Deaths from Cancer

4

Yuri Ito, Yoshikazu Nishino, Seiki Kanemura, and Tomoki Nakaya

This chapter provides maps which show geographical inequalities in mortality from major cancer sites in Japan from 1995 to 2014. Cancer is the most common cause of death in Japan, accounting for 28.9% of all deaths from 2010 to 2014. The geographical distribution of standardised mortality ratios (SMRs) differs according to cancer site, and this is probably related to their risk factors. Cartograms highlight that urban areas, particularly the Tokyo and Osaka metropolitan areas, have higher SMRs for female breast, lung, oesophageal and ovarian cancer. SMRs for stomach, colorectum and lung cancer were higher in the Tohoku region, which might be related to high prevalence of smoking and heavy alcohol consumption. Age-standardised mortality rates (ASMRs) for all cancers have continuously decreased due to the notable reduction in stomach and liver cancer mortality. However, ASMRs for pancreatic, breast, cervical and uterine corpus cancer and malignant mesothelioma have increased. Socioeconomic inequalities in cancer mortality have widened during the last 2 decades. The widest gap in mortality was observed in liver cancer in the 1990s, but this reduced markedly between 2010 and 2014. Recently, lung cancer mortality has shown the widest absolute inequalities for both sexes. Liver cancer and leukaemia mortalities have also shown large relative indices (RIIs) of inequalities for both sexes. Inverse inequalities, i.e. higher ASMRs, in breast and ovarian cancer, were observed in less deprived areas than in more deprived areas; SMRs of these cancers were high in urban areas.

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4.1 All Cancers (ICD10: C00–C97): Anybody Can Die from Cancer

Yuri Ito

Overview

Cancer has been the primary cause of death for contemporary Japanese since 1981. The number of deaths has been steadily increasing and now 1 in 3.6 people die from cancer. In every part of the country, a substantial proportion of people, particularly the older adults, have died from cancer, but mortality varies across the country (Fig. 4.1). Among men, some areas of high SMR (over 150) were found in southern Hokkaido, Aomori and Akita Prefectures in the Tohoku region, Osaka Prefecture in the Kinki region, and Fukuoka and Nagasaki Prefectures in the Kyushu region. Among women, areas of high SMR were found in Osaka Prefecture in the Kinki region.

In Japan, cancer deaths among men were mainly attributed to tobacco smoking (34.4%), infection (23.2%) and alcohol intake (8.6%); among women they were attributed to infection (19.4%), tobacco smoking (6.2%) and alcohol intake (2.5%) (Inoue et al. 2012). High SMR areas roughly corresponded to those with a high prevalence of tobacco smoking and heavy alcohol intake at the prefecture level (Ministry of Health Labour and Welfare 2016). When we look at the prismic cartogram of the SMR, the red peaks of high SMR are found in metropolitan inner-city areas, particularly in Osaka Prefecture. This indicates that socio-economically deprived regions in the metropolitan regions tend to have high SMRs.

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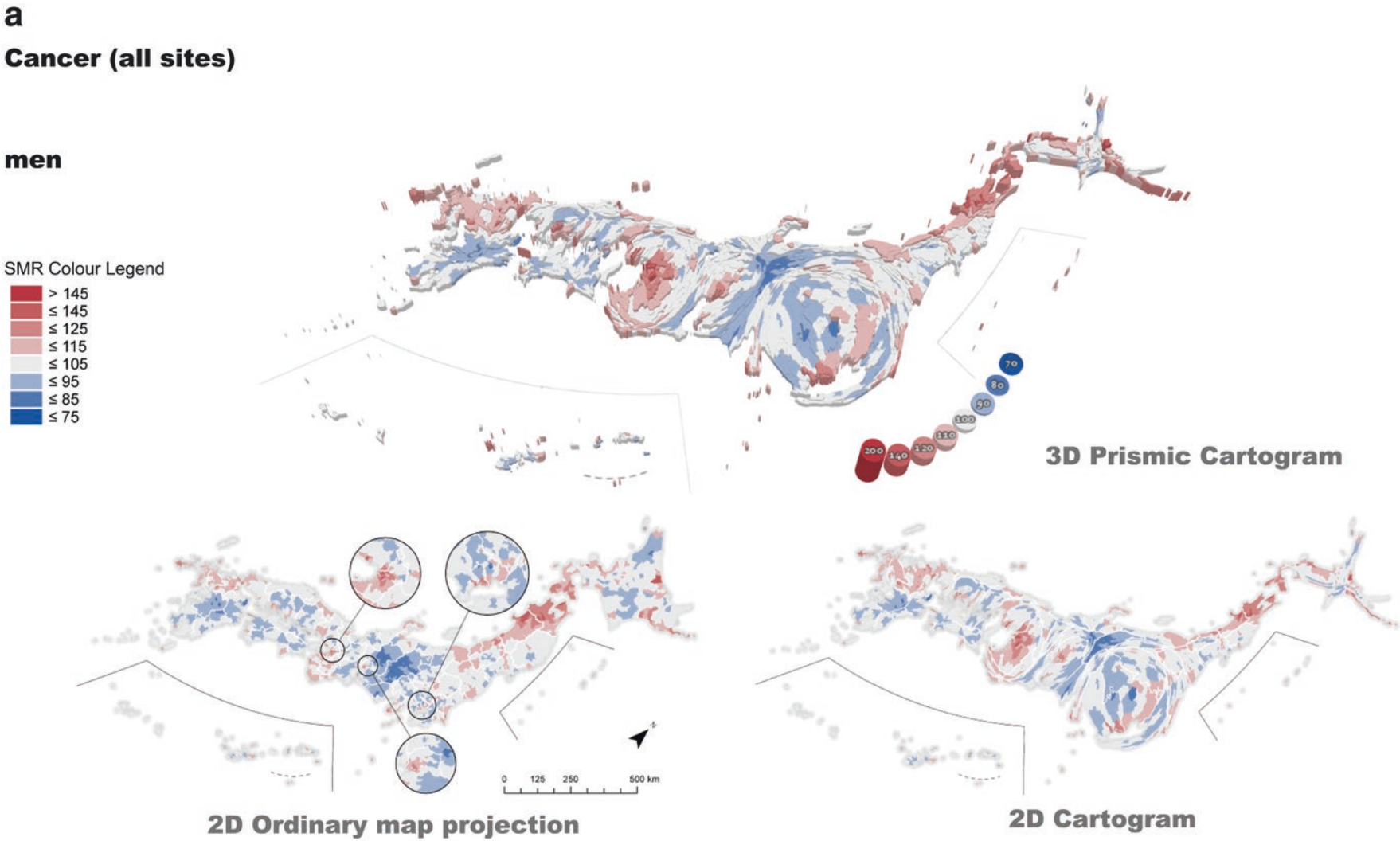
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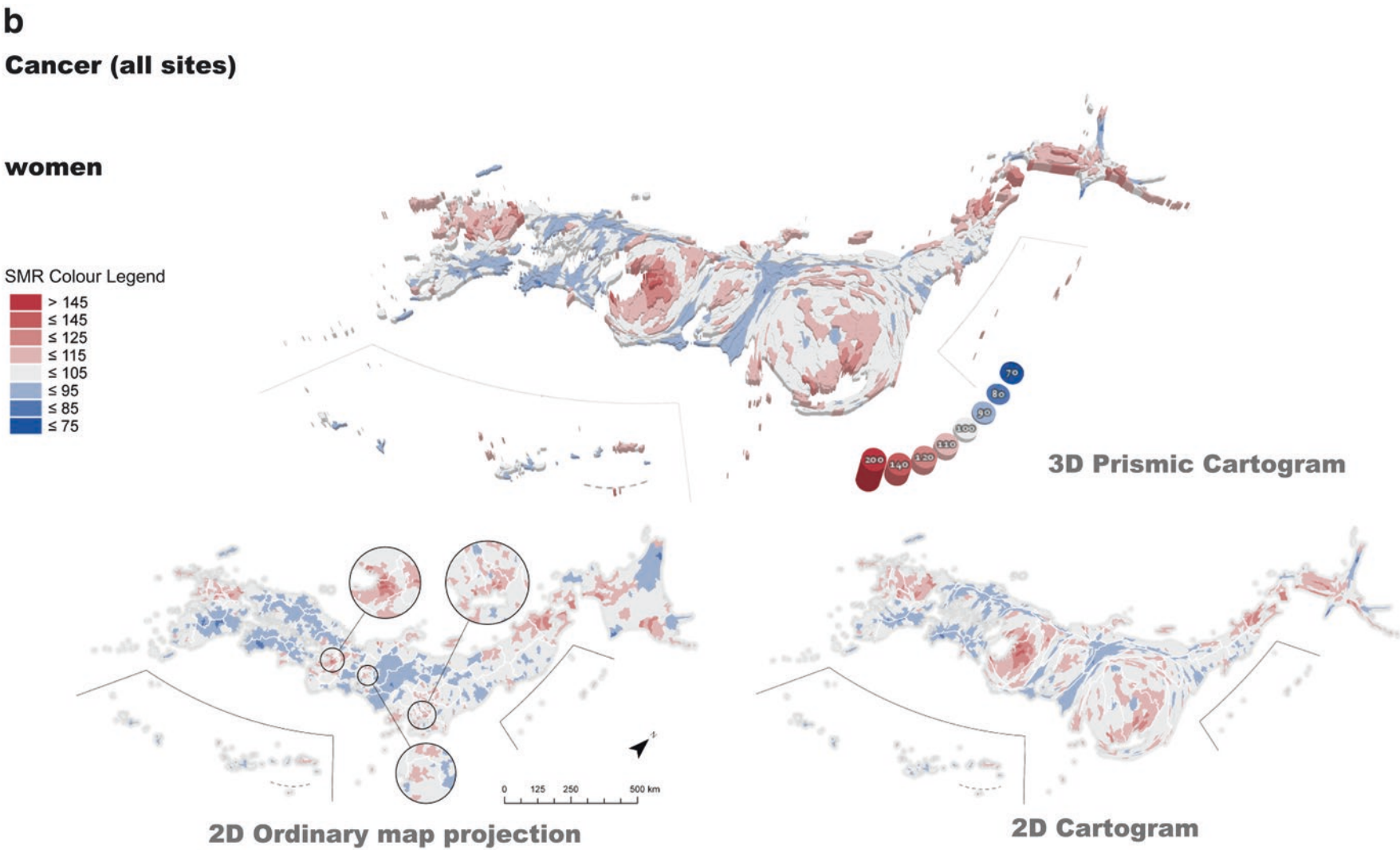
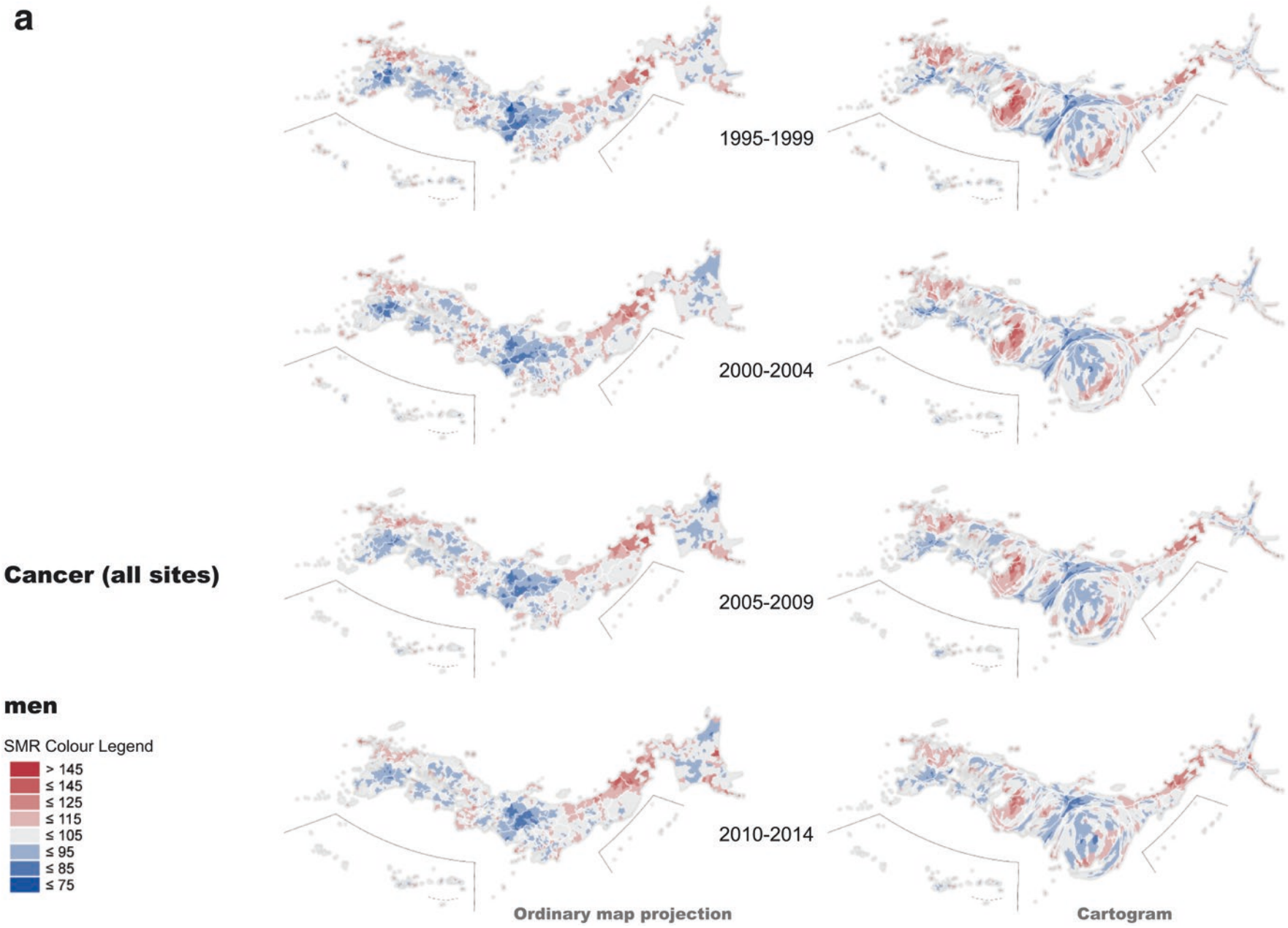


