ORIGINAL ARTICLE

The burden of stomach cancer in indigenous populations: a systematic review and global assessment

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ABSTRACT

Objective Stomach cancer is a leading cause of cancer death, especially in developing countries. Incidence has been associated with poverty and is also reported to disproportionately affect indigenous peoples, many of whom live in poor socioeconomic circumstances and experience lower standards of health. In this comprehensive assessment, we explore the burden of stomach cancer among indigenous peoples globally.

Design The literature was searched systematically for studies on stomach cancer incidence, mortality and survival in indigenous populations, including Indigenous Australians, Maori in New Zealand, indigenous peoples from the circumpolar region, native Americans and Alaska natives in the USA, and the Mapuche peoples in Chile. Data from the New Zealand Health Information Service and the Surveillance Epidemiology and End Results (SEER) Program were used to estimate trends in incidence.

Results Elevated rates of stomach cancer incidence and mortality were found in almost all indigenous peoples relative to corresponding non-indigenous populations in the same regions or countries. This was particularly evident among Inuit residing in the circumpolar region (standardised incidence ratios (SIR) males: 3.9, females: 3.6) and in Maori (SIR males: 2.2, females: 3.2). Increasing trends in incidence were found for some groups.

Conclusions We found a higher burden of stomach cancer in indigenous populations globally, and rising incidence in some indigenous groups, in stark contrast to the decreasing global trends. This is of major public health concern requiring close surveillance and further research of potential risk factors. Given evidence that improving nutrition and housing sanitation, and *Helicobacter pylori* eradication programmes could reduce stomach cancer rates, policies which address these initiatives could reduce inequalities in stomach cancer burden for indigenous peoples.

Significance of this study

What is already known on this subject?

- Stomach cancer is the second leading cause of cancer death worldwide and wide geographical and ethnic variations exist in its occurrence.
- Indigenous peoples carry a disproportionate burden of stomach cancer; however the extent of inequalities has not yet been quantified from a global perspective.
- Indigenous peoples often live in poor socioeconomic circumstances which has implications for their health and well-being, including a reduced access to healthcare, which may increase their risk for certain cancers.

What are the new findings?

- Stomach cancer risk in indigenous populations substantively exceeds that of their non-indigenous counterparts in a number of countries with incidence and mortality up to fivefold that of non-indigenous populations.
- By contrast with the well-established declining trends seen in most countries and regions of the world, stomach cancer incidence appears to be increasing in several indigenous groups.

How might it impact on clinical practice in the foreseeable future?

- Due to their socioeconomic circumstances and dietary habits, indigenous peoples are often at higher risk for dyspeptic disorders, in particular, stomach cancer. Increasing awareness among clinicians may help to gain control of this global public health problem.
- Future prevention and public health measures must support government policies that focus on the improvement of social conditions, for example, housing and reducing overcrowding, and need to be tailored to specific indigenous groups.
- Further research is required, including randomised trials, to assess the benefit of *Helicobacter pylori* eradication on stomach cancer risk in indigenous populations. In the interim, tailored guidelines for eradication in high-risk groups, especially in children, should be developed.

INTRODUCTION

Globally, stomach cancer incidence has declined over the past 4–5 decades, but still remains a major public health problem.[1] Stomach cancer is the second leading cause of cancer death worldwide, with large geographical differences in incidence and mortality in different regions and countries.[2] In 2008, about three-quarters of cases and deaths from stomach cancer occurred in low- and middle-income

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and middle-income countries (LMIC). Rates are also elevated in Eastern Europe including Russia, as well as certain parts of Latin America and East Asia.[3]

Approximately 90% of stomach cancers are adenocarcinomas which are further divided histologically into two categories: intestinal and diffuse.[4] Both types are strongly associated with *Helicobacter pylori* infection,[5] the former more common in older patients and males and linked to dietary factors, smoking and obesity.[1 6 7] The decrease in incidence over the past 40 years has occurred primarily for the intestinal type, while incidence of diffuse-type gastric cancer has remained relatively unchanged, although time trend studies in the USA report increasing rates.[8] Furthermore, risk factors for cancers arising in the cardia (proximal) and the non-cardia (distal) parts of the stomach differ. Whereas cardia stomach cancers, alongside adenocarcinomas of the oesophagus,[9] have been associated with obesity and gastro-oesophageal reflux as main risk factors, non-cardia tumours are more common in less developed countries and positively associated with lower socioeconomic status and *H pylori* infection.[10]

