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abstract

Where Are We Dying? Ethnic Differences in Place of Death Among New Zealanders Dying of Cancer

Jason Kevin Gurney, PhD[1]; James Stanley, PhD[1]; Jonathan Koea, MD[2]; Jonathan Adler, MBChB[3]; June Atkinson, NZC Statistics[1]; and Diana Sarfati, PhD[4]

PURPOSE Around a third of people with cancer will die outside of their preferred place of death, with substantial variation occurring between and within countries in terms of place of death. Here, we examine place of death within the New Zealand cancer context, with specific focus on differences between Indigenous Māori and other ethnic groups.

METHODS Using national-level data, we identified all those who died in New Zealand between 2007 and 2018 of cancer (N = 107,373), stratified by ethnicity and cancer type, and linked these patients to national health and mortality records. We then described the crude and age-standardized proportions of cancer deaths by location separately by ethnic group, and conducted logistic regression to compare odds of death within a given location between ethnic groups.

RESULTS After adjusting for age, sex, and deprivation, we found that Māori people with cancer are more likely to die in a private residence than Europeans (46% *v* 26%; odds ratio [OR] 2.45; 95% CI, 2.36 to 2.55), and also somewhat more likely to die in hospital (27% *v* 23%; OR 1.26; 95% CI, 1.21 to 1.32). Commensurately, Māori are less likely to die in either hospice inpatient unit (14% *v* 27%; OR 0.48; 95% CI, 0.45 to 0.51) or residential care (12% *v* 30%; OR 0.56; 95% CI, 0.52 to 0.59). Pacific patients generally follow the same pattern as Māori patients. These findings were largely repeated across cancer types, with some variation in the magnitude not overall pattern.

CONCLUSION It remains unclear whether these differences reflect differences in preferences for place of death between ethnic groups, or whether they reflect differences in access to appropriate supportive care. Further research is required to examine these differences in greater detail.

INTRODUCTION

A recent systematic review and meta-analysis of studies from across international contexts found that more than half (55%) of people with cancer would prefer to die at home.[1] Another systematic review found that this preference for a home death was shared by these people with cancer, their families, and the general public.[2] However, the relationship between preferred and actual place of death is not straightforward,[3] and around a third of people with cancer will die outside of their preferred place of death.[4-6] Location of death is often viewed as a quality indicator for palliative and end-of-life care.[7]

Internationally, the most common places of death for people with cancer are within a hospital or at home.[8-10] However, there is substantial variation between countries, with one multicenter study reporting that the proportion of cancer deaths in the home ranged from

12% in South Korea to 57% in Mexico, and the proportion of hospital deaths ranging from 26% in New Zealand and the Netherlands to 87% in South Korea.[8]

There are also known differences in actual place of death between racial and ethnic groups living within countries, with the general pattern being that non-White populations tend to be more likely to die in hospital, less likely to die at home, and also less likely to die in hospice care.[9-13] It is plausible that differences in place of death between racial and ethnic groups within a population may indicate differences in access to high-quality palliative and end-of-life care; such differences would be congruent with observations of inequity between races/ethnicities in access to health care services across the clinical pathway. In New Zealand, the Indigenous Māori population experience poorer access to best-practice care, and subsequently experience poorer health outcomes compared with non-Māori[14]; however, there is a lack of substantial

CONTEXT

Key Objective

Are there differences in where people with cancer are dying between ethnic groups in New Zealand, and what can be inferred from these differences regarding access to best-practice palliative and end-of-life care?

Knowledge Generated

In this national study, we found that Māori and Pacific patients are substantially more likely to die in a private residence or in hospital, and less likely to die in hospice inpatient unit or residential care facilities, than European patients. Whether these differences reflect reasonable divergences in preferences for place of death between ethnic groups, or differences in access to appropriate supportive care, requires further investigation.

Relevance

Given the significant divergences in place of cancer death observed between ethnic groups, our findings highlight the need for clinicians and support staff to ensure that the end-of-life supportive care needs of patients with cancer are met equitably across the population, regardless of place of death.

evidence regarding differences in access to palliative and end-of-life care for this population.

Around 9,000 people die of cancer each year in New Zealand,[15] with the Māori population nearly twice as likely to die of cancer compared with non-Māori.[16] There are some data from a decade ago that show that Māori (in general) are more likely to die at home and less likely to die in a hospice inpatient unit (IPU) compared with non-Māori.[17] However, since cause of death affects place of death, a more up-to-date cancer-focused assessment of place of death by ethnic group and cancer type is required to further our understanding in this area. As such, the purpose of this study was to examine place of death within the New Zealand cancer context, with specific focus on differences between Māori and other ethnic groups.

METHODS

Participants and Data Sources

The participants in this study were those who died in New Zealand between 2007 and 2018, where cancer (International Classification of Diseases, 10th Revision, Australian Modification, Third Edition prefix: "C") was identified as the underlying cause of death (N = 107,373; n = 11,587 Māori, n = 4,185 Pacific, n = 3,206 Asian, n = 87,989 European, and n = 406 Middle Eastern/Latin American/African/Other [otherwise known as MELAA/Other]). These participants were identified from the national Mortality Collection as held by the Ministry of Health.

Variables

Cancer type was identified using the underlying cause of death variable within the Mortality Collection. For brevity, and to ensure that our analysis had an equity focus, our cancer-stratified analyses focused on the nine most-common causes of specified cancer death for Māori[18]: lung, female breast, colorectal, liver, pancreas, stomach, leukemia, non-Hodgkin lymphoma, and prostate cancers. Place of death was determined from the Mortality Collection,[14] and

categorized as one of the following locations: hospice inpatient unit (hospice IPU), public hospital, private residence/home (including individuals receiving hospice care in their home at the time of death), residential care facility (including private care facilities, rest homes, centers, or lodges), or other (ie, location other than one of these facilities/locations, such as roads, rivers, and other locations).

Prioritized ethnicity was derived from the Mortality Collection, with people with cancer categorized as either Māori, Pacific, Asian, European, or MELAA/Other. Māori are the Indigenous peoples of New Zealand, and around 17% of the population identify as Māori. Pacific peoples are those New Zealanders who identify as having Pacific Island ethnicity (eg, Samoan); around 8% of the population identify as Pacific. Asian peoples are those New Zealanders who identify as having Asian ethnicity (eg, Chinese); around 15% of the population identify as Asian. Those New Zealanders who identify as having European ethnicity are the majority population of New Zealand (70%). The 3% of New Zealanders who identify as MELAA/Other stem from a variety of ethnic groups.[19] Age at death was derived from the Mortality Collection by using date of birth and date of death data. Sex was derived from the Mortality Collection, and defined as either male or female; unfortunately the available data would not allow for gender attribution beyond this binary classification. Area deprivation was also derived from the Mortality Collection, and involved mapping domicile code of residence at the time of death to the New Zealand's Deprivation Index (NZDep) deprivation scale, a measure of small-area socioeconomic deprivation.[20] For the purposes of this study, we categorized NZDep (2013 version) into quintiles (1 = least deprived, 5 = most deprived). Missing data prevented the attribution of deprivation for 3,999 participants (4% of cohort).

