

# Ethnic Inequalities in Cancer Survival in New Zealand: Linkage Study

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We explored the contribution of stage at diagnosis to ethnic disparities in cancer survival in New Zealand. We linked 115 811 adult patients with invasive cancer registered on the cancer registry (1994 to 2002) to mortality data. Age-standardized, 5-year relative survival rates were lowest for Maori, intermediate for Pacific people (otherwise known as Pacific Islanders), and highest for non-Maori/non-Pacific people for many cancers. Stage at diagnosis accounted for only part of these differences. Possible factors responsible for ethnic inequalities might include access to specialized cancer services and the quality of care received. (*Am J Public Health*. 2005; 95:834–837. doi:10.2105/AJPH.2004.053678)

The ethnic mix of the more than 4 million people of New Zealand includes the indigenous Maori (15% of the population) and Pacific Islanders (7%), originally from the South Pacific islands (hereafter referred to as Pacific people). The majority of non-Maori/non-Pacific people are of European descent. The Treaty of Waitangi (1840) was a formal agreement between Maori hapu (subtribes) and the British Crown, which guaranteed equity between Maori and other New Zealand citizens.<sup>1</sup> Because health rights are implicit in the treaty,<sup>2</sup> the poor health status of Maori<sup>3</sup> can be considered a breach of their rights under the treaty.<sup>4</sup>

Since 1980, ethnic disparities in cancer mortality have widened.<sup>5</sup> These inequalities cannot be explained by the differences in incidence<sup>6,7</sup> and point to likely differences in access to and quality of health care.<sup>8</sup> The few

studies that have examined ethnic inequalities in cancer survival in New Zealand<sup>9–11</sup> did not account for background (other cause) mortality rates. Our goal was to quantify the disparities and to estimate the magnitude of the contribution of stage of disease to these inequalities.

## METHODS

Adult patients (aged 15 to 99 years) who had a cancer registered in the New Zealand Cancer Registry between July 1, 1994, and June 30, 2002, were identified (n=124 599). We restricted the analyses to 20 main sites (n=118 188) and excluded patients with (1) death certificate only registrations (n=23 45, 2.0%), (2) in situ cancer (n=7, <0.1%), or (3) a home address overseas (n=25, <0.1%).

We used the National Health Index, which uniquely identifies health care users, to obtain mortality data to June 2003. We used a Maori, Pacific, non-Maori/non-Pacific-prioritized system of assigning ethnicity<sup>12</sup> that is based on hospitalization and health administration data, as is standard in New Zealand. Patients with missing ethnicity data (2.6%) were analyzed with the non-Maori/non-Pacific group.

We used SURV3 software<sup>13</sup> to estimate relative survival rates (RSRs)<sup>14</sup> and standard errors<sup>15,16</sup> based on ethnic-specific life tables by single year of age (15 to 99 years) from the 1996 census. Survival probabilities were estimated at yearly intervals.

RSRs were directly standardized first for age (15–44, 45–54, 55–64, 65–74, and 75–99 years) and then for disease stage (local, regional, distant spread).<sup>17</sup> Pacific people were omitted from stage-standardized analyses because of their small numbers. We compared the age-standardized to the age- and stage-standardized Maori to non-Maori/non-Pacific RSR ratio to determine the contribution of stage to the survival inequalities.

## RESULTS

Among 115 811 patients, site-specific 5-year RSRs (Table 1) showed lower survival for Maori than for non-Maori/non-Pacific people at many sites, including cancer of the breast, cervix, colon/rectum, lung, prostate,

**TABLE 1—Age-Standardized 5-Year Relative Survival Rates (RSR), by Ethnicity and Cancer Site: New Zealand, 1994 to 2002**