While public health measures, including improved sanitation, and a greater availability of fresh food have likely contributed to the steady decline of stomach cancer incidence,[11] the resulting benefits have not necessarily been transferred equitably to all people. Poverty-associated risk factors, such as housing density and overcrowding, remain major contributors to the disproportionate burden of stomach cancer seen in the most deprived population groups.[12] A particularly high stomach cancer burden has previously been reported among some indigenous populations[i] [13 14] who are also typically over-represented in the lowest socioeconomic groupings in their respective countries.[15 16] Although the political, social and cultural circumstances of indigenous populations are diverse and unique, historical disadvantage has continued through the process of colonisation contributing to strikingly similar patterns of poor current-day health status in many indigenous groups.[17] Compared to their non-indigenous counterparts, indigenous peoples not only experience an increased burden of lifestyle diseases, such as obesity, type 2 diabetes, cardiovascular disease and mental disorders, but also retain a high prevalence of infectious diseases.[15] Additionally, higher rates of these comorbid conditions, together with decreased access to treatment, have important implications for cancer outcomes, including reduced survival prospects and elevated mortality rates.[15]

The extent to which global inequalities of stomach cancer among indigenous peoples exist has not been systematically explored. As there is considerable heterogeneity among indigenous peoples worldwide, each group needs individual study in the context of their political and social histories, environmental factors and other health determinants in order to derive tailored public health measures. The aim of this review is to assess available evidence on the stomach cancer burden in indigenous peoples worldwide, identifying populations at increased risk of developing and dying from this cancer and highlighting trends that deserve closer attention by public health and cancer prevention specialists.

METHODS

We systematically searched the literature up to May 2013 using PubMed and regional databases (see online supplementary appendix 1). The search terms and strategy, following the PRISMA guidelines, can be found in online supplementary appendix 1. Briefly, separate searches were carried out using a predefined set of population terms, complemented with geographical restrictions and epidemiological terms, with a focus on stomach cancer. Studies were included if age-standardised rates or rate ratios (incidence and/or mortality) or survival proportions in indigenous peoples (relative to non-indigenous) were reported. First, titles and abstracts were reviewed in order to identify potentially relevant studies. Subsequently, a manual search was carried out based on the references cited in the relevant papers. Case reports, reviews and editorials were excluded. Studies were grouped and reviewed based on geographical regions and ethnic/indigenous groups: circumpolar region (including Inuit, Alaska Natives, Greenlanders, Sami, Indigenous Siberians and others), USA (American Indians and Alaska Natives), South America (among others, Mapuche), Australia (Indigenous Australians) and New Zealand (Maori). Studies with results displayed in figures only were excluded; studies with less than 10 cases were included in online supplementary table S1, but were not considered in the results and the conclusion. If there was clear overlap between studies, only the most comprehensive or most recent study was included.

To complement the literature search, we analysed trends in incidence in two indigenous groups, with data from routine sources in New Zealand and the USA. Specifically, data on new cases of stomach cancer among Maori and non-Maori were available from annual reports of the New Zealand Ministry of Health[18] and among American Indians and Alaska Natives (AI/AN) from the Surveillance, Epidemiology and End Results (SEER) Program (13 registries) for the period 1995–2009.[19]

We calculated 3-year averaged age-standardised incidence rates using the world standard population and the estimated annual percentage change (EAPC) using joinpoint regression analysis,[20] a common method in cancer epidemiology to analyse incidence and mortality trends.. Using this method, abrupt changes in long-term trends, linear segments of time during which rates are relatively stable, can be identified and tested. EAPCs were calculated by fitting connected linear trends on a log scale with calendar year as a regressor variable, assuming constant variance and uncorrelated errors, allowing for up to two joinpoints (three trend-line segments). The final model provides an estimate of the direction and magnitude of the trend between each set of joinpoints, thus avoiding the need to base trend estimation on arbitrary calendar periods. STATA V.11 and Joinpoint 4.0 were used for the statistical analyses.

RESULTS

Literature search

The search yielded 5219 studies, 74 of which were relevant for our overview (see online supplementary figure S1). Five main regions and their indigenous peoples were identified based on the results of our search: Indigenous Australians, Maori in New Zealand, indigenous peoples from the circumpolar region (including Inuit, Sami and Indigenous Siberians), Native Americans and Alaska Natives in the USA and Mapuche peoples in Chile.