Statistical Analysis

As well as determining the crude numbers and proportions of deaths by location, we also used direct age-standardization

to determine age-standardized proportions of deaths by location for our ethnicity-stratified results,[21] using the total Māori cancer population between 2007 and 2018 as the standard population. We chose this standard population because (1) the underlying age structure largely reflects that of Māori people with cancer in this study, and (2) using an Indigenous standard population is a best-practice approach when comparing Māori with other ethnic groups, as it normalizes the age structure of the Māori population.[22,23] The use of this Indigenous standard also reflects our desire to focus on outcomes for Māori, who have among the poorest health outcomes in New Zealand across clinical contexts and tend to have the poorest access to socioeconomic resources.[14]

We used crude and adjusted logistic regression models to compare the likelihood of dying in a given location between ethnic groups. In the adjusted models, we included age (continuous variable) and sex (male/female) as classic confounding variables, and also area deprivation (NZDep quintile). Deprivation was included in the adjusted models as a means of adjusting for the substantial differences in socioeconomic deprivation experienced by Māori (and Pacific) peoples relative to Europeans.[14]

Patient consent was not required for this national study of deidentified health records. Ethical approval was sought and received from the University of Otago Human Ethics Committee (reference no. HD18/056).

RESULTS

The crude proportion of deaths, by location of death, among New Zealanders who died of cancer between 2007 and 2018 is shown in Table 1. We found that, when ethnic groups are combined, the most common place of cancer death is within a private residence (crude proportion: 29%), followed by residential care facilities (27%), hospital (24%), hospice IPU (19%), or other location (2%).

The age-standardized proportion of deaths by place of death and ethnicity is shown in Figure 1. These data are also shown in Table 1 in tabulated form, along with crude (ie, not age-standardized) proportions and absolute numbers of deaths. When all cancer deaths were combined together, we observed that the most common place for Māori to die of cancer was in a private residence (age-standardized proportion: 46%), followed by hospital (27%). Similarly, the most common place for Pacific patients to die was in a private residence (39%), followed by hospital (35%). The most common place for Asian patients to die was in hospital (34%), followed by hospice IPU (27%). The most common place for European patients to die was in a private residence (31%), followed by hospice IPU. The most common place for MELAA/Other patients to die was hospice IPU (32%), followed by hospital (30%; Table 1).

Crude and adjusted odds ratios (ORs) comparing the likelihood of dying at a given location between ethnic groups is shown for all cancer deaths in Table 2. Even after

adjusting for potential differences between groups in age, sex, deprivation, and cancer type, Māori patients were substantially less likely than European patients to die in a hospice IPU (adjusted OR 0.48; 95% CI, 0.45 to 0.51) or in a residential care facility (0.56; 95% CI, 0.52 to 0.59), around twice as likely to die in a private residence (2.02; 95% CI, 1.93 to 2.11), and somewhat more likely to die in hospital (1.10; 95% CI, 1.05 to 1.16). A similar trend was observed for Pacific patients. Asian patients were less likely than European patients to die in a private residence (0.79; 95% CI, 0.73 to 0.86) or in residential care (0.76; 95% CI, 0.68 to 0.83), similarly likely to die in a hospice IPU (0.94; 95% CI, 0.86 to 1.03), and substantially more likely to die in hospital (1.68; 95% CI, 1.55 to 1.81). The MELAA/Other population appeared less likely to die in a residential care facility (0.68; 95% CI, 0.52 to 0.91) than European patients, but low absolute numbers of deaths prevented precise results for this group for other locations (Table 2).

The age-standardized proportion of deaths by place of death and ethnicity is shown for the nine most-common causes of cancer death for Māori in Figure 2. These data are also shown in Appendix Table A1 in tabulated form. The same trends observed for the total combined cohort were also broadly observed for all ethnic groups when data were stratified by cancer type, with minor variation: for example, of those Māori patients with lung cancer who died over the study period, 46% died in a private residence, 27% died in hospital, 13% died in hospice IPU, 12% died in a residential care facility, and 2% died in another location.

Crude and adjusted ORs comparing the likelihood of dying at a given location between ethnic groups is shown separately by cancer type in Table 3. Again, similar trends to those observed for the combined cancer cohort were observed when data were stratified by cancer type: for example, Māori patients with lung cancer were half as likely to die in a residential care facility (adjusted OR 0.50; 95% CI, 0.45 to 0.56) or hospice IPU (0.46; 95% CI, 0.41 to 0.52), around twice as likely to die in a private residence (2.17; 95% CI, 2.00 to 2.35), and somewhat more likely to die in hospital (1.10; 95% CI, 1.01 to 1.20).

DISCUSSION

We have described the place of death for New Zealanders dying of cancer over a 12-year period, and also presented patterns by ethnic group. After adjusting for age, sex, and deprivation, Māori patients with cancer are more likely to die in a private residence than European patients, and also somewhat more likely to die in hospital. Commensurately, Māori are less likely to die in either hospice IPU or residential care. Pacific patients generally follow the same pattern as Māori patients. Asian patients are more likely to die in hospital than European patients, similarly likely to die in hospice IPU, and less likely to die in a private residence or in residential care. Data for MELAA/Other patients are difficult to interpret because of low numbers of cancer

TABLE 1. The Number and Proportions of Cancer Deaths in New Zealand (2007-2018), by Place of Death and Ethnicity

Variable	Total Population			Māori			Pacific			Asian			European			MELAA/Other		
	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %
Total cancer deaths	107,373	—	—	11,587	—	—	4,185	—	—	3,206	—	—	87,989	—	—	406	—	—
Location of death																		
Public hospital	25,429	24	—	3,097	27	27	1,414	34	35	1,070	33	34	19,733	22	23	115	28	30
Hospice IPU	20,841	19	—	1,512	13	14	618	15	16	763	24	27	17,833	20	27	115	28	32
Residential care	28,462	27	—	1,440	12	11	420	10	9	558	17	14	25,977	30	18	67	17	11
Other	2,005	2	—	206	2	2	29	1	1	27	1	1	1,735	2	1	8	2	1
Private residence	30,636	29	—	5,332	46	46	1,704	41	39	788	25	25	22,711	26	31	101	25	26

Abbreviations: IPU, inpatient unit; MELAA, Middle Eastern/Latin American/African; Std., standardized.