Site (ICD-10 codes)	Maori		Pacific		Non-Maori/non-Pacific	
	No. of Cancers	RSR (95% CI)	No. of Cancers	RSR (95% CI)	No. of Cancers	RSR (95% CI)
Bladder (C67)	100	0.58 (0.46, 0.71)	35	0.68 (0.44, 0.92)	4157	0.69 (0.67, 0.71)
Brain (C71)	80	0.24 (0.15, 0.33)	37	0.30 (0.18, 0.42)	1541	0.16 (0.14, 0.17)
Breast (C50)	1394	0.74 (0.71, 0.78)	448	0.71 (0.66, 0.77)	14925	0.81 (0.80, 0.82)
Cervix (C53)	316	0.63 (0.57, 0.69)	65	0.56 (0.42, 0.70)	1272	0.75 (0.72, 0.77)
Colon/rectum (C18–C21)	574	0.41 (0.36, 0.47)	203	0.53 (0.44, 0.62)	18850	0.60 (0.59, 0.61)
Esophagus (C15)	88	0.06 (0.01, 0.11)	16	0.40 (0.19, 0.61)	1443	0.11 (0.09, 0.13)
Head and neck, larynx (C01–C14, C32)	178	0.53 (0.43, 0.63)	96	0.64 (0.51, 0.76)	2064	0.56 (0.53, 0.59)
Kidney, uterus, urethra (C64–C66, C68)	159	0.46 (0.37, 0.56)	44	0.60 (0.44, 0.76)	2407	0.56 (0.53, 0.59)
Leukemia (C91–C95)	234	0.38 (0.30, 0.46)	105	0.42 (0.31, 0.54)	3523	0.46 (0.44, 0.48)
Liver (C22)	194	0.07 (0.03, 0.11)	114	0.18 (0.10, 0.25)	672	0.11 (0.08, 0.13)
Lung, trachea, bronchus (C33–C34)	1562	0.06 (0.04, 0.07)	353	0.22 (0.17, 0.27)	9712	0.10 (0.10, 0.11)
Melanoma (C43)	111	0.93 (0.83, 1.00)	24	0.92 (0.75, 1.09)	12791	0.91 (0.90, 0.92)
Non-Hodgkin's lymphoma (C82–C85, C96)	236	0.48 (0.40, 0.56)	117	0.54 (0.43, 0.66)	3949	0.51 (0.49, 0.53)
Ovary (C56)	182	0.60 (0.52, 0.68)	83	0.51 (0.40, 0.62)	1979	0.42 (0.40, 0.45)
Pancreas (C25)	182	0.09 (0.04, 0.14)	48	0.46 (0.28, 0.63)	2063	0.04 (0.03, 0.05)
Pleura, thymus, heart (C37–C38)	20	0.11 (0.00, 0.27)	13	0.63 (0.41, 0.86)	152	0.26 (0.18, 0.34)
Prostate (C61)	723	0.69 (0.62, 0.75)	326	0.83 (0.75, 0.92)	19587	0.83 (0.82, 0.84)
Stomach (C16)	379	0.19 (0.14, 0.24)	165	0.35 (0.26, 0.43)	2386	0.18 (0.16, 0.20)
Thyroid gland (C73)	133	0.87 (0.80, 0.95)	102	0.97 (0.90, 1.03)	861	0.91 (0.88, 0.94)
Uterus (C54–C55)	210	0.62 (0.54, 0.70)	157	0.77 (0.68, 0.85)	1871	0.75 (0.72, 0.77)

Note. ICD-10 = *International Classification of Diseases, 10th Revision*,<sup>18</sup> 95% CI = 95% confidence interval; RSR = 5-year relative survival rate, estimated using ethnic-specific life tables. Analysis based on all patients (with and without) stage data recorded on the New Zealand Cancer Registry, n = 115 811.

and uterus. Ovarian cancer survival was higher in Maori compared with non-Maori/non-Pacific women. Survival among Pacific people was lower than non-Maori/non-Pacific people for colorectal, breast, and cervical cancer and higher for lung cancer. There were no differences by gender (results not shown).

The survival pattern among the patients with missing stage data (35%) differed by site, but age-standardized RSRs were similar between the total population and those patients with recorded stage data (Tables 1 and 2). Following standardization for stage, the RSRs for Maori and non-Maori/non-Pacific people were close for cancers of the breast and prostate. However, stage at diagnosis explained little of the survival disparities for cancers of the bladder, cervix, colorectum, head/neck/larynx, lung, or uterus. The apparent survival advantage among Maori for ovarian cancer was fully explained by stage.

## DISCUSSION

Stage at diagnosis explains some but not all of the ethnic differences in cancer survival in New Zealand. Residual confounding through inaccuracies in stage classification could explain some of the results. Although little bias appears to have been introduced through exclusion of people with missing stage data. Differential access to health services and health system factors are likely to contribute to the remaining disparities.