Incidence

Totally, 57 studies exploring cancer incidence were included (see Methods). Stomach cancer incidence among all indigenous groups exceeded that of their non-indigenous counterparts (see online supplementary table S1). The highest rates of stomach cancer were observed in Indigenous Siberians,[21 22] Mapuche[23]

[i]For clarification and consistency, initial capitals for the term *indigenous* were only used if they referred to a (recognised) population group, such as Indigenous Australians, but not when they were used as an adjective to refer to indigenous peoples in general.

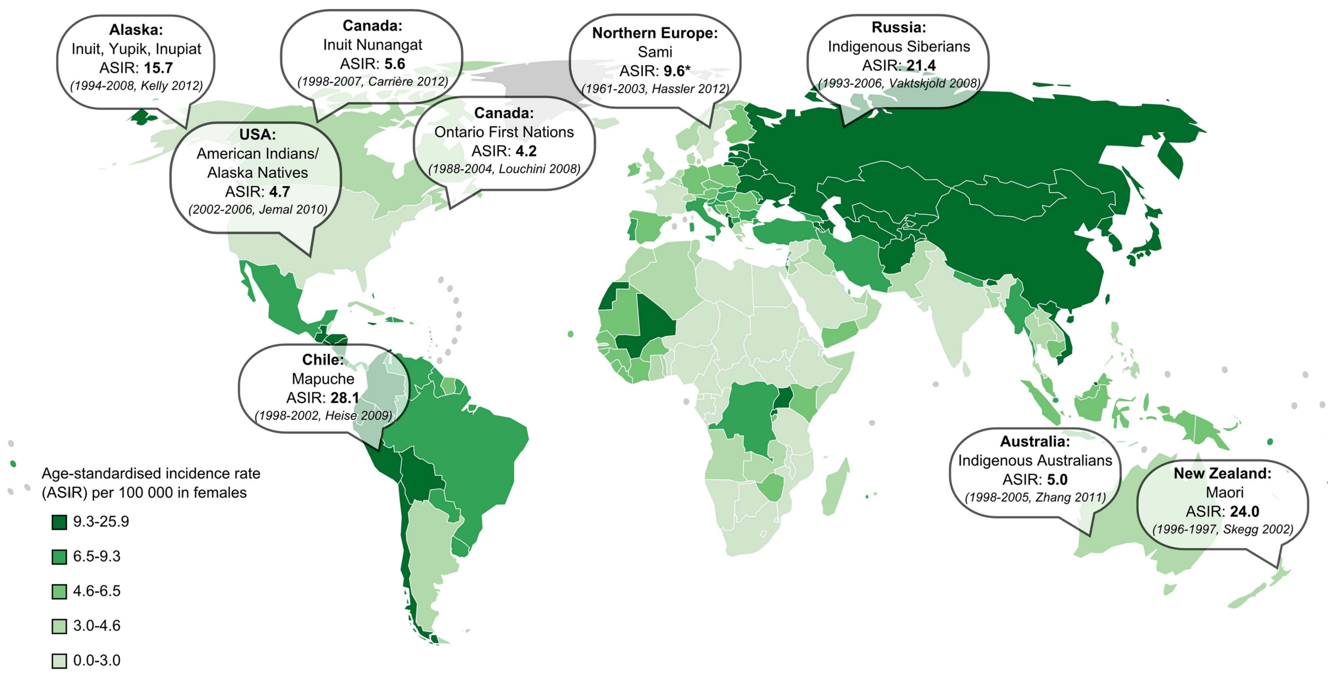

Figure 1 Global map of female stomach cancer incidence: comparisons of age-standardised incidence rates (ASIR per 100 000) in indigenous populations (years of incidence provided) versus national estimates from GLOBOCAN (2008).

and among Alaskan Inuit.[24] Incidence rates in men were double those of women in most populations examined (figures 1–3).

Trends in incidence

Age-standardised incidence rates rose in male indigenous Greenlanders from 5.9 for the period 1955–1964[25] to 23.4 in 1989–2003[24] and similarly among Alaska Natives.[26] Whereas Paltoo and colleagues[27] found an increasing trend in Native Americans and Alaska Natives between 1992 and 1999 — non-significant in men (EAPC: +3.3%) and significant in women (+11%) — Espey and colleagues[28] found significant decreases during 1975–1988 (−1.2%) and 1988–2004 (−2.1%).