Fig. 4.1 SMR distribution of cancer (all sites), 2010–2014. (**a**) Men. (**b**) Women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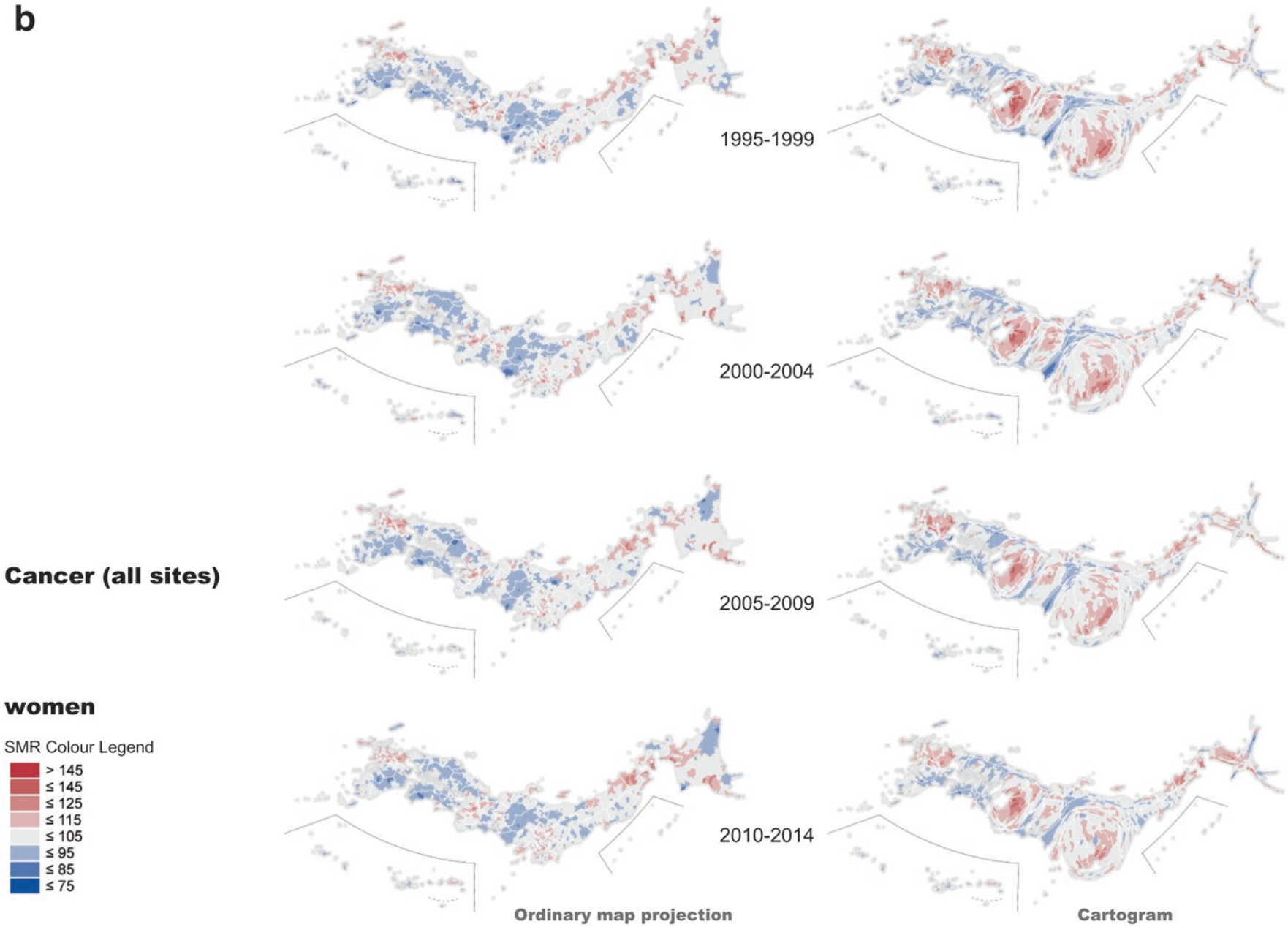


Fig. 4.2 Transition of SMR distribution of cancer (all sites) from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

Transitions and Socioeconomic Disparities

There were no large changes of SMR distribution during the period from 1995 to 2014. However, according to cartogram-based SMR mapping, the high SMRs in metropolitan areas have slightly decreased and the contrast between low and high SMR regions has become more prominent within the areas (Fig. 4.2). The geographical inequality of SMRs for all cancers is quite stable across the country, but it has slightly increased within the metropolitan areas.

The ASMR of cancer has decreased over the 20 years (Fig. 4.3). This means that absolute mortality rates from all cancers have persistently decreased. Among men, a clear gradient of ASMR from the least deprived group (Q1) to the most deprived group (Q5) was observed (Fig. 4.4). The slope index of inequalities (SII), the absolute gap of ASMR

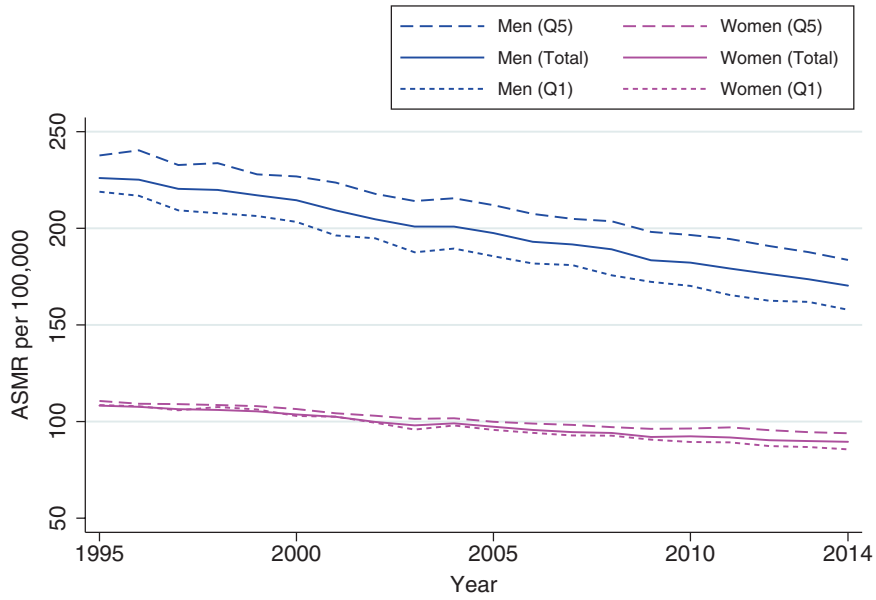


Fig. 4.3 Annual transition in the ASMR of cancer (all sites) from 1995 to 2014

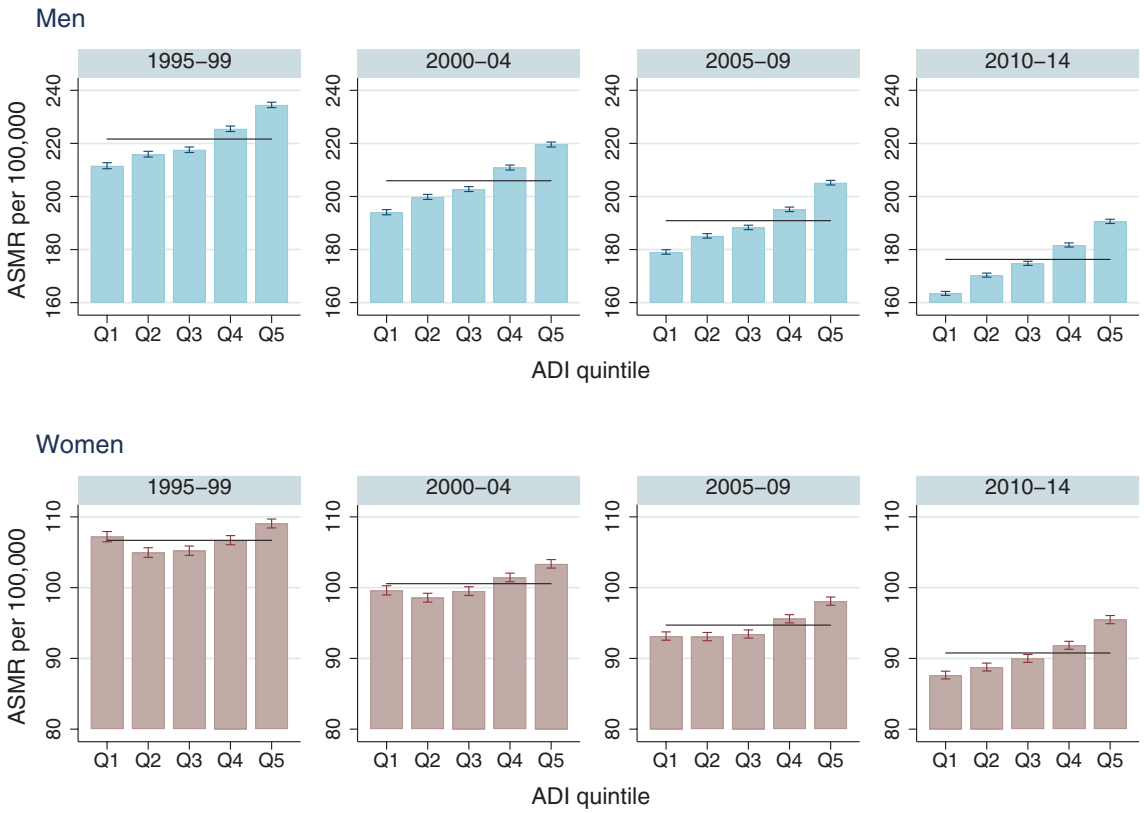


Fig. 4.4 The transition in the ASMR distribution of cancer (all sites) by ADI quintile (top: men, bottom: women)

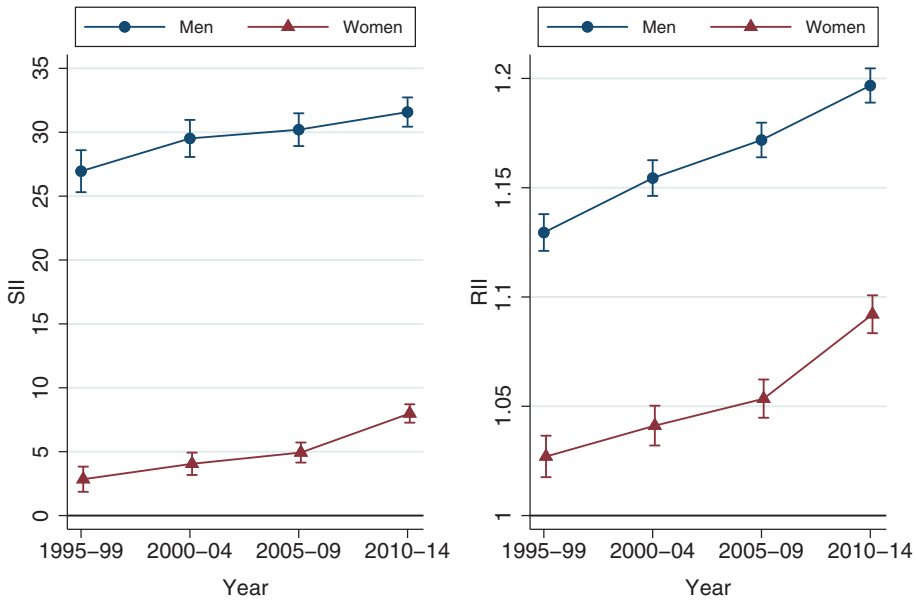


Fig. 4.5 Transition in SII and RII of cancer (all sites) from 1995 to 2014 by 5-year period (left: SII, right: RII)

between the most and least deprived areas, indicated large socioeconomic inequalities (Fig. 4.5). Among women, the second least deprived group (Q2) showed the lowest ASMR as a 'J-shape' curve before 2005 (Fig. 4.4). In the most recent period from 2010 to 2014, a clear gradient of ASMR from Q1 to Q5 and a markedly widening gap were observed. Trends in the RII show that the relative socioeconomic inequalities of ASMR have widened. For the 20 years, the RII among men has been larger than among women (Fig. 4.5).

4.2 Oesophageal Cancer (ICD10: C15): Smoking and Alcohol Cancer

Yuri Ito

Overview

Japan has one of the world's highest incident rates of oesophageal cancer in men. However, while the incidence rate is still increasing, the mortality rate is decreasing (Forman et al. 2013). The incidence and mortality rates observed in men were about six times higher than those in women in Japan. Deaths from oesophageal cancer were mainly attributed to tobacco smoking (58.9%) and alcohol intake (53.8%) in men, and alcohol intake (28.9%) and tobacco smoking (14.7%) in women in Japan (Inoue et al. 2012). Areas of high SMR were associated with high prevalence of tobacco smoking and heavy alcohol intake at the prefectural level (Ministry of Health Labour and Welfare 2016).