Because cancer and death registration are mandatory, selective underascertainment is unlikely to explain the results. Using prioritized ethnicity, misclassification of Maori and Pacific ethnicity<sup>19</sup> would underestimate the differences in survival between ethnic groups. Selective migration of terminally ill Pacific cancer patients to the Pacific would artificially inflate their survival rate, which may explain some of our results. Higher comorbidities in Maori, which could limit treatment

options, might account for some of the observed differences.

Biological or genetic differences cannot account for ethnic differences in health.<sup>20</sup> The unequal distribution of socioeconomic position by ethnicity may explain some, but probably not all,<sup>21–23</sup> of the survival differences. In the United States, similar outcomes are experienced by people of different ethnicities in equal-access settings<sup>24</sup>; in other settings, the quality of cancer treatment differs by ethnicity.<sup>8</sup> Health care utilization by Maori is not proportional to the expected need,<sup>3</sup> which suggests that Maori are medically underserved in New Zealand.<sup>25</sup> Factors that influence the receipt of optimal health care include cost,<sup>26</sup> access through the secondary care system,<sup>27,28</sup> rurality,<sup>10</sup> and cultural safety,<sup>29</sup> including perceived attitudes of health workers and acceptability of health providers to Maori.<sup>3,28</sup> Maori-led health services may provide more acceptable opportunities for appropriate care for some Maori.<sup>30</sup>

**TABLE 2—Age- and Age- and Stage-Standardized 5-Year Relative Survival Rates (RSR), by Ethnicity and Cancer Site: New Zealand, 1994 to 2002**

Site (ICD-10 codes)	Age-Standardized					Age- and Stage-Standardized			
	Maori		Non-Maori/non-Pacific		RSRR	Maori		Non-Maori/non-Pacific	
	No. of Cancers	RSR (95% CI)	No. of Cancers	RSR (95% CI)		RSR (95% CI)	RSR (95% CI)	RSRR	
Bladder (C67)	32	0.36 (0.20, 0.52)	945	0.55 (0.50, 0.69)	0.65	0.37 (0.22, 0.51)	0.54 (0.50, 0.58)	0.69	
Brain (C71)	64	0.27 (0.17, 0.37)	1297	0.16 (0.14, 0.18)	1.69	0.18 (0.11, 0.25)	0.17 (0.15, 0.19)	1.06	
Breast (C50)	1154	0.76 (0.72, 0.79)	11965	0.82 (0.81, 0.83)	0.93	0.81 (0.76, 0.87)	0.82 (0.81, 0.83)	0.99	
Cervix (C53)	193	0.73 (0.66, 0.79)	846	0.87 (0.84, 0.89)	0.84	0.74 (0.69, 0.79)	0.85 (0.83, 0.87)	0.87	
Colon/rectum (C18-C21)	484	0.43 (0.37, 0.50)	16729	0.61 (0.60, 0.62)	0.70	0.44 (0.35, 0.53)	0.61 (0.60, 0.62)	0.72	
Esophagus (C15)	28	No survivors	549	0.12 (0.09, 0.16)	...	No survivors	0.12 (0.09, 0.15)	...	
Head and neck, larynx (C01-C14, C32)	101	0.46 (0.32, 0.59)	1136	0.54 (0.50, 0.58)	0.85	0.38 (0.27, 0.49)	0.54 (0.51, 0.58)	0.70	
Kidney, uterus, urethra (C64-C66, C68)	135	0.52 (0.42, 0.63)	1972	0.59 (0.56, 0.62)	0.88	0.49 (0.34, 0.63)	0.59 (0.57, 0.62)	0.83	
Liver (C22)	60	0.02 (0.00, 0.60)	226	0.11 (0.06, 0.15)	0.18	0.05 (0.00, 0.12)	0.14 (0.09, 0.18)	0.36	
Lung, trachea, bronchus (C33-C34)	716	0.06 (0.04, 0.08)	4786	0.11 (0.10, 0.12)	0.55	0.06 (0.03, 0.09)	0.11 (0.10, 0.12)	0.55	
Melanoma (C43)	104	0.94 (0.84, 1.00)	12302	0.91 (0.90, 0.92)	1.02	0.97 (0.81, 1.00)	0.91 (0.90, 0.92)	1.06	
Ovary (C56)	167	0.60 (0.52, 0.69)	1793	0.42 (0.39, 0.44)	1.43	0.42 (0.28, 0.56)	0.43 (0.41, 0.45)	0.98	
Pancreas (C25)	108	0.09 (0.03, 0.15)	1138	0.05 (0.03, 0.06)	1.80	0.05 (0.01, 0.09)	0.05 (0.03, 0.06)	1.00	
Pleura, thymus, heart (C37-C38)	6	0.19 (0.00, 0.46)	71	0.33 (0.21, 0.45)	0.58	0.07 <sup>a</sup>	0.27 (0.19, 0.35)	0.26	
Prostate (C61)	197	0.54 (0.44, 0.65)	4884	0.73 (0.71, 0.74)	0.74	0.66 (0.55, 0.76)	0.71 (0.70, 0.73)	0.93	
Stomach (C16)	259	0.20 (0.14, 0.26)	1543	0.22 (0.19, 0.24)	0.91	0.15 (0.10, 0.20)	0.22 (0.20, 0.25)	0.68	
Thyroid gland (C73)	120	0.87 (0.79, 0.95)	747	0.93 (0.90, 0.95)	0.94	0.86 (0.81, 0.91)	0.92 (0.89, 0.94)	0.93	
Uterus (C54-C55)	169	0.65 (0.56, 0.74)	1555	0.77 (0.74, 0.80)	0.84	0.48 (0.40, 0.57)	0.77 (0.74, 0.79)	0.62	