Declining stomach cancer incidence rates after 1988 were observed in American Indians and Alaska Natives based on SEER data,[19] with a significant annual decline of 8.4% among women between 1998 and 2004, and in men of 11.6% per year

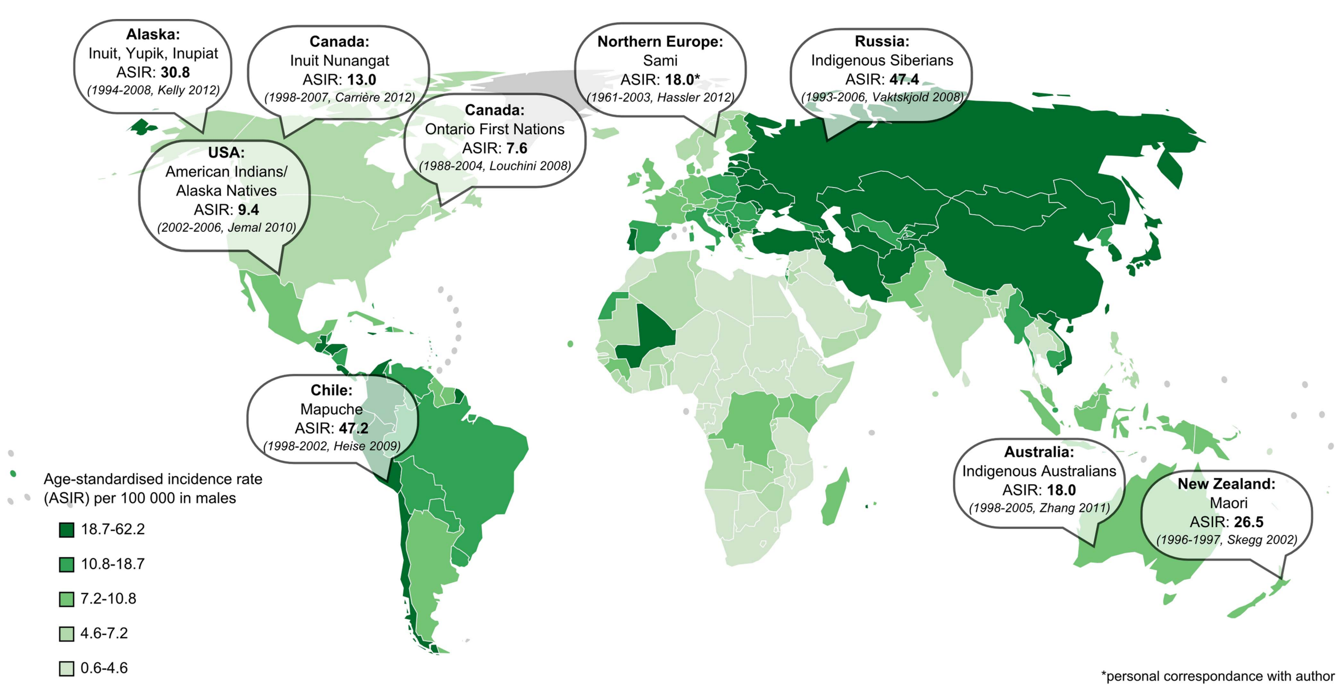

Figure 2 Global map of male stomach cancer incidence: comparisons of age-standardised incidence rates (ASIR per 100 000) in indigenous populations (years of incidence provided) versus national estimates from GLOBOCAN (2008).

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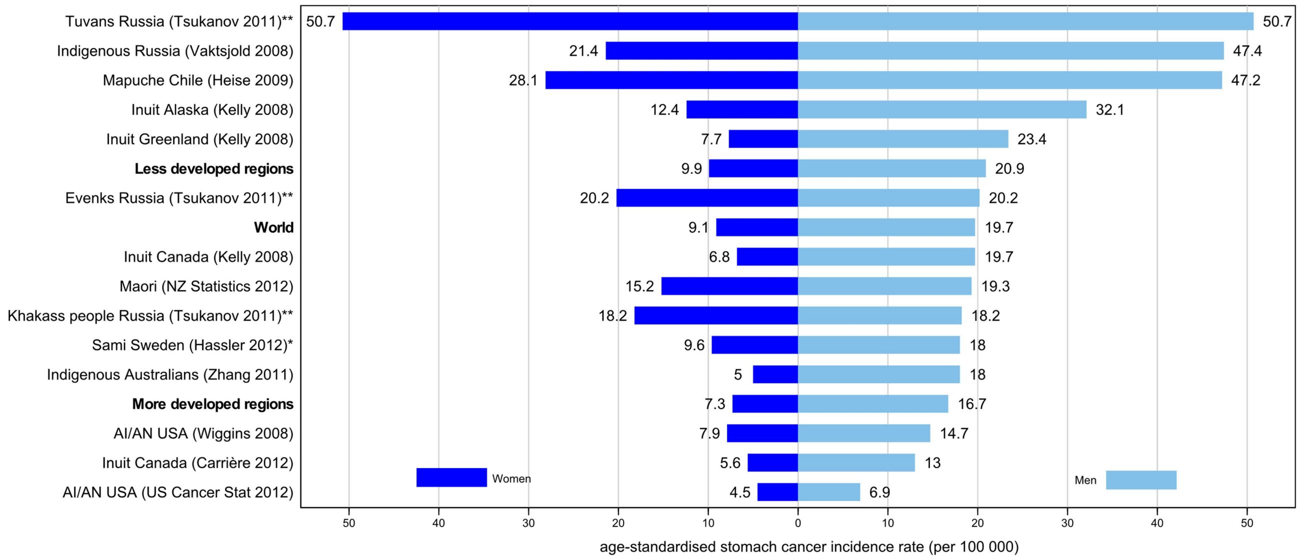