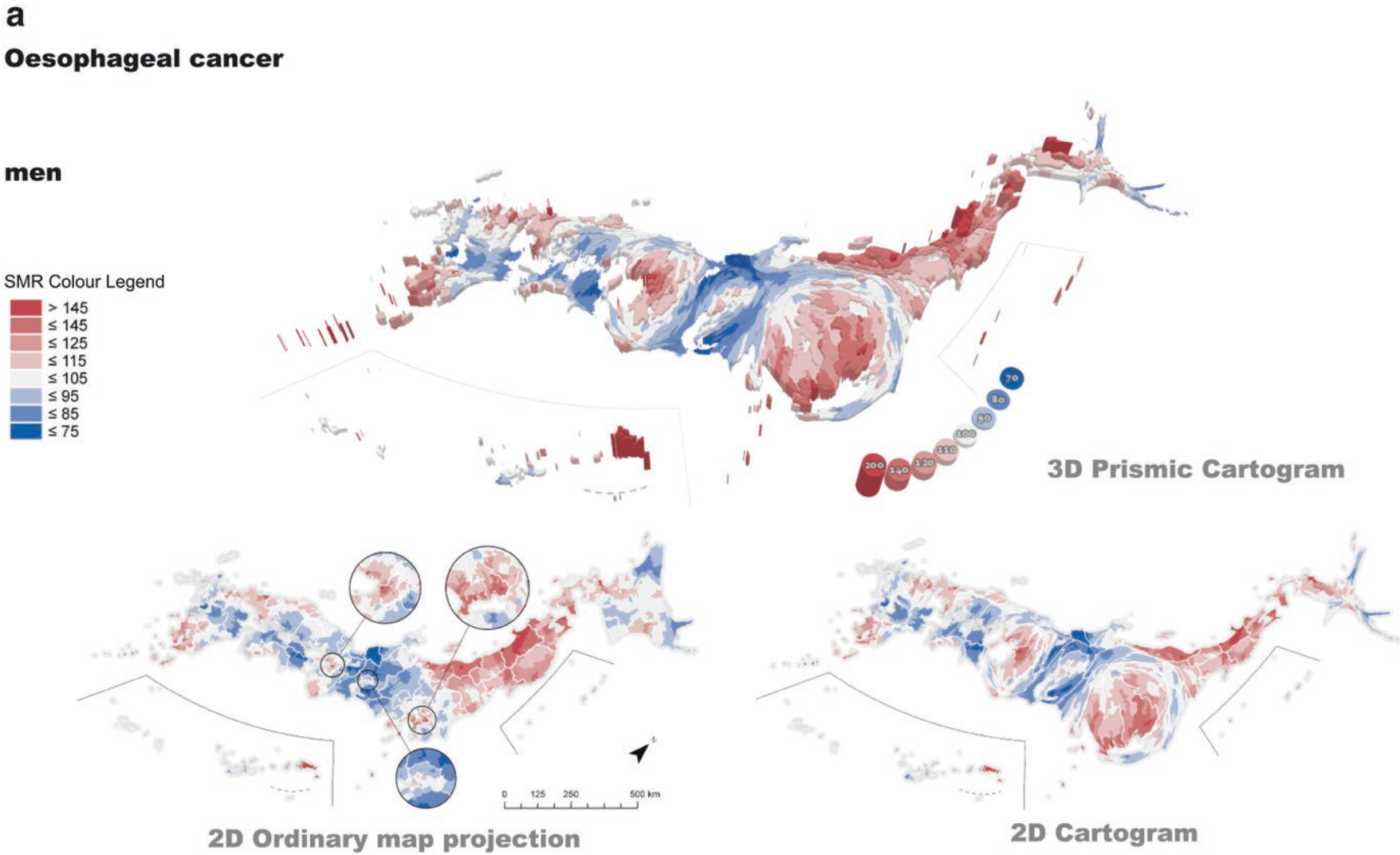
Among men, areas of high SMR (over 150) were spread over the Sea of Japan side of the Tohoku region and the coastal areas of Tokyo, as well as Osaka and Hyogo Prefectures in the Kinki region, Yamaguchi, Fukuoka and Kagoshima Prefectures in the Kyushu region, and Okinawa Prefecture (Fig. 4.6). Among women, areas of high SMR were mostly observed in metropolitan areas such as Tokyo, Osaka and Fukuoka-Kitakyushu, but high SMRs were also found in several non-metropolitan areas in Hokkaido Prefecture and the remote islands around Kagoshima and Okinawa Prefectures.

We observed large differences between men and women on the SMR maps based on the ordinary map projection. However, on the cartogram-based SMR maps, such gender differences become minor. SMRs in the urban areas are lower, and the variation over the entire country is also smaller.

Transitions and Socioeconomic Disparities

Figure 4.7 shows the transitions in the SMR distributions from 1995 to 2014. Among men, higher SMRs were consistently observed in the Sea of Japan side of the Tohoku region, where areas of higher alcohol intake in men were also seen. Among women in the Tohoku region, high regional SMRs decreased in the period 2010–2014, but urban areas continue to show high SMRs. High alcohol intake was reported among women in the urban area (Ministry of Health Labour and Welfare 2016).

The ASMRs of oesophageal cancer have decreased slightly during the last 20 years in men and remain low and stable in women (Fig. 4.8). Among men, Q3 showed the lowest ASMR, a 'J-shape/U-shape' curve, in 1995–2000 in contrast to the high ASMRs in Q1 and Q5 (Fig. 4.9). In the most recent period, the most deprived group showed the highest ASMR. Among women, different patterns of ASMR by deprivation group were observed. In 1995–1999, the highest ASMRs were observed in the least deprived group (Q1),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Oesophageal cancer
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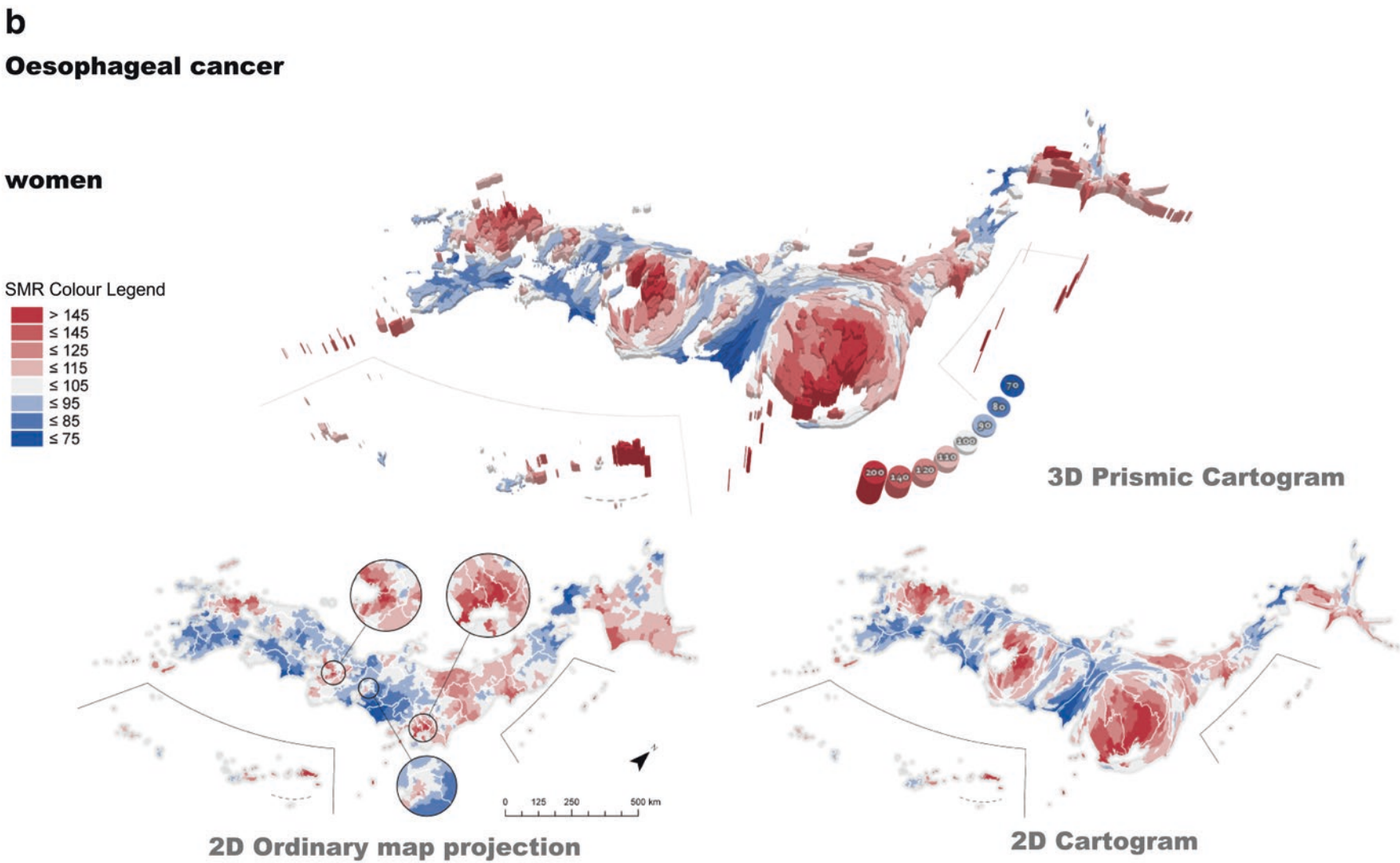
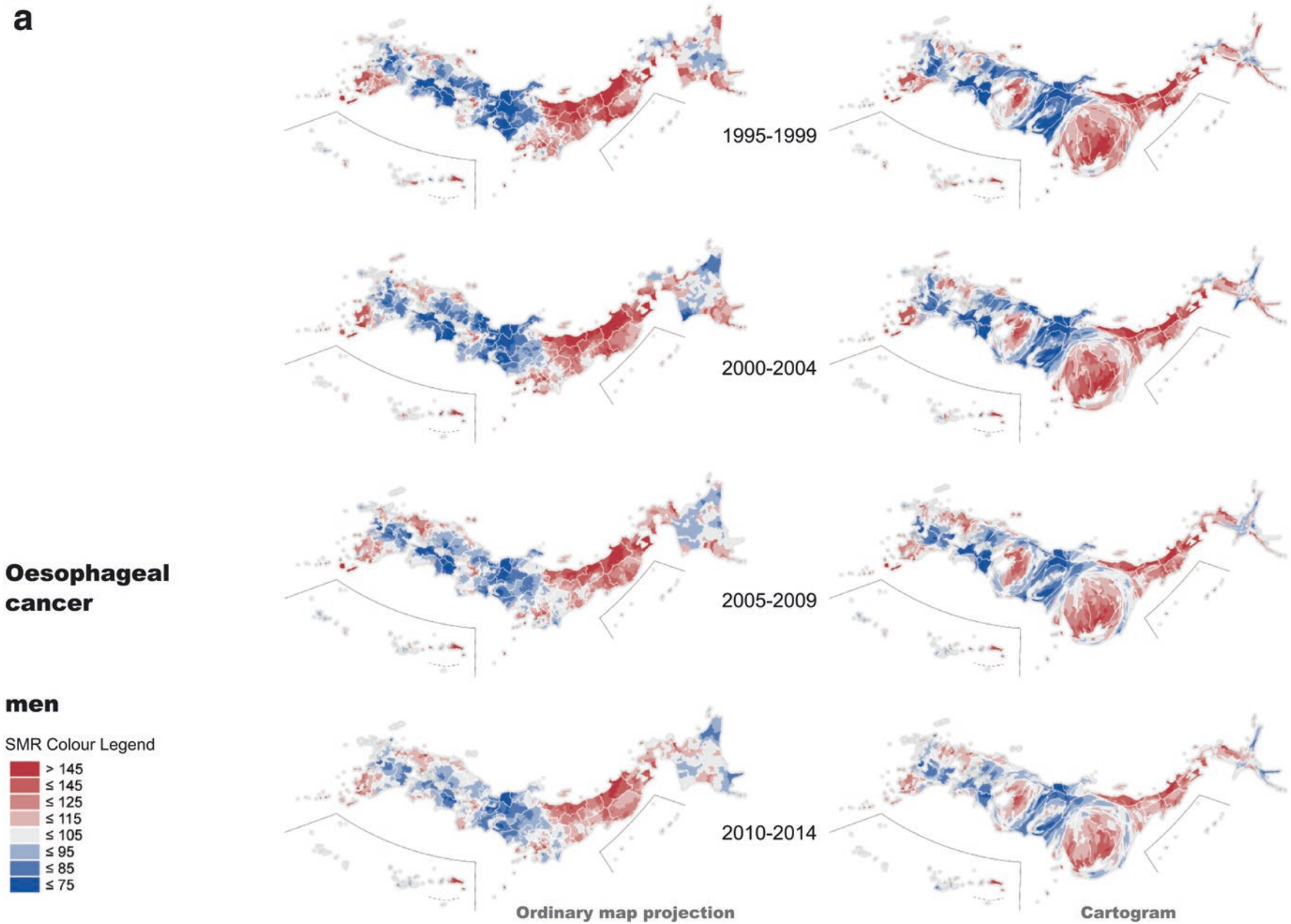