Note. ICD-10 = International Classification of Diseases, 10th Revision,<sup>18</sup> 95% CI = 95% confidence interval; RSR = 5-year relative survival rate, estimated using ethnic-specific life tables; RSRR = Maori to non-Maori/non-Pacific RSR ratio. Analysis based on all patients with stage data recorded on the New Zealand Cancer Registry, n = 68 581. This table excludes leukemia and non-Hodgkin's lymphoma, because surveillance, epidemiology, and end results (SEER) summary staging data are not available for these sites.

<sup>a</sup>CI not included because data corresponds to a single individual.

To tackle these documented inequalities, it is necessary to pinpoint where on the cancer continuum inequalities arise. Survival disparities also could be reduced by addressing structural and service barriers within the health sector and by ensuring a commitment, with sufficient funding, to strengthen the Maori and Pacific health workforces. ■

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**Contributors**

M. Jeffreys, V. Stevanovic, and N. Pearce developed the study. C. Lewis and V. Stevanovic performed the linkage. V. Stevanovic and M. Jeffreys performed the data analyses. T. Blakely, M. Tobias, V. Stevanovic, and M. Jeffreys participated in initial discussions of the results. M. Jeffreys wrote the first draft. All authors contributed to subsequent drafts and the final brief. The discussions of indigenous health were contributed primarily by L. Ellison-Loschmann.

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**Human Participant Protection**

Formal protocol approval was not sought because the study involved only anonymous linkage between 2 databases.

**References**

1. Durie M. *Whaiora: Maori Health Development*. Auckland, New Zealand: Oxford University Press; 1994.
2. Durie MH. *Tè mana Te Kawanatanga: The Politics of Maori Self-Determination*. Auckland, New Zealand: Oxford University Press; 1998.
3. Pomare E, Keefe-Ormsby V, Ormsby C, et al. *Hauora. Maori Standards of Health III. A Study of the Years 1970-1991*. Wellington, New Zealand: Te Ropu Rangahau Hauora a Eru Pomare; 1995.
4. Robson B, Reid P. *Ethnicity Matters: Maori Perspectives. Review of the Measurement of Ethnicity*. Wellington, New Zealand: Statistics New Zealand; 2001.
5. Ajwani S, Blakely T, Robson B, Tobias M, Bonne M. *Decades of Disparity: Ethnic Mortality Trends in New Zealand 1980-1999*. Wellington, New Zealand: Ministry of Health and University of Otago; 2003.
6. New Zealand Ministry of Health. *Cancer in New Zealand: Trends and Projections*. Wellington, New Zealand: New Zealand Ministry of Health; 2002. Public Health Intelligence Occasional Bulletin No. 15.
7. Foliaki S, Jeffreys M, Wright C, Blakey K, Pearce N. Cancer in Pacific people in New Zealand: a descriptive study. *Pac Health Dialog*. 2005. In press.
8. Smedley B, Stith A, Nelson A, eds. *Unequal Treat-*