Figure 3 Age-standardised incidence rates (ASIR per 100 000) of stomach cancer in indigenous populations (based on literature review) by sex, with comparisons with more and less developed regions and the world (GLOBOCAN 2008).

between 2005 and 2008 (figure 4, table 1). The incidence in Maori men decreased significantly between 1963 and 1984 by −0.8% per year,[29] and more rapidly since 1996 (figure 4, table 1). However, a significant increase in incidence was observed in Maori of both sexes since 2000, in contrast with incidence rates in the non-Maori population which continued to uniformly decline (figure 4, table 1).

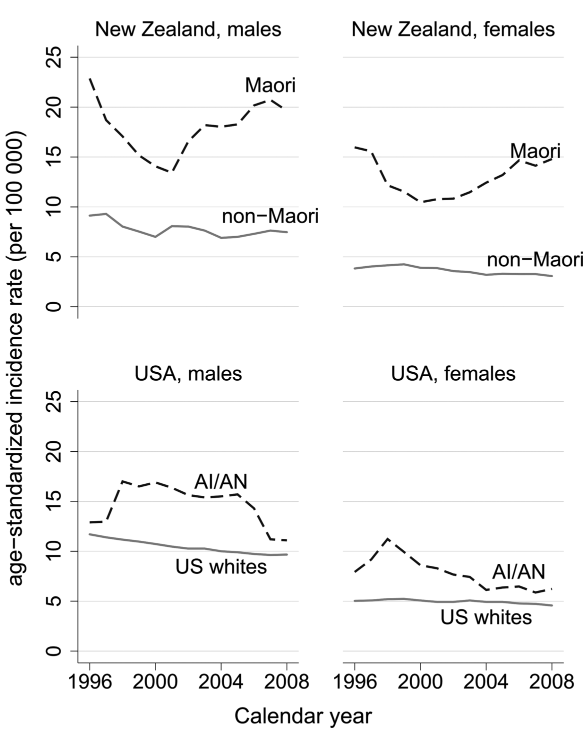

Figure 4 Trends in age-standardised* incidence rates (ASIR per 100 000) of stomach cancer (smoothed using 3-year moving averages) in Maori and American Indians/Alaska Natives (AI/AN) 1996–2008 by sex, with comparisons with non-Maori and the US Caucasian population, (source: SEER, NZHIS).

Incidence ratios

A number of studies have compared stomach cancer in indigenous groups with non-indigenous populations using either standardised incidence ratios (SIR) or incidence rate ratios as measures of relative risk (RR) (see online supplementary table S2a). Circumpolar Inuit were at a threefold higher risk of developing stomach cancer compared with SEER whites,[24] similar to Maori in New Zealand when compared to non-Maori.[29] By contrast with increased SIRs among Mapuche in Chile,[23] lower risks for stomach cancer were found among the indigenous population relative to the non-indigenous population of the Amazon basin of Ecuador.[30] Notably, SIRs were higher in women than men in Maori,[29] Mapuche,[23] AI/ANs[28 31] and Sami.[32]

Subsites

A significantly higher percentage of diffuse-type gastric cancer, and a higher incidence rate of non-cardia, distal tumours (non-cardia: 9.7/7.9 per 100 000 in men/women vs cardia: 0.9/0.6) have been reported in Maori.[33] Low rates of cardia adenocarcinomas were also noted in American Indians and Alaska Natives (0.9 per 100 000 in men, 0.2 in women), especially relative to non-indigenous Caucasians (3.4 in males, 0.9 in females) and other ethnic groups in the USA.[34] High rates of non-cardia were also observed in Native Americans in the study by Brown and colleagues.[35] In Alaska, the incidence of central/distal stomach cancer was significantly higher in American Indians and Alaska Natives relative to non-Hispanic whites (RR men: 5.8, 95% CI 2.6 to 13.5; RR women: 14.9, 95% CI 6.0 to 44.9).[31]

