85	4.57	<.0001
70-79	5.98	5.47	6.54	<.0001
80+	8.91	7.91	10.02	<.0001
Australian born	1.00			
Eng speaking	0.91	0.84	0.98	0.0183
NESB	0.88	0.83	0.94	0.0002
1980-1983	1.00			
1984-1988	0.99	0.90	1.07	0.7364
1989-1993	0.99	0.91	1.08	0.7578
1994-1998	0.93	0.85	1.01	0.0766
1999-2003	0.78	0.72	0.85	<.0001
Glioblastoma	1.00			
medulloblastoma	0.45	0.36	0.56	<.0001
Astrocytoma high grade	0.60	0.51	0.71	<.0001
Astrocytoma nos	0.62	0.58	0.66	<.0001
ependymal	0.32	0.25	0.40	<.0001
glioma, malignant	0.64	0.59	0.70	<.0001
low_grade	0.45	0.38	0.53	<.0001
oligodendroglioma	0.28	0.24	0.32	<.0001
other	0.57	0.52	0.62	<.0001

DISCUSSION

Five year relative survival in the US differs little by sex, race and place of residence. Similar to this study, age at diagnosis is the main factor in survival in the US. Five-year survivals and the associated decline seen in NSW is similar to US figures of 63.3% for those aged less than 45 years declining to 27.1% for those aged 45–54 years and 4.3% in those aged 75 years and older (SEER, 1996–2002). Responses to radiotherapy and chemotherapy have been correlated to the age of the patient and are suggested to explain some of the prognostic variations seen in patients with brain tumours. Survival from glioblastoma in patients in the US have not shown any improvement since the 1980s compared to all brain cancers. According to a Los Angeles County survey, glioma survival was higher in Whites than in Blacks, Latinos, and Asians. In a recent report from the US, the overall incidence of all brain and central nervous system tumours was also higher in Whites than in Blacks. Whites had incidence rates of malignant glioma twice as high as those in Blacks.

In NSW, unlike the US, the likelihood of dying from brain cancer was lower for the later periods of diagnosis compared to the earliest time period, while controlling for all covariates.

CONCLUSION

Unadjusted five-year survival shows little improvement by period of diagnosis. However, modelling revealed that the risk of dying of brain cancer has improved for more recent diagnostic periods compared to the earliest diagnostic period. Age at diagnosis and histological type are the main factors in variations in survival for brain cancer in NSW.

Grouping histology into categories reflecting grade is a useful prognostic indicator of survival.