- ment: *Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academy Press; 2002.
9. Lethaby AE, Mason BH, Holdaway IM, Kay RG. Age and ethnicity as prognostic factors influencing overall survival in breast cancer patients in the Auckland region. Auckland Breast Cancer Study Group. *N Z Med J*. 1992;105(947):485–488.
  10. Gill AJ, Martin IG. Survival from upper gastrointestinal cancer in New Zealand: The effect of distance from a major hospital, socio-economic status, ethnicity, age and gender. *ANZ J Surg*. 2002;72:643–646.
  11. Phillips AR, Lawes CM, Cooper GJ, Windsor JA. Ethnic disparity of pancreatic cancer in New Zealand. *Int J Gastrointest Cancer*. 2002;31(1–3):137–145.
  12. New Zealand Department of Statistics. *Ethnicity in New Zealand: Recommendations for a Standard Classification*. Discussion paper. Wellington, New Zealand: New Zealand Department of Statistics; 1990.
  13. Dickman P, Hakulinen T, Voutilainen E. SURV3: Relative Survival Analysis [computer program]. v3.00. Helsinki, Finland: Finnish Cancer Registry; 2002.
  14. Esteve J, Benhamou E, Croasdale M, Raymond L. Relative survival and the estimation of net survival: elements for further discussion. *Stat Med*. 1990;9: 529–538.
  15. Greenwood M. *The Natural Duration of Cancer*. London, England: HMSO; 1926. Report on Public Health and Medical Subjects No. 33
  16. Capocaccia R, Gatta G, Roazzi P, et al. The EUROCARE-3 database: methodology of data collection, standardisation, quality control and statistical analysis. *Ann Oncol*. 2003;14(suppl 5):v14–v27.
  17. Young JL Jr, Roffers SD, Ries LAG, Fritz AG, Hurlbut AA, eds. *SEER Summary Staging Manual—2000: Codes and Coding Instructions*. Bethesda, MD: National Cancer Institute; 2001. NIH Pub. No. 01-4969.
  18. *International Classification of Diseases, 10th Revision*. Geneva, Switzerland: World Health Organization; 1992.
  19. Ajwani S, Blakely T, Robson B, Atkinson J, Kiro C. Unlocking the numerator-denominator bias III: adjustment ratios by ethnicity for 1981–1999 mortality data. The New Zealand Census-Mortality Study. *N Z Med J*. 2003;116(1175):U456.
  20. Pearce N, Foliaki S, Sporle A, Cunningham C. Genetics, race, ethnicity and health. *BMJ*. 2004;328: 1070–1072.
  21. Pearce N, Pomare E, Marshall S, Borman B. Mortality and social class in Maori and non-Maori New Zealand men: changes between 1975–7 and 1985–7. *N Z Med J*. 1993;106:193–196.
  22. Salmond C, Crampton P. Deprivation and Health. In: Howden-Chapman PTM, ed. *Social Inequalities in Health: New Zealand 1999*. Wellington, New Zealand: Ministry of Health; 2000:9–64.
  23. Blakely T, Kiro C, Woodward A. Unlocking the numerator-denominator bias. II: Adjustments to mortality rates by ethnicity and deprivation during 1991–94. The New Zealand Census-Mortality Study. *N Z Med J*. 2002;115(1147):43–48.
  24. Shavers VL, Brown ML. Racial and ethnic disparities in the receipt of cancer treatment. *J Natl Cancer Inst*. 2002;94:334–357.
  25. Malcolm L. Inequities in access to and utilisation of primary medical care services for Maori and low income New Zealanders. *N Z Med J*. 1996;109(1030): 356–358.
  26. Schoen C, Blendon R, DesRoches C, Osborn R, Doty M, Downey D. *New Zealand Adults' Health Care System Views and Experiences, 2001. Findings From the Commonwealth Fund 2001 International Health Policy Survey*. New York, NY: The Commonwealth Fund; 2002. Report No. 553.
  27. Baxter J. *Eight Health Gain Priority Areas for Maori Health. Report 1: Mental Health. A Report Prepared for the Maori Health Group, Health Funding Authority*. Auckland, New Zealand: Health Funding Authority; 2000.
  28. Baxter J. *Barriers to Health Care for Maori with Known Diabetes: A Literature Review and Summary of Issues*. Wellington, New Zealand: New Zealand National Working Group on Diabetes; 2002.
  29. Trans-HHS Cancer Health Disparities Progress Review Group. *Making Cancer Health Disparities History*. Washington, DC: US Department of Health and Human Services; 2004.
  30. Ellison-Loschmann L, Pearce N. He Mate Huango: an update on Maori asthma. *Pac Health Dialog*. 2000; 7:82–93.