FIG 1. Stacked bar chart showing the age-standardized breakdown of place of death among New Zealanders who died of cancer, 2007-2018. IPU, inpatient unit; MELAA, Middle Eastern/Latin American/African.
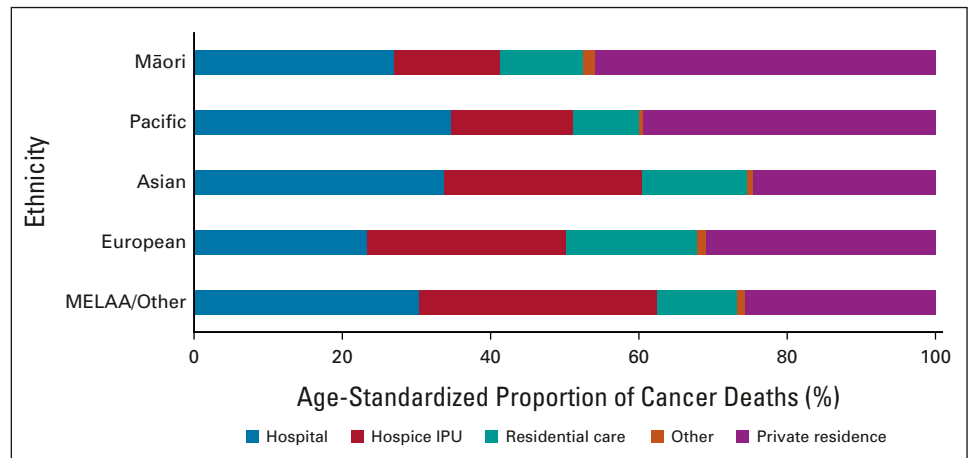
deaths. The above observations were largely repeated across cancer contexts, with some variation in the magnitude of differences, but not in the general pattern.

Our observation that Māori and Pacific were substantially more likely to die in a private residence than European patients is contrary to observations in both the United Kingdom and the United States, where ethnic minorities with cancer are typically less likely to die at home than European/White patients.[1,10,11,13] This trend has also been found outside the cancer context. Our observation that Māori, Pacific, and Asian patients with cancer are more likely to die in hospital compared with European patients is consistent with international evidence.[1,10-12] It should be noted that although we have found some differences and some similarities in results relative to other international contexts, there is striking variability internationally in place of death among patients with cancer or with diseases requiring palliative care.[8,24]

In this study, place of death describes only the broad location where an individual was at the time of their death; it cannot tell us the quality of care they received in the build-up to death, or where they preferred to die. As such, in the context of informing improvements in the provision of supportive care around the time of death, our findings cannot be used to determine whether one location of death is better than another, or whether one ethnic group or another is more or less likely to die in accordance with their preferences.

First, our observation that Māori and Pacific patients with cancer are more likely to die of their cancer in a private residence means that Māori and Pacific whānau and supporters may be providing in-home care for whānau dying of cancer to a greater extent than European patients. It remains unclear whether this additional burden is met by increased assistance to deliver this care, such as might be made available through community provision of palliative care/hospice services (such as home nursing). However, these observations serve as an impetus for ensuring that

there is equity in the provision of home support for these families, and equity in the way palliative care is funded across different settings and different District Health Boards. Further research is required to understand both of these factors.

Second, we observed some variation in place of death of cancer to cancer—but very little variation in differences between ethnicities. In other words, regardless of cancer type, Māori were more likely to die at in a private residence, and less likely to die in hospice IPU or in residential care. This suggests that the drivers of differences in place of death are universal (or pan-cancer) and therefore, likely relate to factors that are patterned according to ethnic group. However, as noted above, we cannot distinguish these unique factors from the available data; they may reflect underlying differences in preference for place of death, or other patient, service, or environmental factors that may drive death location.[10,25] The current absence of high-quality published data on the pathway leading up to death prevents us from further understanding what these factors might be, and whether intervention is needed to achieve equity between ethnic groups—or whether these differences reflect reasonable divergences in preferences between ethnic groups (eg, it remains unclear whether Māori are less likely to die in hospice IPU because these environments are less suitable locations from the perspective of Māori patients). These relationships remain underexplored in the New Zealand setting, and are therefore worthy of future research.

As noted above, we did find some variation in place of death between cancers. In some cases, these might be explained by the typical age of patients: for example, nearly 40% of the patients with prostate cancer (median age at death: 80 years, data not shown) died within residential care, compared with 18% of patients with leukemia (75 years) and 19% of patients with both liver (70 years) and stomach (72 years) cancer. This is consistent with international evidence.[26] Death within public hospital was the highest for blood cancers (leukemia 43% and non-Hodgkin lymphoma 35%), compared with around 20% for all cancers

TABLE 2. Crude and Adj. ORs, Comparing the Likelihood of Dying in a Given Location Between Ethnic Groups

Location of Death	Māori		Pacific		Asian		MELAA/Other		European
	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	
Public hospital	1.26 (1.21 to 1.32)	1.10 (1.05 to 1.16)	1.77 (1.65 to 1.89)	1.49 (1.39 to 1.60)	1.73 (1.61 to 1.87)	1.68 (1.55 to 1.81)	1.37 (1.10 to 1.70)	1.25 (0.99 to 1.57)	Reference
Hospice IPU	0.59 (0.56 to 0.63)	0.48 (0.45 to 0.51)	0.68 (0.63 to 0.74)	0.56 (0.51 to 0.62)	1.23 (1.13 to 1.34)	0.94 (0.86 to 1.03)	1.56 (1.25 to 1.93)	1.17 (0.93 to 1.47)	Reference
Private residence	2.45 (2.36 to 2.55)	2.02 (1.93 to 2.11)	1.98 (1.85 to 2.10)	1.63 (1.53 to 1.75)	0.94 (0.86 to 1.02)	0.79 (0.73 to 0.86)	0.95 (0.76 to 1.19)	0.86 (0.68 to 1.09)	Reference
Other	0.90 (0.78 to 1.04)	1.33 (1.13 to 1.56)	0.35 (0.24 to 0.50)	0.48 (0.33 to 0.72)	0.42 (0.29 to 0.62)	0.53 (0.36 to 0.79)	1.00 (0.50 to 2.02)	1.17 (0.55 to 2.49)	Reference
Residential care	0.34 (0.32 to 0.36)	0.56 (0.52 to 0.59)	0.27 (0.24 to 0.30)	0.43 (0.38 to 0.47)	0.50 (0.46 to 0.55)	0.76 (0.68 to 0.83)	0.47 (0.36 to 0.61)	0.69 (0.52 to 0.91)	Reference

NOTE. Adj. ORs are adjusted for age, sex, deprivation, and cancer type.