Fig. 4.6 SMR distribution of oesophageal cancer, 2010–2014. (**a**) Men. (**b**) Women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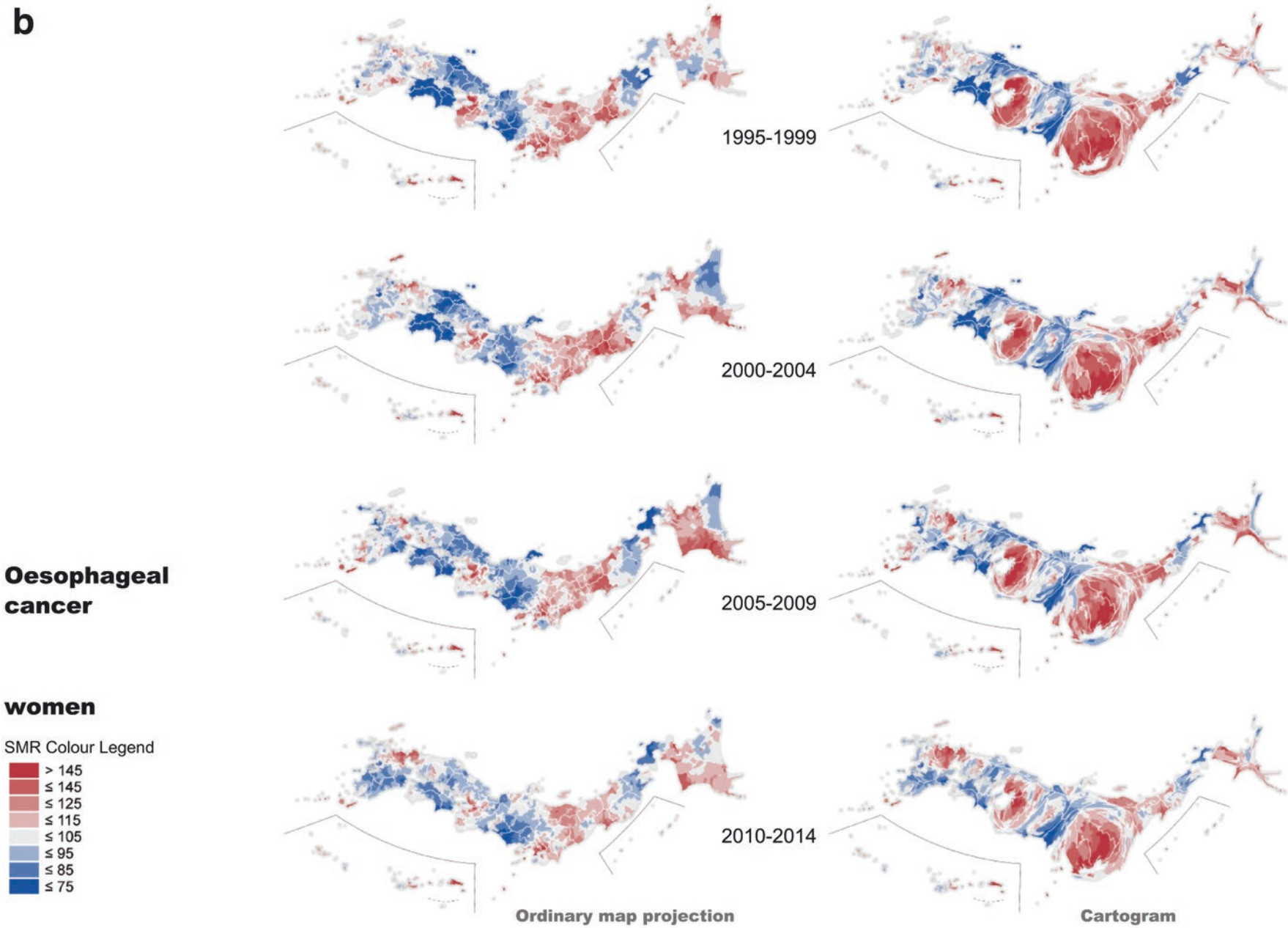


Fig. 4.7 Transition of SMR distribution of oesophageal cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

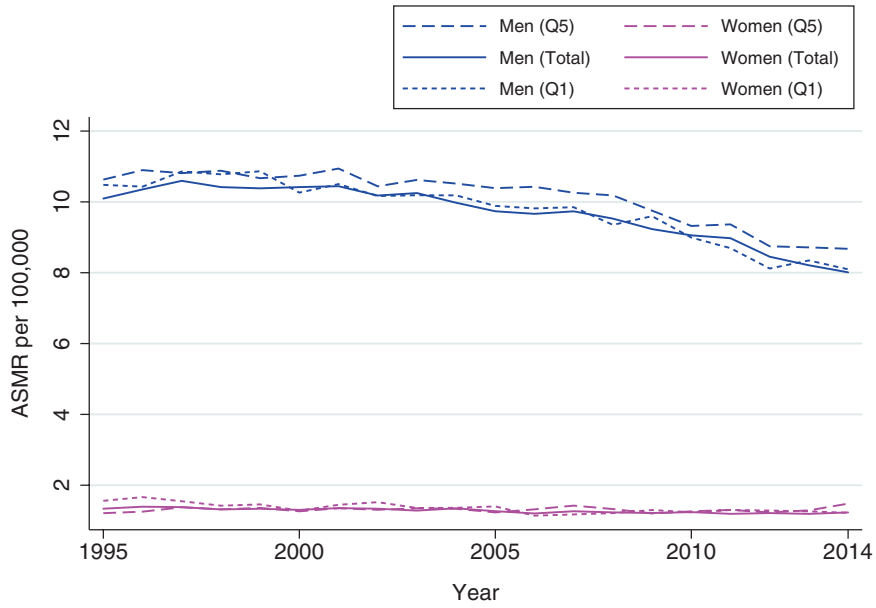


Fig. 4.8 Annual transition in the ASMR of oesophageal cancer from 1995 to 2014

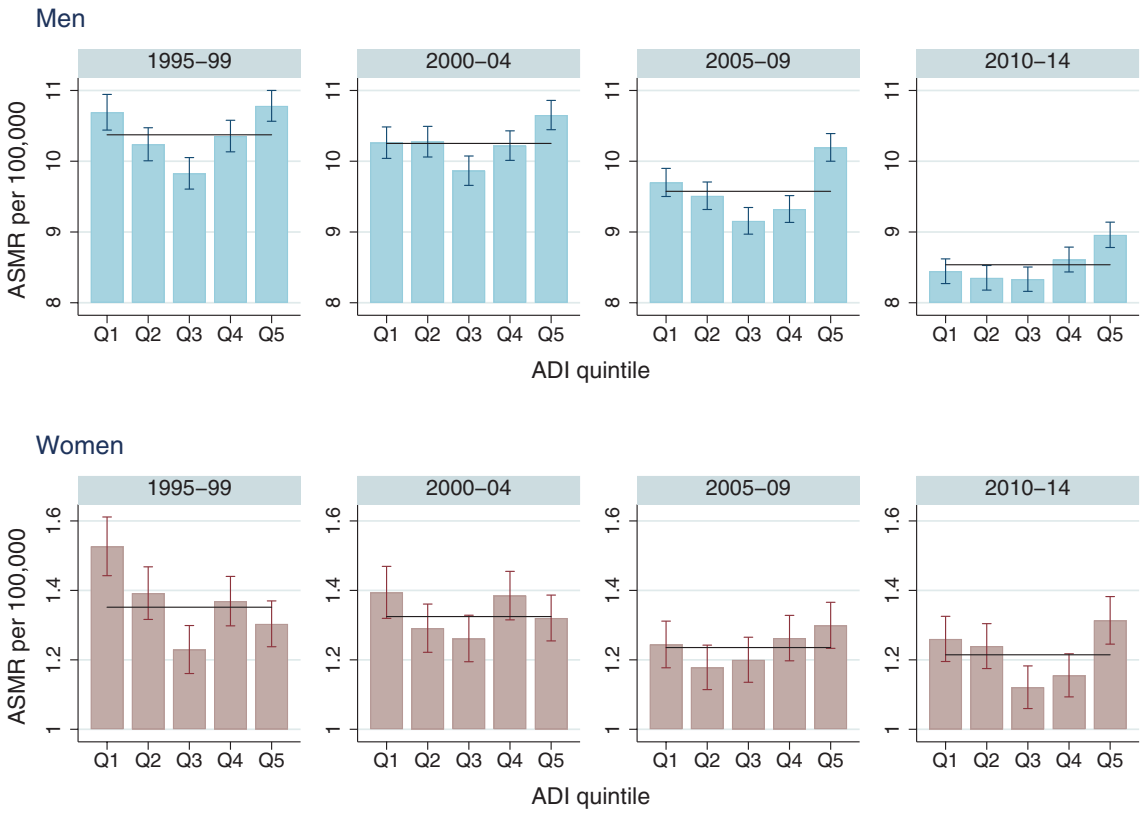


Fig. 4.9 The transition in the ASMR distribution of oesophageal cancer by ADI quintile (top: men, bottom: women)

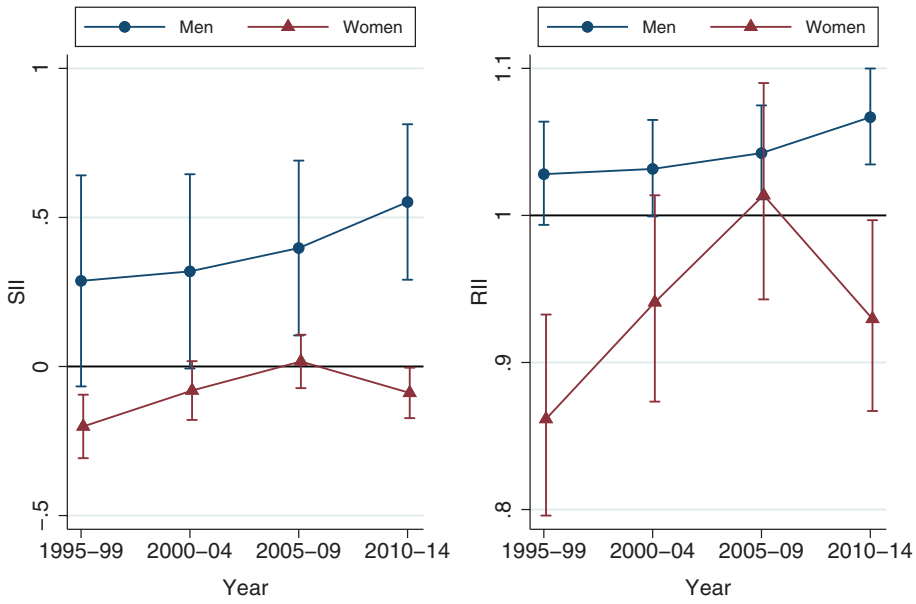


Fig. 4.10 Transition in SII and RII of oesophageal cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

which is an inverse socioeconomic gradient in the ASMR. While there was a slightly increasing trend in the RII and SII in men, among women they there were inverse socioeconomic gradients in 1995–1999 and 2010–2014 (Fig. 4.10).

4.3 Stomach Cancer (ICD10: C16): A Legacy Cancer

Yuri Ito

Overview

Until recently, stomach cancer was the most common cancer in Japan, although incidence and mortality rates have decreased considerably, due to an improvement in hygiene levels. In 2010–2014, 15% of all cancer deaths in Japanese men and 11.5% in Japanese women were due to stomach cancer, making it the second and third (respectively) most common cause of cancer death in Japan. Infection of *Helicobacter pylori* is the main risk factor for non-cardia stomach cancer incidence; the Population Attributable Risk Fraction (PAF) is 81.5% in men and 69.9% in women. Other attributable risk factors are salt intake (PAF = 8.9%) and active tobacco smoking (23.5% in men and 3.4% in women) (Inoue et al. 2012).

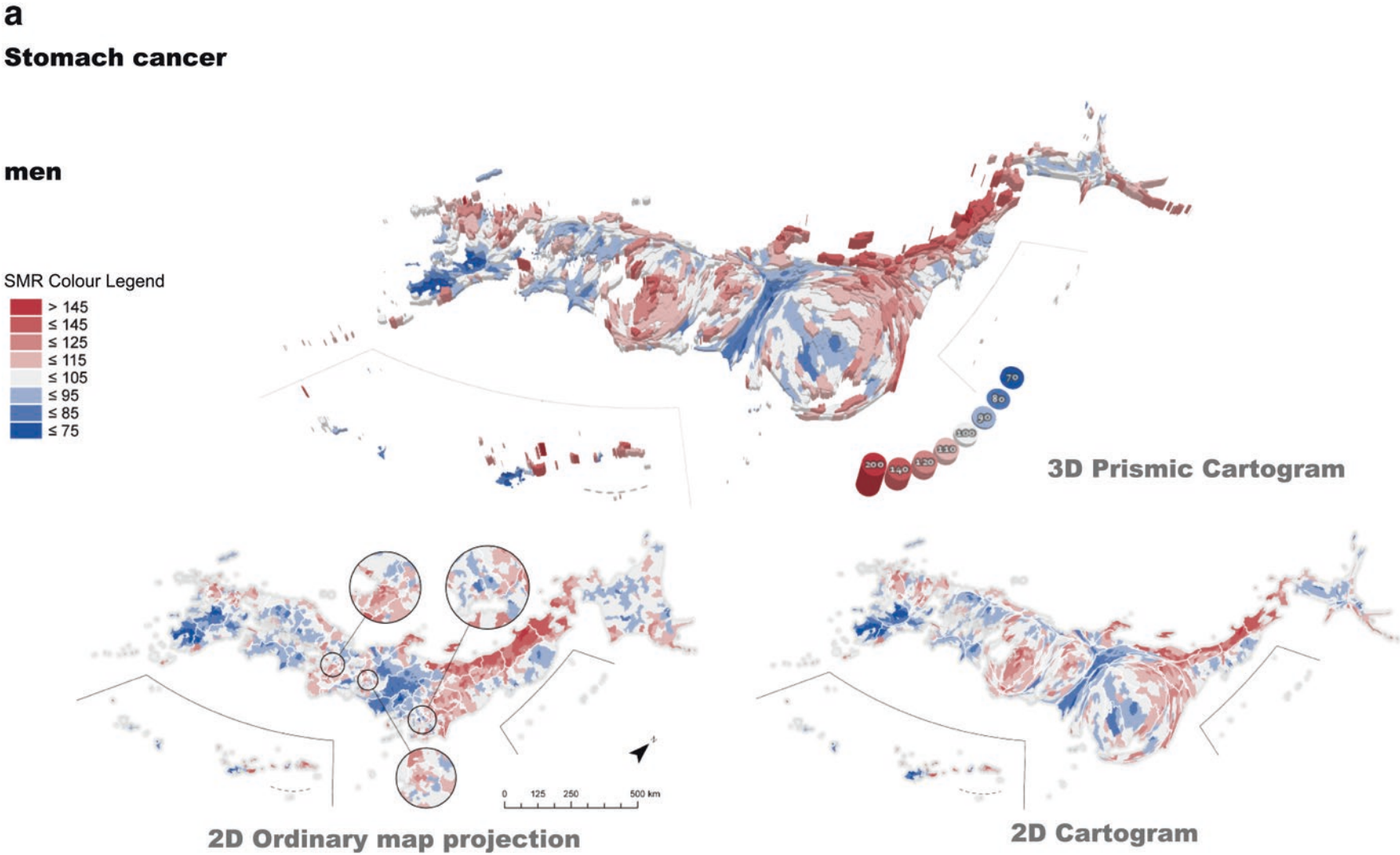
High SMR areas were related to high intake of salt and prevalence of tobacco smoking (Ministry of Health Labour and Welfare 2016). Mass screening for stomach cancer was introduced in Miyagi Prefecture during the 1960s, the earliest phase of screening worldwide. In 1983, the Japanese government started nationwide mass screening for stomach cancer using photofluorography, under the Health Service Law for the Aged (Hamashima et al. 2008). In the global surveillance of cancer survival 2018, Japan had the highest stomach cancer survival (Allemani et al. 2018).