Mortality

In total, 30 studies examined stomach cancer mortality among indigenous peoples (see Methods). For Maori, Dockerty *et al*[29] reported high mortality rates from stomach cancer in men (31.4 per 100 000) and women (18.9) between 1950 and 1986, with annual declines of −0.9% and −1.3%, respectively. Skegg *et al*[36] observed slightly lower mortality rates among Maori 1996–1997 and more recently, rates decreased to 13.8 in men and 9.6

Table 1 Estimated annual percentage change (EAPC) in the incidence of stomach cancer and its 95% CIs for Maori and non-Maori and for American Indians/Alaska Natives (AI/AN) and US Caucasians between 1996 and 2008

	Men			Women	
Year	EAPC	95% CI	Year	EAPC	95% CI
Maori					
1996–2000	**−10.3**	(−16.3 to −3.9)	1996–2000	**−11.2**	(−15.2 to −6.9)
2000–2008	**5.5**	(3.0 to 8.1)	2000–2008	**5.1**	(3.4 to 6.8)
Non-Maori					
1996–2008	**−1.6**	(−2.7 to −0.4)	1996–1999	2.9	(−0.7 to 6.7)
			1999–2004	**−4.9**	(−7.1 to −2.8)
			2004–2008	−0.9	(−3.1 to 1.4)
AI/AN					
1996–1998	16.2	(−1.9 to 37.6)	1996–1998	**17.3**	(1.7 to 35.2)
1998–2005	−1.0	(−3.8 to 1.9)	1998–2004	**−8.4**	(−11.3 to −5.5)
2005–2008	**−11.6**	(−18.8 to −3.8)	2004–2008	−1.2	(−5.5 to 3.4)
US Caucasians					
1996–2002	**−2.1**	(−2.5 to −1.7)	1996–2008	**−0.8**	(−1.2 to −0.4)
2002–2008	**−1.2**	(−1.5 to −0.8)			

Bold numbers are significant at p≤0.05 level.

in women in 2009, compared with 4.7 and 1.7 in non-Maori men and women, respectively.[37] Similarly, rates among AI/ANs were higher than among other ethnic groups, reported as 9.8 in men and 4.6 in women during 2002–2006.[38] Declines in mortality were also found among AI/ANs between 1975 and 1987 (−2.3% per annum), and between 1991 and 2004 (−3.5%). Similar (but non-significant) trends were observed among Indigenous Australians between 1977 and 2000 (EAPC: −0.8%).[39] Mortality rates in Indigenous Australians of 21.2 and 7.9 were estimated in men and women, respectively, in a recent study by Morrell *et al*.[40]

Mortality ratios

A high standardised mortality ratio was estimated for stomach cancer mortality among Indigenous Australian men (2.1; 95% CI 1.5 to 2.9) and women (2.0; 1.2 to 3.2),[41] and among AI/ANs men (1.47) and women (1.77)[42] (see online supplementary table S2b). By contrast, significantly lower risks were found in Ontario First Nation men.[43] The risk of dying after stomach cancer was 10 times higher in Alaska Native men relative to US Caucasians 1994–2008,[44] while higher stomach cancer mortality was reported among Skolt Sami in Finland compared with both the overall Finnish population as well as other Sami groups.[45]

Survival

Six studies reported survival from stomach cancer among indigenous peoples. Low relative survival proportions were found among Mapuche in Chile with 5 years survival only 4.4% (11.9% in other Hispanics).[23] Similarly, Young *et al*[46] observed the lowest 5 years survival proportions among American Indians (11% in men and 7% in women) when compared with other ethnic groups. In a study among American Indians in New Mexico and Arizona, survival differences could be explained by stage at diagnosis and treatment.[47] Relative survival in American Indians climbed to 14% between 1983 and 1994,[48] however, cause-specific survival remained lowest of all ethnic groups in the USA more recently.[49] Jeffreys *et al*[50] found slightly lower age-standardised and stage-standardised relative survival proportions among Maori (15%) relative to non-Maori (22%).