Abbreviations: Adj. OR, adjusted odds ratio; IPU, inpatient unit; MELAA, Middle Eastern/Latin American/African; OR, odds ratio.
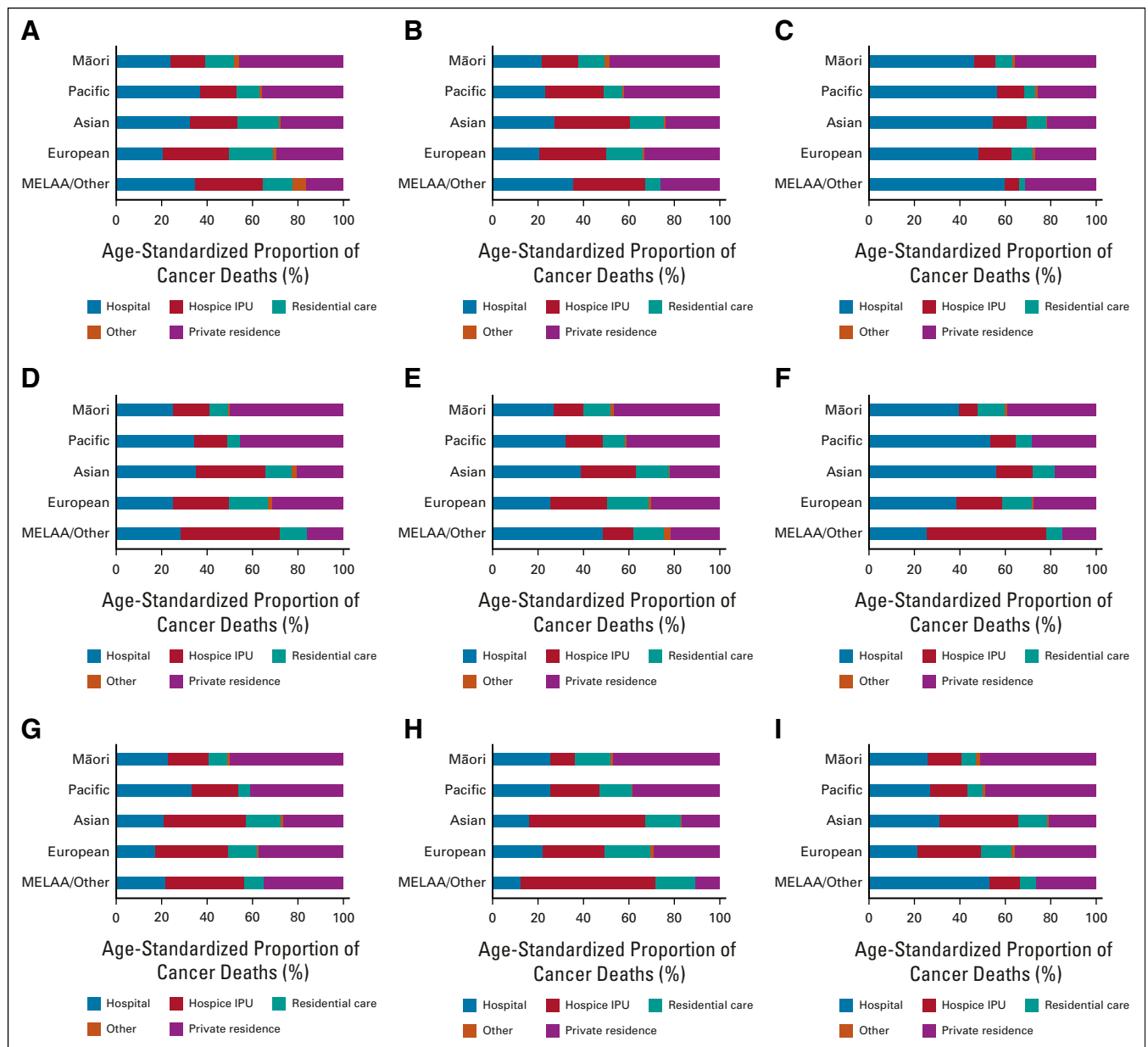
FIG 2. Stacked bar chart showing the age-standardized breakdown of place of death among those who died of cancer, stratified by type of cancer: (A) breast cancer, (B) colorectal cancer, (C) leukemia, (D) liver cancer, (E) lung cancer, (F) non-Hodgkin lymphoma, (G) pancreatic cancer, (H) prostate cancer, and (I) stomach cancer. MELAA, Middle Eastern/Latin American/African.

except lung (25%). This is in keeping with other international contexts, wherein most blood cancer deaths occur in hospital.[27-29] Plausible reasons for this include the time from diagnosis to death, the acute nature of the illness, and the difficulty/complexity in safely treating and caring for some patients with blood cancer outside of hospital environments.[27] These findings emphasize that there is some patterning to where patients with certain cancers are likely to die, with this patterning driven by the unique characteristics of these cancers.

A strength of this study is that we have used national-level data to describe place of death for all registered cancer deaths in New Zealand over more than a decade, which enhances the generalizability of our findings. In terms of limitations, this study relies on the accuracy of clinical coding, including cause of death coding. We note that in some instances private residence can be conflated with home, when in fact the private residence of death may not be the home of the patients (eg, it may be the home of a relative). We also note that deaths in nonhospice residential care facilities include a wide range of facility types, including private hospitals, lodges, and aged care facilities—making it difficult to interpret differences between ethnic groups for this category. Because of the use of

TABLE 3. Crude and Adj. ORs, Comparing the Likelihood of Dying in a Given Location Between Ethnic Groups, Separately for the Nine Most-Common Causes of Cancer Death for Māori