According to the SMR distribution of stomach cancer (Fig. 4.11), among men, high SMR areas were spread across the Sea of Japan side of the Tohoku and Chubu regions, Osaka and Hyogo Prefectures in the Kinki region, and Okinawa Prefecture. Among women, high SMR areas were observed in the Sea of Japan side of the Tohoku and Chubu regions, Nagoya City in the Chubu region, Osaka and Hyogo Prefectures in the Kinki region, and Okinawa Prefecture.

Transitions and Socioeconomic Disparities

High SMRs were persistently observed in the Sea of Japan side of the Tohoku and Chubu regions for both sexes for the period from 1995 to 2014 (Fig. 4.12). In the affluent suburbs in the western Tokyo metropolitan area, SMRs have decreased, especially in women, resulting in a widening socioeconomic disparity of stomach cancer mortality in the metropolitan area.

The ASMR of stomach cancer has markedly decreased during the 20 years for both sexes (Fig. 4.13). For men, the highest and lowest ASMRs were observed for Q3 and Q5, respectively, in the period 1995–1999, indicating that the socioeconomic gradient in the mortality was not clearly identified (Fig. 4.14). According to the SII trend, the absolute socioeconomic inequalities in ASMR widened in men, although an inverse socioeconomic gradient of mortality was observed in 1995–1999 (Fig. 4.15). For women, inverse socioeconomic gradients were observed in 1995–2009, and the gap between the least and most deprived areas disappeared in the most recent period, 2010–2014 (Fig. 4.14).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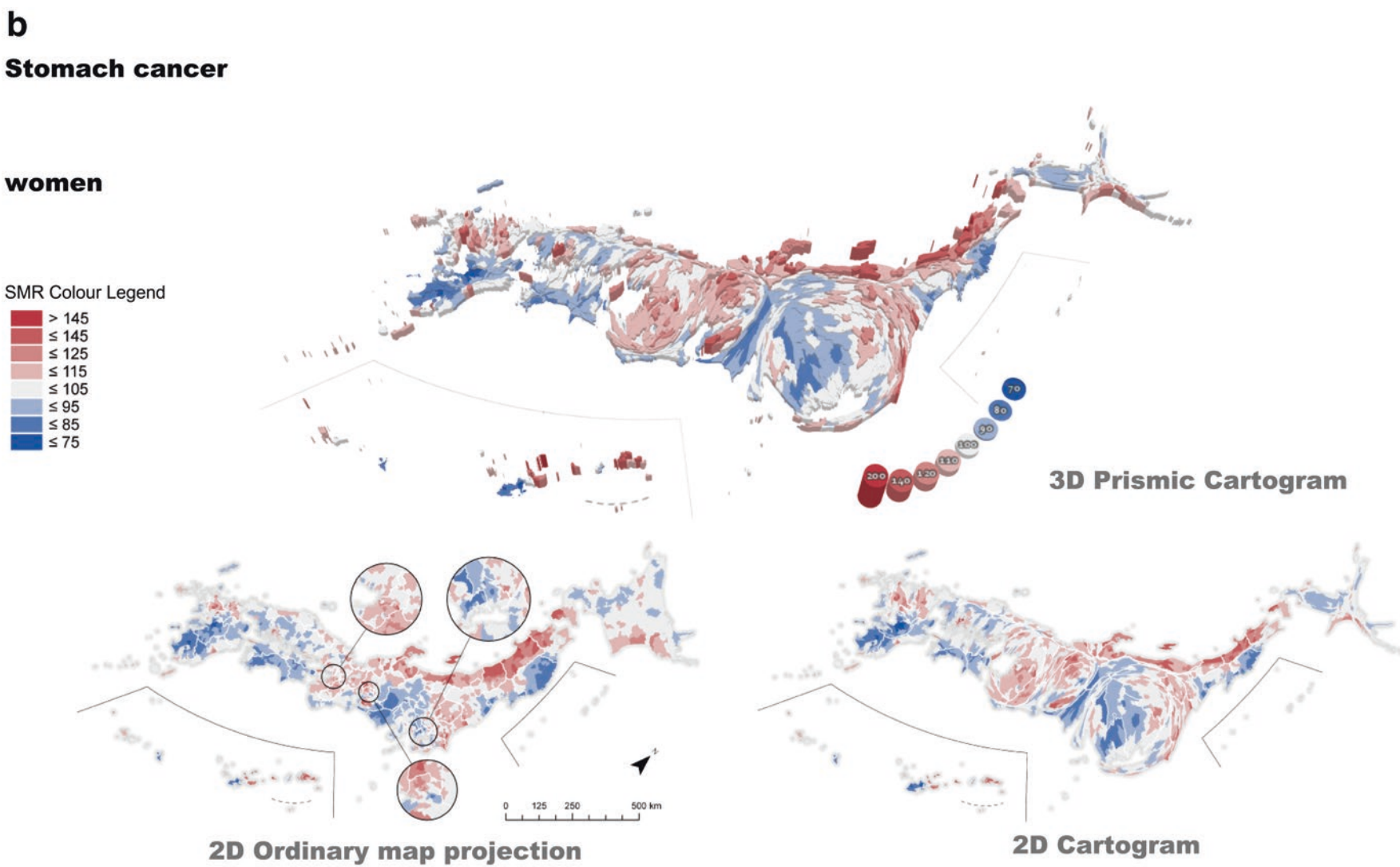
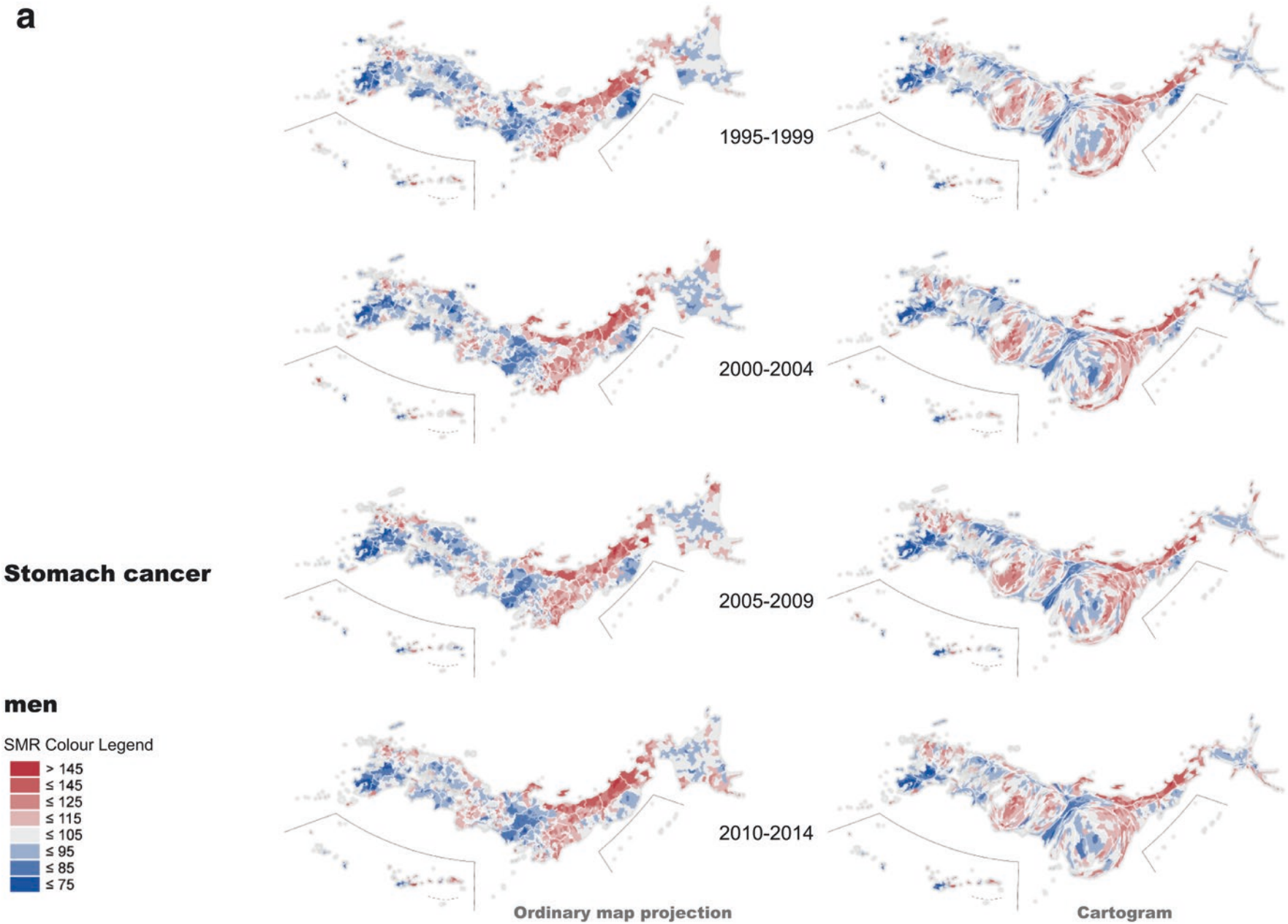


Fig. 4.11 SMR distribution of stomach cancer, 2010–2014. (**a**) Men. (**b**) Women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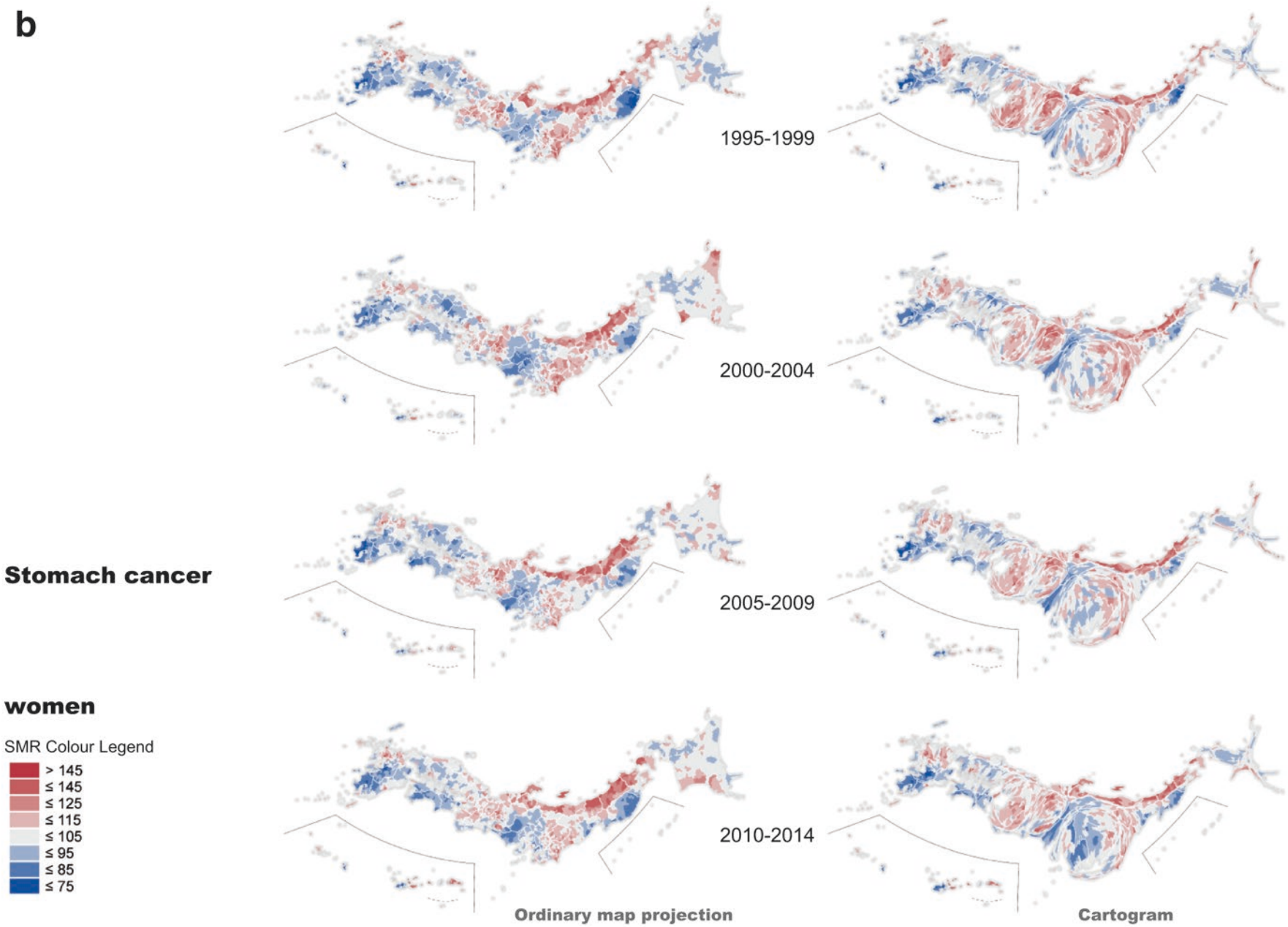