DISCUSSION

Marked contrasts exist in the relative burden of stomach cancer in indigenous and non-indigenous populations included in this review, particularly among Inuit in the circumpolar region and Maori in New Zealand. Whereas incidence and mortality rates from stomach cancer have uniformly decreased in the last four decades in most parts of the world,[51] rates have increased for some indigenous population groups. Incidence of stomach cancer has been associated with poor nutrition and sanitation,[52] hallmarks of poverty, and it is plausible that indigenous peoples, who are among the poorest globally,[53] are affected more than other population groups. A high intake of salt may also play a key role in modifying risk in some indigenous groups, especially in the Arctic region where salt is especially prevalent in traditional foods.[54] Evidence from migrant studies has shown that first-generation migrants from countries with high incidence of stomach cancer that migrate to low-incidence countries largely retain the risk profile of their country of origin. However, decreases in the incidence rate have been observed over time and in successive generations, acknowledging the strong link between stomach cancer and environmental risk factors, acting early in life.[55 56]

H pylori infection can damage the gastrointestinal tract and is the most consistent risk factor for non-cardia gastric cancer, accounting for an estimated 75% of all distal gastric cancers according to a review of global data published in 2008.[52] However, only a minority of infected persons develop clinical signs of infection. Lifetime risks of the acquisition of peptic ulcers or distal stomach cancer in *H pylori*-positive persons is estimated to be 10–15% and 1–2%, respectively.[57] *H pylori* infection is usually acquired in childhood and is fostered by overcrowding and poverty.[10] In LMICs, the prevalence of stomach cancer has been found to be similar to that of *H pylori* infection, resulting in a much higher burden.[58] Studies on the prevalence of *H pylori* infection among indigenous peoples confirm this pattern, suggesting high rates among Maori,[59] Indigenous Australians,[60] as well as Arctic aboriginal populations.[61] The fact that the relationship between *H pylori* infection and stomach cancer is confined to non-cardia (distal) tumours, was confirmed in some studies that stratified by anatomical subsite, reporting particularly high rates of non-cardia tumours in indigenous populations.[31 62]

H pylori infection is curable and comprehensive guidelines for its management have been developed.[63] Elimination therapy to prevent gastric cancer has been recommended for dyspeptic persons from high-prevalence regions.[64] However, the exact source of *H pylori* is still unknown and given that infection is ubiquitous in many populations (prevalence >80%), elimination therapy is neither feasible nor (cost-)efficient. Additionally, elimination rates have decreased in past years due to increasing bacterial resistance to drug regimens.[65] Some studies have also suggested that *H pylori* eradication might have detrimental effects, for example, as a contributing factor to the onset of Barrett's oesophagus.[66 67] However, this relationship remains controversial and evidence is needed from clinical trials. Comprehensive public health approaches to reduce exposure to *H pylori* infection may yield more widespread and sustainable results, including improved housing and living conditions for indigenous and poor populations who are at increased risk of developing stomach cancer.

Lifestyle factors, including nutrition and smoking habits, have both been found to be important in the development of stomach cancer.[10] Maori have one of the highest smoking rates in the world and also begin smoking at a much earlier age than many other populations.[36] Estimates suggest that up to 17% of stomach cancer cases may be attributable to smoking,[1] with an increased risk seen in relation to duration and quantity of cigarettes smoked.[68] Some studies have found obesity to be associated with an increased risk of cardia tumours but a decreased risk of non-cardia stomach cancer.[1] Whereas a high consumption of fresh fruits and vegetables has been found to be protective, excess salt intake can promote early atrophic gastritis and gastric cancer.[69] The diet of some indigenous peoples is characterised by a higher consumption of salt, for example, salt-cured whale meat in Alaska, Greenland and Northern Russia,[70] and a lower intake of fresh fruits and vegetables. The traditional Sami diet, high in red meat and fatty fish and low in vegetables and fibre, has been reported to contribute to a higher cancer and all-cause mortality.[71] These dietary patterns often reflect cultural preferences and seasonal availability, as well as economic circumstances.