	Māori		Pacific		Asian		MELAA/Other		
Cancer	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	Crude OR (95% CI)	Adj. OR (95% CI)	European
Breast									
Location of death									
Public hospital	1.31 (1.12 to 1.55)	1.12 (0.94 to 1.34)	2.48 (2.01 to 3.06)	2.14 (1.71 to 2.69)	2.15 (1.66 to 2.79)	1.91 (1.46 to 2.50)	2.18 (1.17 to 4.08)	1.92 (0.98 to 3.74)	Reference
Hospice IPU	0.59 (0.49 to 0.71)	0.50 (0.41 to 0.62)	0.64 (0.49 to 0.84)	0.56 (0.42 to 0.75)	0.86 (0.64 to 1.16)	0.59 (0.43 to 0.80)	1.35 (0.71 to 2.59)	0.90 (0.44 to 1.86)	Reference
Residential care	0.35 (0.29 to 0.43)	0.56 (0.45 to 0.70)	0.29 (0.21 to 0.39)	0.42 (0.29 to 0.60)	0.48 (0.34 to 0.66)	0.95 (0.67 to 1.36)	0.38 (0.16 to 0.91)	0.66 (0.26 to 1.66)	Reference
Other	1.00 (0.63 to 1.59)	1.52 (0.91 to 2.53)	—	—	—	—	—	—	Reference
Private residence	2.43 (2.11 to 2.80)	2.05 (1.75 to 2.39)	1.54 (1.25 to 1.90)	1.26 (1.00 to 1.58)	1.12 (0.86 to 1.47)	0.93 (0.71 to 1.23)	0.55 (0.24 to 1.22)	0.53 (0.23 to 1.21)	Reference
Colorectal									
Location of death									
Public hospital	1.01 (0.85 to 1.20)	0.96 (0.80 to 1.15)	1.13 (0.88 to 1.46)	1.06 (0.81 to 1.38)	1.37 (1.08 to 1.75)	1.45 (1.13 to 1.86)	1.73 (0.92 to 3.28)	1.80 (0.93 to 3.50)	Reference
Hospice IPU	0.62 (0.50 to 0.76)	0.46 (0.37 to 0.57)	1.10 (0.85 to 1.42)	0.85 (0.64 to 1.12)	1.52 (1.19 to 1.93)	1.14 (0.88 to 1.47)	1.86 (0.98 to 3.52)	1.29 (0.64 to 2.60)	Reference
Residential care	0.39 (0.32 to 0.47)	0.66 (0.53 to 0.82)	0.28 (0.20 to 0.40)	0.48 (0.33 to 0.70)	0.56 (0.43 to 0.74)	0.79 (0.59 to 1.07)	0.25 (0.09 to 0.70)	—	Reference
Other	1.44 (0.94 to 2.22)	2.40 (1.52 to 3.79)	0.75 (0.31 to 1.84)	1.03 (0.38 to 2.82)	—	—	—	—	Reference
Private residence	2.53 (2.20 to 2.92)	2.00 (1.72 to 2.33)	2.01 (1.61 to 2.50)	1.50 (1.18 to 1.89)	0.89 (0.70 to 1.15)	0.76 (0.59 to 0.99)	0.95 (0.48 to 1.89)	0.72 (0.35 to 1.49)	Reference
Leukemia									
Location of death									
Public hospital	1.28 (1.03 to 1.59)	0.96 (0.75 to 1.22)	1.73 (1.27 to 2.37)	1.24 (0.89 to 1.74)	1.71 (1.20 to 2.44)	1.47 (1.01 to 2.14)	1.12 (0.42 to 3.01)	0.81 (0.29 to 2.27)	Reference
Hospice IPU	0.63 (0.44 to 0.92)	0.67 (0.45 to 0.99)	0.72 (0.44 to 1.18)	0.82 (0.48 to 1.37)	1.00 (0.60 to 1.66)	0.97 (0.57 to 1.62)	0.40 (0.05 to 3.06)	—	Reference
Residential care	0.33 (0.22 to 0.49)	0.77 (0.50 to 1.2)	0.27 (0.15 to 0.50)	0.60 (0.30 to 1.19)	0.44 (0.25 to 0.79)	1.04 (0.55 to 1.94)	0.26 (0.03 to 1.97)	—	Reference
Other	—	—	—	—	—	—	—	—	Reference
Private residence	1.83 (1.45 to 2.31)	1.48 (1.15 to 1.92)	1.28 (0.91 to 1.82)	1.05 (0.72 to 1.53)	0.89 (0.57 to 1.38)	0.62 (0.38 to 1.00)	2.69 (1.00 to 7.25)	2.14 (0.78 to 5.86)	Reference
Liver									
Location of death									
Public hospital	1.17 (0.94 to 1.46)	1.01 (0.79 to 1.29)	1.89 (1.43 to 2.50)	1.62 (1.18 to 2.21)	1.67 (1.22 to 2.28)	1.62 (1.17 to 2.24)	1.45 (0.51 to 4.15)	1.54 (0.52 to 4.58)	Reference
Hospice IPU	0.69 (0.53 to 0.89)	0.65 (0.49 to 0.86)	0.54 (0.37 to 0.79)	0.57 (0.38 to 0.86)	1.37 (0.99 to 1.90)	1.15 (0.81 to 1.62)	2.48 (0.94 to 6.55)	1.44 (0.48 to 4.31)	Reference
Residential care	0.29 (0.21 to 0.40)	0.48 (0.34 to 0.67)	0.20 (0.12 to 0.34)	0.31 (0.18 to 0.53)	0.59 (0.40 to 0.87)	0.82 (0.55 to 1.23)	0.41 (0.09 to 1.79)	—	Reference
Other	0.47 (0.18 to 1.19)	0.59 (0.21 to 1.62)	—	—	—	—	—	—	Reference
Private residence	2.34 (1.92 to 2.84)	2.00 (1.61 to 2.49)	2.02 (1.55 to 2.63)	1.68 (1.25 to 2.25)	0.69 (0.49 to 0.97)	0.67 (0.47 to 0.96)	0.52 (0.15 to 1.82)	—	Reference
Lung									
Location of death									
Public hospital	1.19 (1.10 to 1.29)	1.10 (1.01 to 1.20)	1.53 (1.32 to 1.78)	1.37 (1.17 to 1.60)	2.01 (1.71 to 2.36)	1.98 (1.68 to 2.34)	2.14 (1.21 to 3.77)	1.98 (1.07 to 3.64)	Reference
Hospice IPU	0.53 (0.47 to 0.59)	0.46 (0.41 to 0.52)	0.62 (0.50 to 0.76)	0.57 (0.46 to 0.71)	1.08 (0.89 to 1.31)	0.89 (0.73 to 1.09)	0.80 (0.37 to 1.7)	0.64 (0.28 to 1.46)	Reference
Residential care	0.35 (0.32 to 0.39)	0.50 (0.45 to 0.56)	0.29 (0.23 to 0.37)	0.39 (0.31 to 0.49)	0.58 (0.48 to 0.71)	0.68 (0.55 to 0.84)	0.49 (0.23 to 1.04)	0.65 (0.29 to 1.45)	Reference
Other	1.02 (0.79 to 1.33)	1.32 (0.99 to 1.78)	0.45 (0.21 to 0.96)	0.57 (0.27 to 1.23)	—	—	—	—	Reference
Private residence	2.47 (2.30 to 2.66)	2.17 (2.00 to 2.35)	2.10 (1.83 to 2.42)	1.86 (1.61 to 2.16)	0.76 (0.63 to 0.91)	0.72 (0.59 to 0.88)	0.68 (0.34 to 1.36)	0.68 (0.33 to 1.42)	Reference

(Continued on following page)

TABLE 3. Crude and Adj. ORs, Comparing the Likelihood of Dying in a Given Location Between Ethnic Groups, Separately for the Nine Most-Common Causes of Cancer Death for Māori (Continued)