Fig. 4.12 Transition of SMR distribution of stomach cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

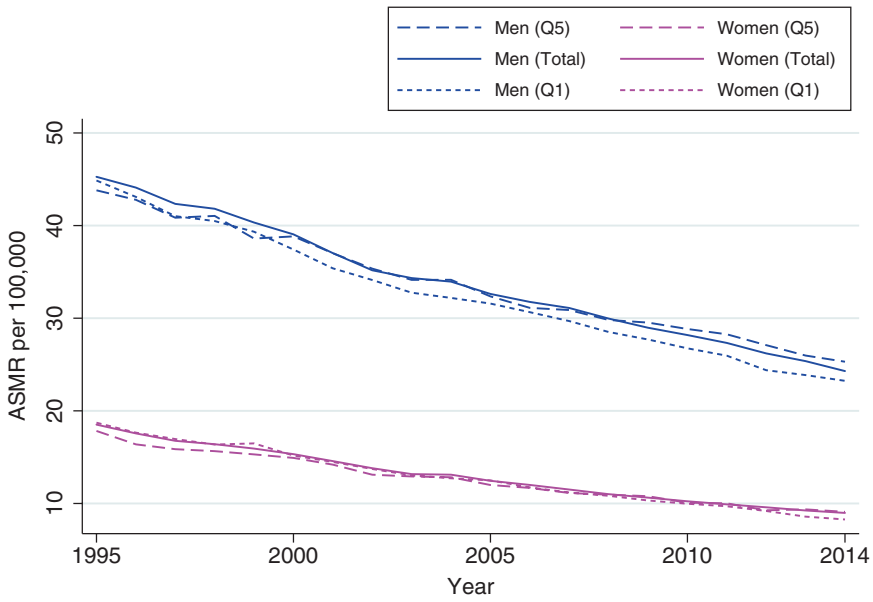


Fig. 4.13 Annual transition in the ASMR of stomach cancer from 1995 to 2014

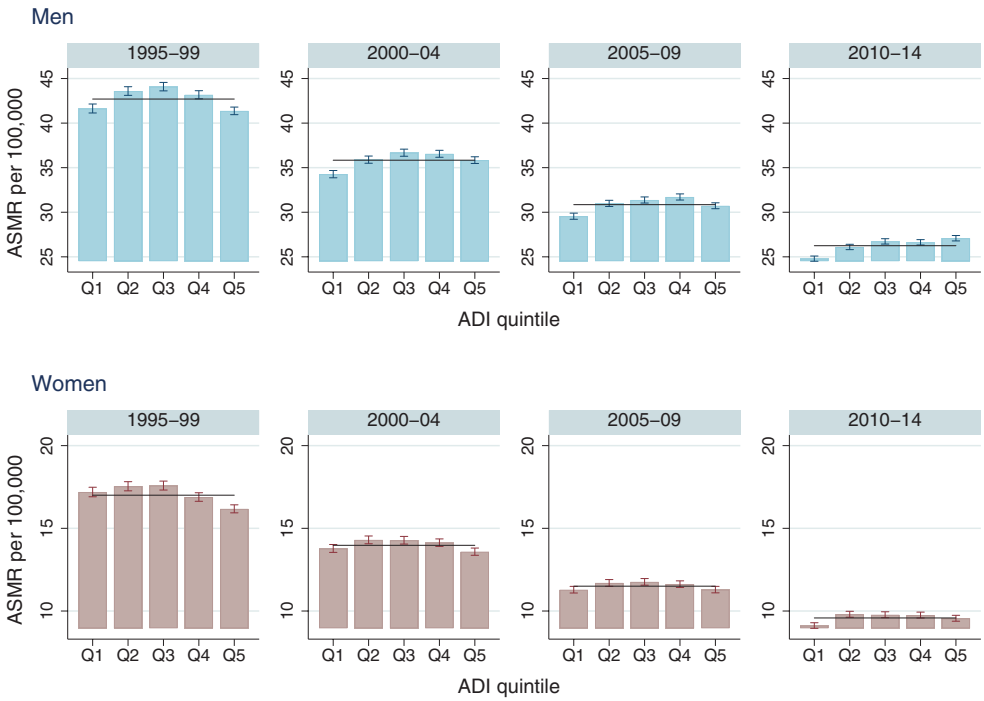


Fig. 4.14 The transition in the ASMR distribution of stomach cancer by ADI quintile (top: men, bottom: women)

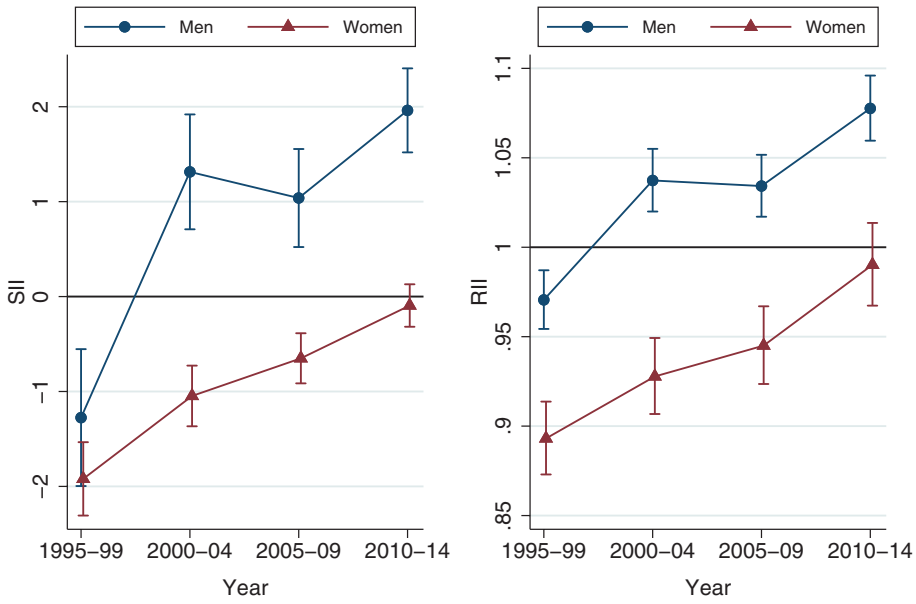


Fig. 4.15 Transition in SII and RII of stomach cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.4 Colorectal Cancer (ICD10: C18–C20): Preventable but Still a Serious Enemy

Yuri Ito

Overview

According to the most recent reports for cancer incidence in 2014, colorectal cancer is the most common cancer incidence site in Japan (Cancer Information Service 2018). The colorectal cancer mortality rate increased until the mid-1990s and then decreased slightly. Japan has one of the highest incidence rates in the world, and it is still increasing. One of the reasons for the steady increase in both incidence and mortality rates until the 1990s was the change from traditional Japanese food to a more Western style diet in Japan. In 1992, the Japanese government started a screening programme for colorectal cancer using the Faecal Occult Blood Test, which was the earliest implementation of such a programme in the world, but coverage was still insufficient.

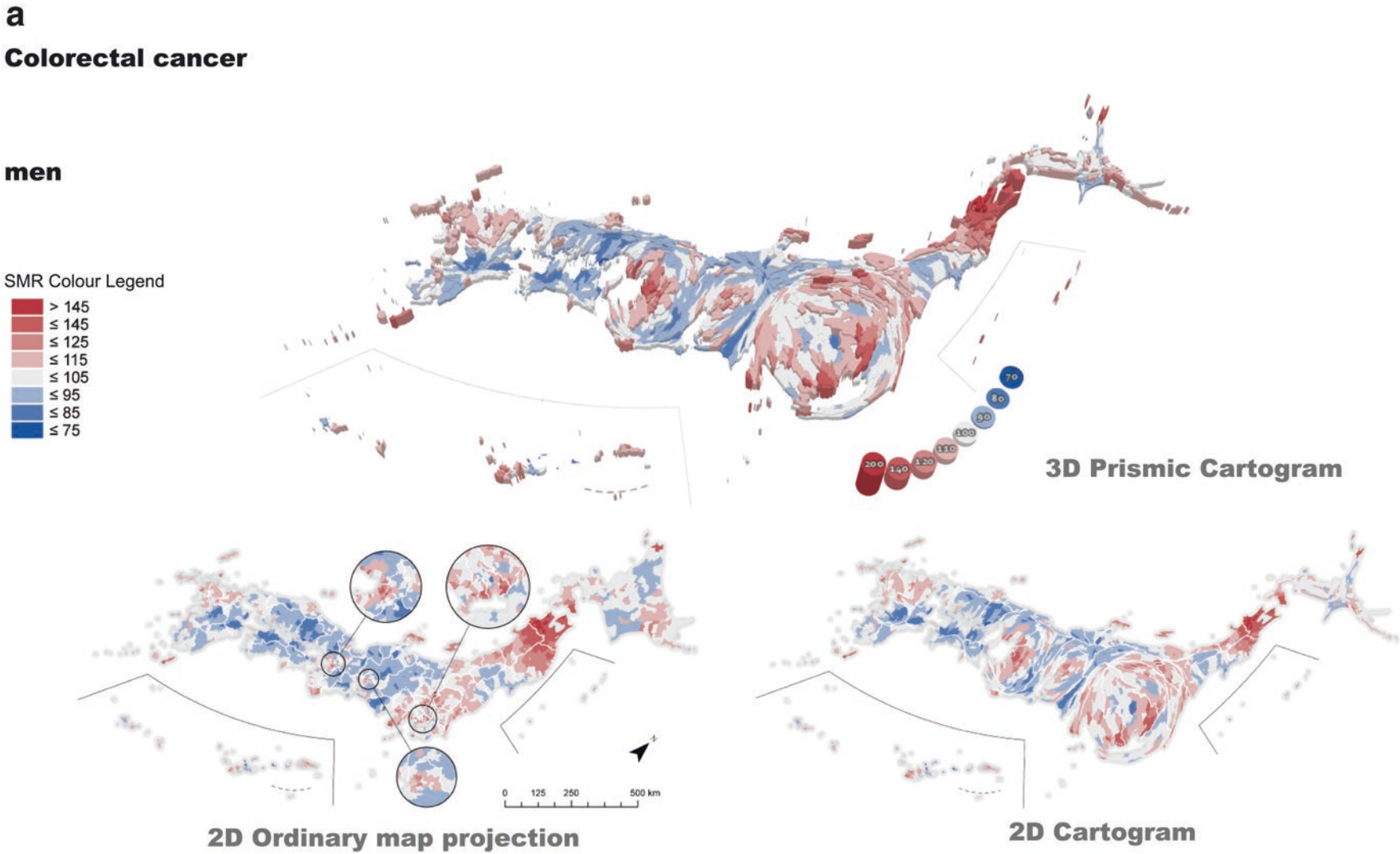
The SMR maps (Fig. 4.16) show that among men, high SMR areas were spread over the northern part of the Tohoku region including Aomori, Akita and Iwate Prefectures, and the metropolitan areas of the Kanto and Kinki regions. Among women, high SMR areas were observed in Aomori and the South of Hokkaido Prefecture.

In Japan, colorectal cancer incidence is mainly attributed to active tobacco smoking (20.4% in men, 4.5% in women), alcohol intake (32.9% in men, 2.1% in women), overweight and obesity (5.2% in men and 4.0% in women) (Inoue et al. 2012). The high SMRs in Aomori Prefecture could be related to the high prevalence of these risk factors (Ministry of Health Labour and Welfare 2016).

Transitions and Socioeconomic Disparities

High SMRs in the Tohoku region have slightly increased for both sexes, while SMRs have decreased in the Tokyo metropolitan areas (Fig. 4.17). In the most recent period from 2010 to 2014, a clear variation in SMRs within the Tokyo metropolitan area was observed in men.