The reasons for the observed increase in stomach cancer incidence among indigenous groups included in this review—in striking contrast to the decreasing trends seen in their non-indigenous counterparts—are largely unknown. Although, for example, Inuit tend to have a high seroprevalence of *H pylori*, general sociocultural and economic changes point against an increase in the prevalence of the infection.[13] However, trends in inequalities may also reflect cohort differences in *H pylori* infection rates; for example, in New Zealand where a dramatic demographic shift occurred for the majority of the Maori population who moved from rural to city environments beginning in the late 1940s–1950s.[72] Similar to findings from other studies,[1 73] an increased incidence of adenocarcinomas of the gastric cardia among indigenous people may relate to changes in lifestyle and higher levels of obesity. In view of the various risk factors and their possible interactions, it will be important to distinguish cardia from non-cardia stomach cancers in the future in order to shed light on the aetiological mechanisms that are responsible for changes in incidence over time. Additionally, the subtype of stomach cancer may be contributing to differing outcomes; for example, compared to non-Maori, Maori appear to experience more diffuse than intestinal stomach cancer which has a worse prognosis.[62]

Stomach cancer has a relatively high case fatality with a 5-year relative survival of 24% in Europe 1995–1999[74] and 27% in the USA 2002–2008.[75] The prospects of early detection measures, or interventions to reduce potential inequalities in access to treatment are thus limited, although screening, gene testing and prophylactic gastrectomy have been offered to families identified with hereditary diffuse gastric cancer since 2000 in New Zealand, and guidelines for management of familial cancer were recently updated.[76–78] Hereditary diffuse stomach cancer is associated with E-cadherin gene mutations,[79] and while mutations in families predominantly affected by diffuse gastric cancer have been documented,[80] the reasons for the higher incidence of such sporadic cancers in Maori remains unclear. The few studies examining stomach cancer mortality or survival reported lower survival among indigenous Chileans,[23] American Indians[46–49] and Maori[50 81] when compared to their non-indigenous counterparts. Differentials in both access to, and quality of, specialised care, as well as more advanced stage at diagnosis, have been suggested as major determinants of the survival disadvantage among indigenous groups.

Strengths/Limitations

To our knowledge this is the first assessment of the global burden of stomach cancer in indigenous populations. However, different study designs, time periods and population groups, restricted comparability. This was mainly related to difficulties in defining and identifying indigenous groups in routine datasets. These vary greatly between countries, ranging from purely geographical indicators (eg, the population of Greenland or residing on Indian reserves), to self-assigned status/ethnicity, including that linked to eligibility to access certain health services dedicated to indigenous groups (eg, the Indian Health Service), each with potential for ethnic misclassification. This may result in under-reporting of cancer in indigenous groups, which has been, for example, known to be substantial in the SEER database.[82] It has therefore been proposed to use linkages with other databases and to include self-identified race in cancer surveillance data in order to improve case ascertainment in Native Americans and Alaska Natives.[83]

In many parts of the world, there is no routine collection of indigenous status in health data. In Latin American countries, where 10% of the population is indigenous,[84] data on cancer in indigenous peoples is particularly scarce. At present, indigenous persons are usually assigned based on their self-reported knowledge of an indigenous language, and more encompassing ways to register indigenous status are still to be developed.[30] Under-reporting may also explain the contrasting results from the two Latin American studies included in this overview.[23 30] Additionally, even where data exist, it often remains difficult to release or gain access to these data due to restrictive policies, which is a particular issue when attempting to address health problems in small communities.[85]

It is important to acknowledge that in New Zealand, changes in the ethnicity definition used in successive censuses (the denominator for incidence rate calculations), which include the time period covered by our analyses, makes the calculation and comparability of data over time difficult.[73] Moreover, recent work in New Zealand linking census and cancer registry data suggest Maori cancer registrations have been underestimated by between 10% and 30% since the 1980s.[72 86] Additionally, the advent of screening and prophylactic gastrectomy in the last 5–7 years may also have contributed to the subsequent increase in incidence rates for Maori from 2005 onwards.[87]

CONCLUSION

The high burden of stomach cancer among indigenous populations remains a public health concern. The need for careful surveillance and public health action is given added weight by the observation that stomach cancer incidence is increasing in some indigenous groups, in contrast with the well-established declining trends in the disease seen in their non-indigenous counterparts within the same regions/countries. Indigenous populations are heterogeneous with respect to their cultural, political and historical backgrounds, and differ greatly in terms of health behaviour and the prevalence and distribution of environmental risk factors; any assessment of cancer risks and implementation of prevention strategies must, therefore, reflect such differences.

In the longer term, a clearer understanding of the causes of the disparate burden of stomach cancer in indigenous populations is needed, and prevention measures developed accordingly. Clearly, optimal strategies to prevent stomach cancer on a global scale must involve improving social conditions, including reducing overcrowding and improving nutrition. In particular, efforts to further reduce salt intake and promote *H pylori* eradication in high-risk indigenous populations could offer a means to prospectively reduce inequalities in stomach cancer risk and mortality in the future, but requires further evaluation in randomised clinical trials.

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