	Māori		Pacific		Asian		MELAA/Other		
Cancer	**Crude OR (95% CI)**	**Adj. OR (95% CI)**	**Crude OR (95% CI)**	**Adj. OR (95% CI)**	**Crude OR (95% CI)**	**Adj. OR (95% CI)**	**Crude OR (95% CI)**	**Adj. OR (95% CI)**	**European**
Non-Hodgkin lymphoma									
Location of death									
Public hospital	1.23 (0.95 to 1.60)	1.02 (0.77 to 1.34)	1.96 (1.37 to 2.81)	1.46 (0.98 to 2.16)	2.16 (1.50 to 3.11)	2.07 (1.42 to 3.01)	0.82 (0.29 to 2.33)	0.83 (0.28 to 2.41)	Reference
Hospice IPU	0.41 (0.26 to 0.65)	0.40 (0.25 to 0.66)	0.57 (0.32 to 1.03)	0.58 (0.31 to 1.08)	0.79 (0.47 to 1.34)	0.72 (0.42 to 1.23)	3.43 (1.30 to 9.06)	3.15 (1.16 to 8.56)	Reference
Residential care	0.48 (0.34 to 0.69)	0.75 (0.51 to 1.11)	0.25 (0.13 to 0.49)	0.34 (0.17 to 0.70)	0.44 (0.26 to 0.74)	0.52 (0.29 to 0.92)	0.39 (0.09 to 1.69)	—	Reference
Other	1.03 (0.41 to 2.60)	1.50 (0.57 to 3.95)	—	—	—	—	—	—	Reference
Private residence	2.16 (1.66 to 2.82)	1.83 (1.37 to 2.43)	1.66 (1.12 to 2.44)	1.48 (0.97 to 2.25)	0.93 (0.60 to 1.46)	0.86 (0.54 to 1.36)	0.77 (0.22 to 2.70)	—	Reference
Pancreas									
Location of death									
Public hospital	1.46 (1.19 to 1.81)	1.37 (1.09 to 1.71)	2.11 (1.52 to 2.93)	1.91 (1.35 to 2.71)	1.50 (1.06 to 2.11)	1.53 (1.08 to 2.17)	1.33 (0.57 to 3.07)	1.39 (0.60 to 3.24)	Reference
Hospice IPU	0.54 (0.43 to 0.68)	0.44 (0.34 to 0.56)	0.60 (0.41 to 0.89)	0.50 (0.33 to 0.76)	1.31 (0.96 to 1.78)	1.05 (0.76 to 1.46)	1.26 (0.60 to 2.65)	1.10 (0.51 to 2.37)	Reference
Residential care	0.35 (0.26 to 0.46)	0.49 (0.36 to 0.66)	0.23 (0.13 to 0.42)	0.30 (0.16 to 0.55)	0.62 (0.42 to 0.91)	0.85 (0.56 to 1.30)	0.58 (0.22 to 1.50)	0.77 (0.28 to 2.12)	Reference
Other	1.16 (0.58 to 2.35)	1.96 (0.93 to 4.16)	—	—	—	—	—	—	Reference
Private residence	2.10 (1.76 to 2.50)	1.92 (1.59 to 2.33)	1.78 (1.32 to 2.4)	1.68 (1.23 to 2.31)	0.79 (0.57 to 1.09)	0.75 (0.54 to 1.04)	1.04 (0.50 to 2.15)	0.86 (0.40 to 1.82)	Reference
Prostate									
Location of death									
Public hospital	1.20 (0.97 to 1.49)	1.13 (0.90 to 1.41)	1.63 (1.20 to 2.21)	1.49 (1.08 to 2.04)	1.56 (1.02 to 2.38)	1.64 (1.07 to 2.52)	0.92 (0.31 to 2.73)	—	Reference
Hospice IPU	0.51 (0.37 to 0.70)	0.40 (0.29 to 0.55)	0.74 (0.49 to 1.13)	0.66 (0.43 to 1.01)	1.05 (0.63 to 1.74)	0.87 (0.51 to 1.49)	2.01 (0.78 to 5.14)	2.38 (0.86 to 6.6)	Reference
Residential care	0.42 (0.33 to 0.52)	0.57 (0.45 to 0.72)	0.39 (0.28 to 0.55)	0.55 (0.39 to 0.77)	0.60 (0.40 to 0.91)	0.68 (0.44 to 1.06)	1.22 (0.53 to 2.84)	1.40 (0.54 to 3.64)	Reference
Other	0.81 (0.43 to 1.55)	1.04 (0.54 to 2.03)	—	—	—	—	—	—	Reference
Private residence	2.90 (2.41 to 3.49)	2.30 (1.89 to 2.80)	2.19 (1.65 to 2.90)	1.72 (1.27 to 2.31)	1.28 (0.83 to 1.96)	1.14 (0.74 to 1.78)	0.36 (0.08 to 1.53)	—	Reference
Stomach									
Location of death									
Public hospital	1.36 (1.10 to 1.68)	1.12 (0.89 to 1.42)	1.33 (0.99 to 1.79)	0.99 (0.72 to 1.38)	1.64 (1.19 to 2.26)	1.55 (1.11 to 2.17)	2.64 (1.07 to 6.49)	2.64 (1.07 to 6.55)	Reference
Hospice IPU	0.55 (0.42 to 0.70)	0.43 (0.33 to 0.58)	0.61 (0.43 to 0.86)	0.54 (0.37 to 0.79)	1.58 (1.15 to 2.16)	1.25 (0.90 to 1.74)	0.38 (0.09 to 1.62)	—	Reference
Residential care	0.26 (0.19 to 0.36)	0.46 (0.32 to 0.65)	0.27 (0.17 to 0.43)	0.47 (0.29 to 0.76)	0.59 (0.40 to 0.87)	0.96 (0.63 to 1.47)	0.57 (0.17 to 1.95)	—	Reference
Other	1.26 (0.66 to 2.44)	1.58 (0.75 to 3.36)	—	—	—	—	—	—	Reference
Private residence	2.25 (1.87 to 2.70)	2.10 (1.71 to 2.58)	2.22 (1.72 to 2.87)	2.14 (1.62 to 2.83)	0.62 (0.44 to 0.88)	0.57 (0.40 to 0.81)	1.16 (0.46 to 2.92)	1.14 (0.45 to 2.88)	Reference

NOTE. Adj. ORs are adjusted for age, sex, and deprivation. ORs not shown where the number of deaths over the follow-up period was < 5.

Abbreviations: Adj. OR, adjusted odds ratio; IPU, inpatient unit; MELAA, Middle Eastern/Latin American/African; OR, odds ratio.

prioritized ethnicity within this study (wherein ethnicity was prioritized in order of Māori, Pacific, Asian, MELAA/Other, and European[30]), there may be some undercounting of ethnic groups (eg, a Māori individual who also identifies as Pacific will only be counted in the Māori group). We have not considered the potential ramifications of this study's findings on costs of care provision, and this may be an area of future research. Finally, we have highlighted the caveats associated with interpretation of the place of death variable above.