The ASMR of colorectal cancer slightly decreased until 2010, and then stabilised for both sexes (Fig. 4.18). Among men, the lowest ASMR was in Q3 and the highest in Q1 and Q5 in 1995–1999 (Fig. 4.19). After 2000, clear socioeconomic gradients were observed for the ASMR of colorectal cancer, and this became wider in men, according to the transition of SII (Fig. 4.20). Among women, an inverse gradient of the deprivation gap was observed in 1995–1999 (Fig. 4.19). In the most recent period from 2010 to 2014, a clear deprivation gap in mortality between the least and most deprived areas was observed in women. The RII is slightly higher in men than in women and has increased during the 20 years from 1995 to 2014 (Fig. 4.20).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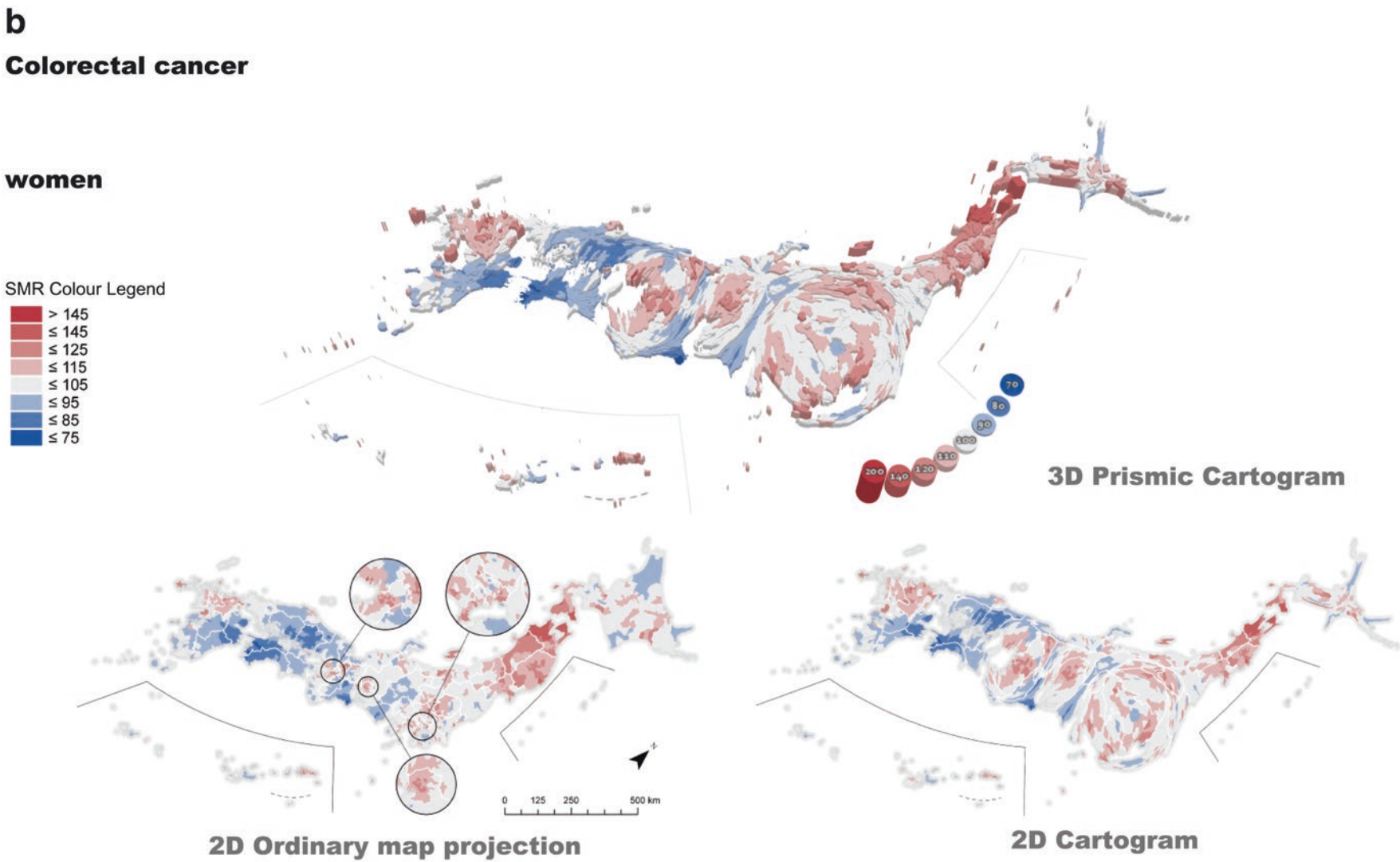
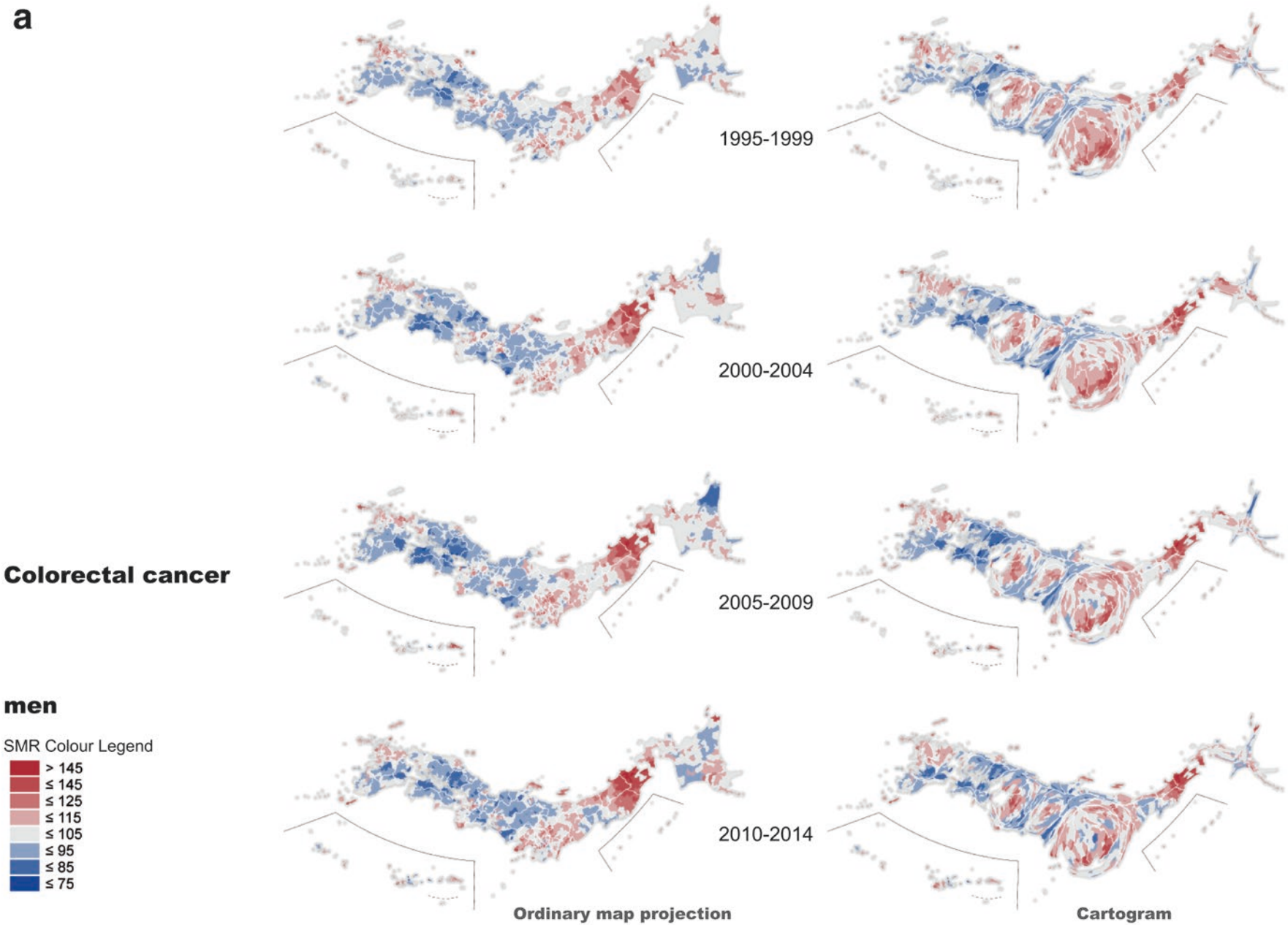


Fig. 4.16 SMR distribution of colorectal cancer, 2010–2014. (**a**) Men. (**b**) Women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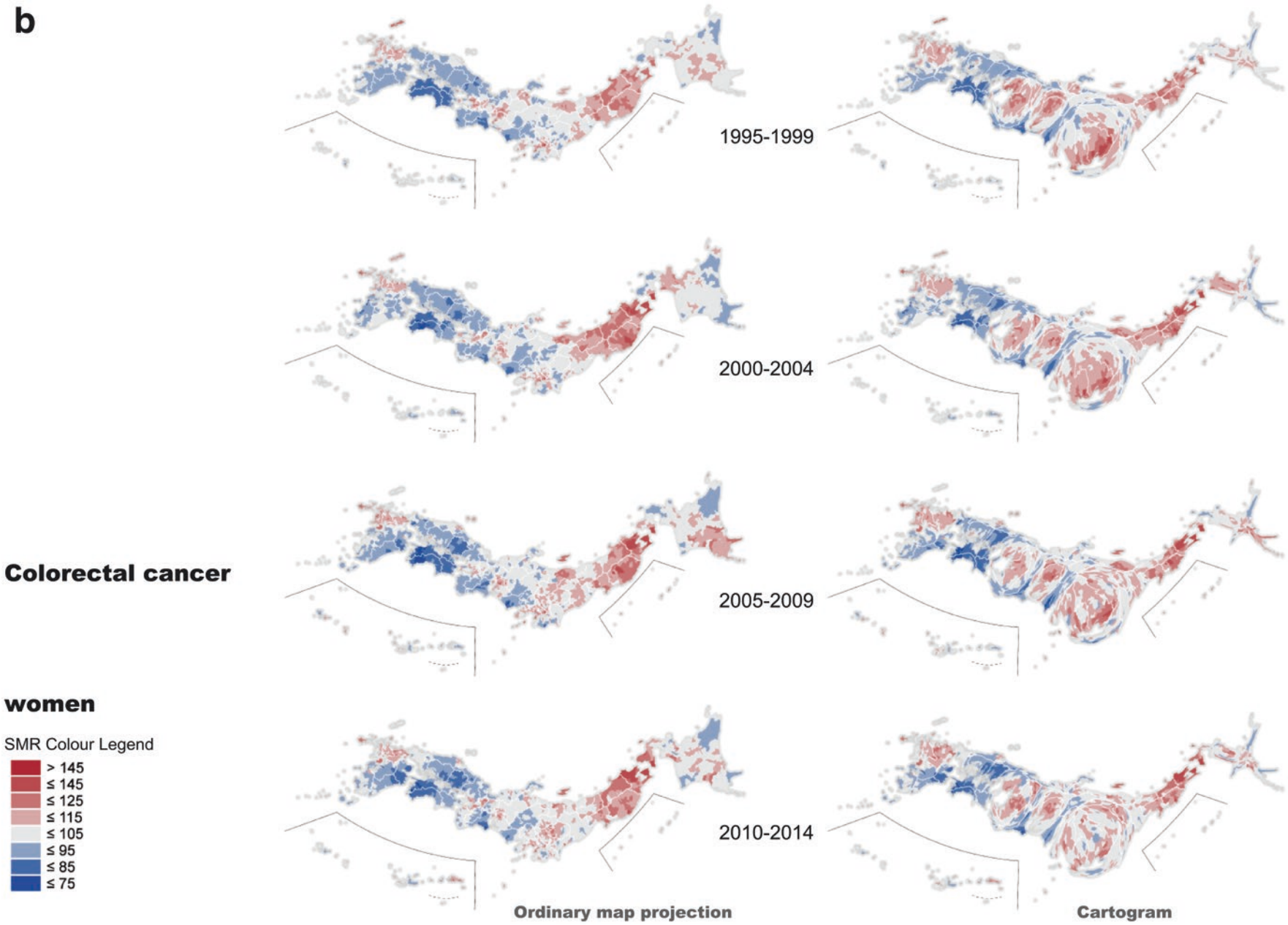


Fig. 4.17 Transition of SMR distribution of colorectal cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

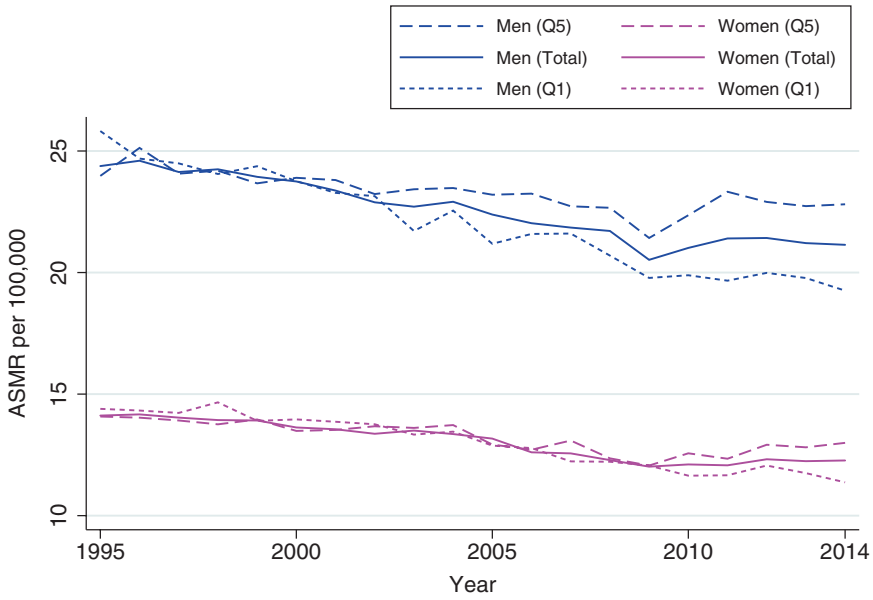


Fig. 4.18 Annual transition in the ASMR of colorectal cancer from 1995 to 2014

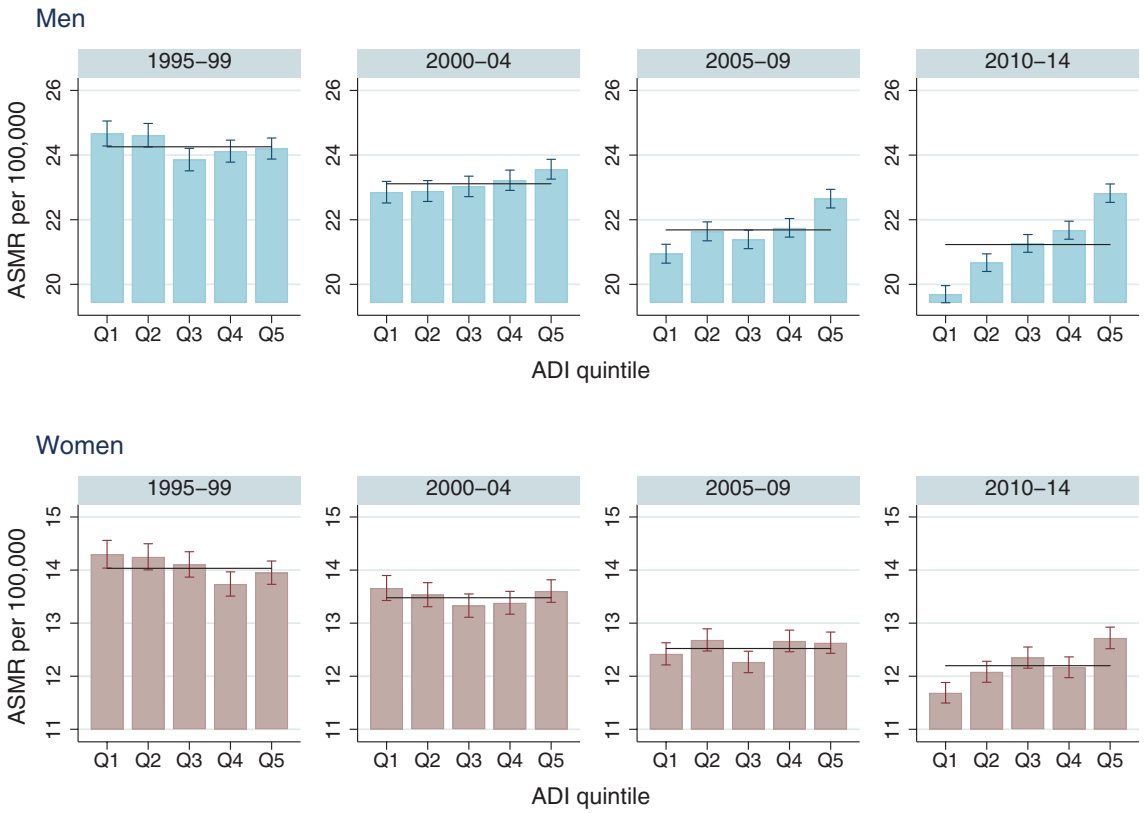


Fig. 4.19 The transition in the ASMR distribution of colorectal cancer by ADI quintile (top: men, bottom: women)