It is highly unlikely that any of these limitations could meaningfully affect the key findings of this study, nor the potential ramifications and recommendations that are based on them.

In conclusion, in this national study of ethnic differences in cancer deaths across more than a decade, we found that Māori and Pacific patients are substantially more likely to die in a private residence or in hospital, and less likely to die in hospice IPU or residential care facilities, than European patients. It remains unclear whether these differences reflect reasonable divergences in preferences for place of death between ethnic groups, or whether they reflect differences in access to appropriate supportive care. The findings of our study elucidate three key areas of future research in the context of ethnic differences in place of death among patients with cancer in New Zealand. First, there is a need to understand whether the high proportion of Māori and Pacific home deaths hides a failure to achieve success with appropriate supports (and therefore inequity) compared with European patients, or a success story that enables more to die at home. Second, there is a need to examine place of care and transitions between places of care in the three months up to death, with a view to understanding potential ethnic differences in access to palliative or supportive care during this time. Finally, given the caveats around examining place of death data without data on preferred place of death and access to supportive/palliative care before death, there is a need to consider how place of death from routine data could be developed to serve as a useful indicator of quality care or inequity, or whether other indicators (such as bereavement surveys) are more useful in this regard.

AFFILIATIONS
[1]Department of Public Health, University of Otago, Wellington, New Zealand
[2]Waitemata District Health Board, Auckland, New Zealand
[3]Capital and Coast District Health Board, Wellington, New Zealand
[4]Te Aho o Te Kahu—Cancer Control Agency, Wellington, New Zealand

CORRESPONDING AUTHOR
Jason Kevin Gurney, PhD, Cancer and Chronic Conditions Research Group, Department of Public Health, University of Otago, PO Box 7343, Wellington 6037, New Zealand; e-mail: jason.gurney@otago.ac.nz.

AUTHOR CONTRIBUTIONS
Conception and design: Jason Kevin Gurney, James Stanley, Jonathan Koea
Collection and assembly of data: Jason Kevin Gurney
Data analysis and interpretation: All authors
Manuscript writing: All authors
Final approval of manuscript: All authors
Accountable for all aspects of the work: All authors

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST
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Open Payments is a public database containing information reported by companies about payments made to US-licensed physicians (Open Payments).

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REFERENCES

1. Fereidouni A, Rassouli M, Salesi M, et al: Preferred place of death in adult cancer patients: A systematic review and meta-analysis. Front Psychol 12:704590, 2021

2. Gomes B, Calanzani N, Gysels M, et al: Heterogeneity and changes in preferences for dying at home: A systematic review. BMC Palliat Care 12:7, 2013

3. Wachterman MW, Luth EA, Semco RS, et al: Where Americans die—Is there really "no place like home?" N Engl J Med 386:1008-1010, 2022

4. Blanchard CL, Ayeni O, O'Neil DS, et al: A prospective cohort study of factors associated with place of death among patients with late-stage cancer in Southern Africa. J Pain Symptom Manage 57:923-932, 2019

5. Beccaro M, Costantini M, Giorgi Rossi P, et al: Actual and preferred place of death of cancer patients. Results from the Italian survey of the dying of cancer (ISDOC). J Epidemiol Community Health 60:412-416, 2006

6. Sheridan R, Roman E, Smith AG, et al: Preferred and actual place of death in haematological malignancies: A report from the UK haematological malignancy research network. BMJ Support Palliat Care 11:7-16, 2021

7. Henson LA, Edmonds P, Johnston A, et al: Population-based quality indicators for end-of-life cancer care: A systematic review. JAMA Oncol 6:142-150, 2020

8. Cohen J, Pivodic L, Miccinesi G, et al: International study of the place of death of people with cancer: A population-level comparison of 14 countries across 4 continents using death certificate data. Br J Cancer 113:1397-1404, 2015

9. Chino F, Kamal AH, Leblanc TW, et al: Place of death for patients with cancer in the United States, 1999 through 2015: Racial, age, and geographic disparities. Cancer 124:4408-4419, 2018

10. Koffman J, Ho YK, Davies J, et al: Does ethnicity affect where people with cancer die? A population-based 10 year study. PLoS One 9:e95052, 2014

11. Coupland VH, Madden P, Jack RH, et al: Does place of death from cancer vary between ethnic groups in South East England? Palliat Med 25:314-322, 2011

12. Cross SH, Ely EW, Kavalieratos D, et al: Place of death for individuals with chronic lung disease: Trends and associated factors from 2003 to 2017 in the United States. Chest 158:670-680, 2020

13. Stephens SJ, Chino F, Williamson H, et al: Evaluating for disparities in place of death for head and neck cancer patients in the United States utilizing the CDC WONDER database. Oral Oncol 102:104555, 2020

14. Ministry of Health: Wai 2575 Māori Health Trends Report. Wellington, New Zealand, Ministry of Health, 2019

15. Te Aho O Te Kahu—Cancer Control Agency: He Pūrongo Mate Pukupuku o Aotearoa 2020, The State of Cancer in New Zealand 2020. Wellington, New Zealand, Te Aho o Te Kahu—Cancer Control Agency, 2021

16. Robson B, Purdie G, Cormack D: Unequal Impact II: Māori and Non-Māori Cancer Statistics by Deprivation and Rural-Urban Status, 2002-2006. Wellington, New Zealand, Ministry of Health, 2010

17. Palliative Care Council of New Zealand: National Health Needs Assessment for Palliative Care Phase 1 Report: Assessment of Palliative Care Need. Wellington, New Zealand, Palliative Care Council of New Zealand, 2011

18. Gurney J, Robson B, Koea J, et al: The most commonly diagnosed and most common causes of cancer death for Maori New Zealanders. N Z Med J 133:77-96, 2020

19. Statistics New Zealand: Ethnic Group Summaries. Wellington, New Zealand, Statistics New Zealand, 2020

20. Salmond C, Crampton P: Development of New Zealand's Deprivation Index (NZDep) and its uptake as a national policy tool. Can J Public Health 103:S7-S11, 2012

21. Ministry of Health: Standardising Rates of Disease. Wellington, New Zealand, Ministry of Health, 1998

22. Robson B, Purdie G, Cram F, et al: Age standardisation—An idigenous standard? Emerging Themes Epidemiol 4:1-11, 2007

23. Ministry of Health: Position Paper on Māori Health Analytics—Age Standardisation. Wellington, New Zealand, Ministry of Health, 2018

24. Pivodic L, Pardon K, Morin L, et al: Place of death in the population dying from diseases indicative of palliative care need: A cross-national population-level study in 14 countries. J Epidemiol Community Health 70:17-24, 2016

25. Gomes B, Higginson IJ: Factors influencing death at home in terminally ill patients with cancer: Systematic review. BMJ 332:515-521, 2006

26. Sedhom R, Kuo PL, Gupta A, et al: Changes in the place of death for older adults with cancer: Reason to celebrate or a risk for unintended disparities? J Geriatr Oncol 12:361-367, 2021

27. Howell DA, Wang H-I, Smith AG, et al: Place of death in haematological malignancy: Variations by disease sub-type and time from diagnosis to death. BMC Palliat Care 12:42, 2013

28. Chino F, Kamal AH, Chino J, et al: Disparities in place of death for patients with hematological malignancies, 1999 to 2015. Blood Adv 3:333-338, 2019

29. Gao W, Ho YK, Verne J, et al: Changing patterns in place of cancer death in England: A population-based study. PLOS Med 10:e1001410, 2013

30. Health Information Standards Organisation: HISO 10001:2017 Ethnicity Data Protocols. Wellington, New Zealand, Ministry of Health, 2017

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APPENDIX

TABLE A1. Crude and Adjusted Proportions of Cancer Deaths, by Place of Death and Ethnicity, for the Nine Most Common Causes of Cancer Death for Māori

	Total Population		Māori			Pacific			Asian			European			MELAA/Other		
Cancer	Deaths (No.)	Crude %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %
Breast																	
Location of death																	
Public hospital	1,661	21	221	24	24	152	37	37	93	34	33	1,180	19	20	15	34	35
Hospice IPU	1,738	22	144	15	15	68	17	16	58	21	21	1,455	24	29	13	30	30
Residential Care	2,004	26	118	13	13	43	10	10	45	16	18	1,792	29	19	6	14	13
Other	169	2	21	2	2	—	—	—	—	—	—	139	2	2	—	—	—
Private residence	2,239	29	426	46	46	143	35	36	77	28	28	1,586	26	29	7	16	16
Colorectal																	
Location of death																	
Public hospital	3,250	22	181	22	22	81	24	23	93	28	27	2,881	22	21	14	33	35
Hospice IPU	3,023	20	114	14	16	75	22	26	95	28	33	2,725	21	30	14	33	32
Residential care	4,061	28	113	14	12	35	10	8	63	19	15	3,846	29	16	—	—	—
Other	289	2	23	3	2	5	1	1	—	—	—	258	2	1	—	—	—
Private residence	4,134	28	394	48	48	142	42	42	82	24	24	3,505	27	33	11	26	26
Leukemia																	
Location of death																	
Public hospital	1,627	43	169	47	46	93	55	57	69	54	54	1,289	41	48	7	44	60
Hospice IPU	516	14	34	9	10	18	11	12	18	14	15	445	14	15	—	—	—
Residential care	695	18	28	8	7	11	6	5	13	10	9	642	20	9	—	—	—
Other	67	2	—	—	—	—	—	—	—	—	—	60	2	1	—	—	—
Private residence	907	24	124	35	36	46	27	26	26	20	21	704	22	27	7	44	31
Liver																	
Location of death																	
Public hospital	718	25	136	25	25	90	35	34	66	32	35	421	22	25	5	29	28
Hospice IPU	602	21	88	16	16	34	13	14	57	28	31	416	22	25	7	41	44
Residential care	563	19	47	9	8	16	6	6	33	16	12	465	25	17	—	—	—
Other	45	2	5	1	1	—	—	—	—	—	—	37	2	2	—	—	—
Private residence	979	34	265	49	50	116	45	45	45	22	20	550	29	31	—	—	—
Lung																	
Location of death																	
Public hospital	5,107	25	1,045	27	27	273	32	32	257	39	39	3,512	24	25	20	40	49
Hospice IPU	3,541	18	433	11	13	109	13	17	137	21	24	2,854	19	25	8	16	13
Residential care	4,845	24	470	12	12	87	10	10	124	19	14	4,156	28	18	8	16	14
Other	356	2	72	2	2	7	1	1	—	—	—	269	2	1	—	—	—
Private residence	6,334	31	1,839	48	46	368	44	41	145	22	22	3,972	27	30	10	20	21
Non-Hodgkin lymphoma																	
Location of death																	
Public hospital	1,262	35	100	39	40	62	50	54	64	52	56	1,031	34	38	5	29	25
Hospice IPU	574	16	20	8	8	13	10	11	17	14	16	517	17	20	7	41	53
Residential care	850	24	37	14	12	10	8	7	16	13	9	785	26	13	—	—	—

(Continued on following page)

TABLE A1. Crude and Adjusted Proportions of Cancer Deaths, by Place of Death and Ethnicity, for the Nine Most Common Causes of Cancer Death for Māori (Continued)

	Total Population		Māori			Pacific			Asian			European			MELAA/Other		
Cancer	Deaths (No.)	Crude %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %	Deaths (No.)	Crude %	Age Std. %
Other	62	2	5	2	1	—	—	—	—	—	—	57	2	1	—	—	—
Private residence	826	23	97	37	39	39	31	28	25	20	18	662	22	27	—	—	—
Pancreas																	
Location of death																	
Public hospital	1,015	18	130	23	23	54	30	34	45	23	21	779	17	17	7	21	22
Hospice IPU	1,376	25	89	16	18	31	17	20	60	31	36	1,186	26	32	10	30	35
Residential care	1,195	21	55	10	8	12	7	5	31	16	15	1,092	24	13	5	15	9
Other	76	1	9	2	1	—	—	—	—	—	—	63	1	1	—	—	—
Private residence	1,931	35	285	50	50	83	46	41	53	27	26	1,499	32	37	11	33	35
Prostate																	
Location of death																	
Public hospital	1,501	20	113	22	25	60	28	25	30	27	16	1,294	19	22	—	—	—
Hospice IPU	1,144	15	44	9	11	26	12	22	18	16	51	1,050	16	27	6	27	59
Residential care	2,901	39	111	22	16	45	21	14	32	29	16	2,703	41	20	10	45	18
Other	174	2	10	2	1	—	—	—	—	—	—	162	2	2	—	—	—
Private residence	1,800	24	226	45	47	81	38	38	29	26	17	1,462	22	29	—	—	—
Stomach																	
Location of death																	
Public hospital	748	22	151	26	26	68	25	27	59	29	31	462	20	21	8	40	53
Hospice IPU	712	21	82	14	15	41	15	16	64	32	35	523	23	28	—	—	—
Residential care	641	19	44	7	7	21	8	7	31	15	13	542	24	13	—	—	—
Other	54	2	12	2	2	—	—	—	—	—	—	37	2	1	—	—	—
Private residence	1,215	36	301	51	51	137	51	49	45	22	21	725	32	36	7	35	26

NOTE. Data not shown where the number of deaths over the follow-up period was < 5.

Abbreviations: IPU, inpatient unit; MELAA, Middle Eastern/Latin American/African; Std., standardized.