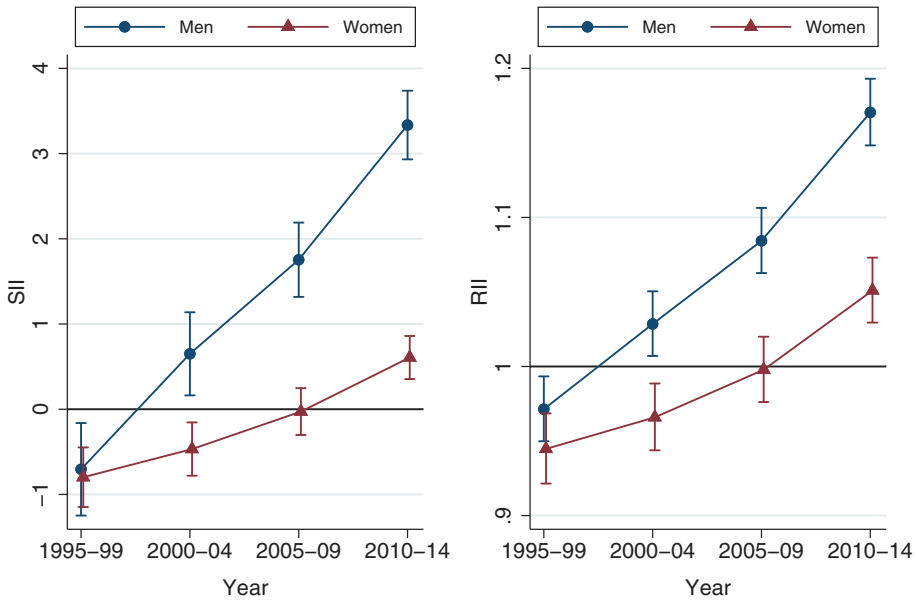


Fig. 4.20 Transition in SII and RII of colorectal cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.5 Liver and Intrahepatic Bile Duct Cancer (ICD10: C22): Eliminating Cancer in the Near Future

Yuri Ito

Overview

Trends in liver and intrahepatic bile ducts cancer (hereafter called liver cancer) incidence and mortality rates were very distinctive in Japan, showing a steady increase until the end of the 1990s, and then a dramatic decrease, which was related to the change in prevalence of hepatitis C viruses (HCV) in Japan (Tanaka et al. 2008). In Japan, the highly prevalent HCV caused high incidence and death rates due to hepatocellular carcinoma (HCC). The population born in the early 1930s has the highest risk of HCV, due to transmission through blood transfusions and parenteral medical procedures (Tanaka et al. 2008; Ito et al. 2011). The birth cohort born in 1925–1935 showed the highest peak of incidence and mortality, and after this cohort, incidence decreased markedly, due to the decrease in HCV prevalence.

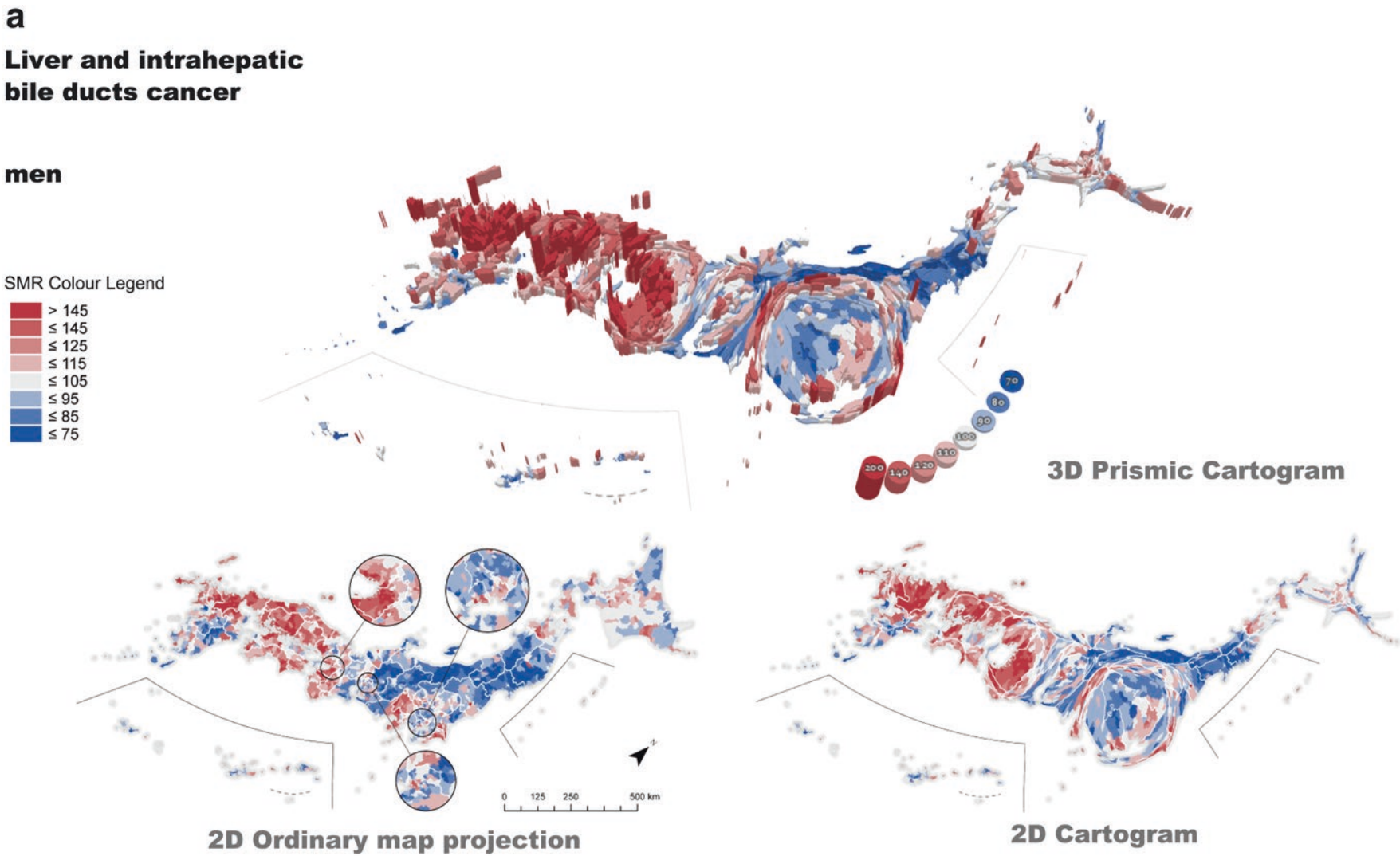
SMRs are much higher in south-western Japan than in the north-east for both sexes (Fig. 4.21). Apart from western Japan, high SMR areas were observed in several local areas in Aomori, Shizuoka, Yamanashi, Fukui and Saitama Prefectures.

In Japan, liver cancer is mainly attributed to infection with hepatitis C viruses (HCV, 70–80%) and hepatitis B viruses (HBV, about 10%), active tobacco smoking (35.1% in men, 6.8% in women) and alcohol intake (11.6% in men, 12.3% in women) (Inoue et al. 2012). A recent report showed high prevalence of both HBV and HCV in the western areas of Japan and low prevalence in the Kanto and Hokuriku/Chubu regions (Tanaka et al. 2018). High prevalence of smoking as well as heavy alcohol intake is also thought to be related to the high SMR areas at the prefecture level (Ministry of Health Labour and Welfare 2016).

Transitions and Socioeconomic Disparities

A clear regional contrast between the high mortality in the south-west and the low mortality in the north-east has not fundamentally changed during the 20 years from 1995 to 2014 (Fig. 4.22). In Tokyo City, a regional difference between the higher SMR in the affluent western suburbs and the lower SMR in the east of the city was observed, but in the period from 2010 to 2014 the regional difference became less pronounced.

While the ASMR of liver cancer has steadily decreased (Fig. 4.23), the ASMR by deprivation group showed clear socioeconomic disparities for both sexes (Fig. 4.24). Both absolute and relative gaps were higher in men than in women. In the period 1995–1999, the SII of liver cancer was the largest among major cancer sites (12.5 death per 100,000 person), which contributed 46% to the SII of ASMR of all cancers (27.0 deaths per 100,000 person) in men (Fig. 4.25). In 2010–2014, the SII of liver cancer in men decreased and contributed 25% to the SII of all cancers. This means that socioeconomic inequality in liver cancer mortality was one


a
Liver and intrahepatic bile ducts cancer
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
≤ 85
≤ 75
70
80
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120
140
200
3D Prismic Cartogram
0 125 250 500 km
2D Ordinary map projection
2D Cartogram

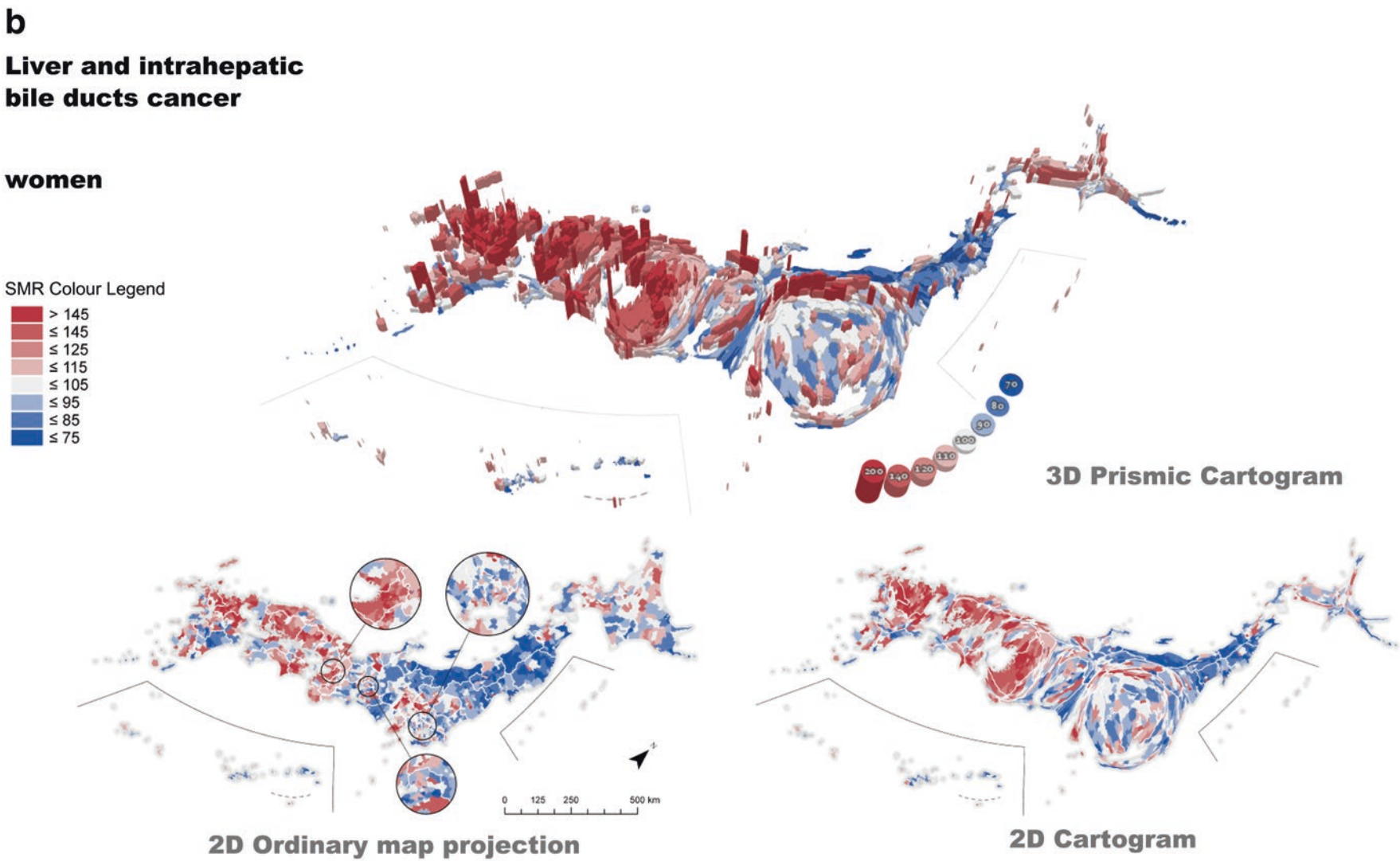
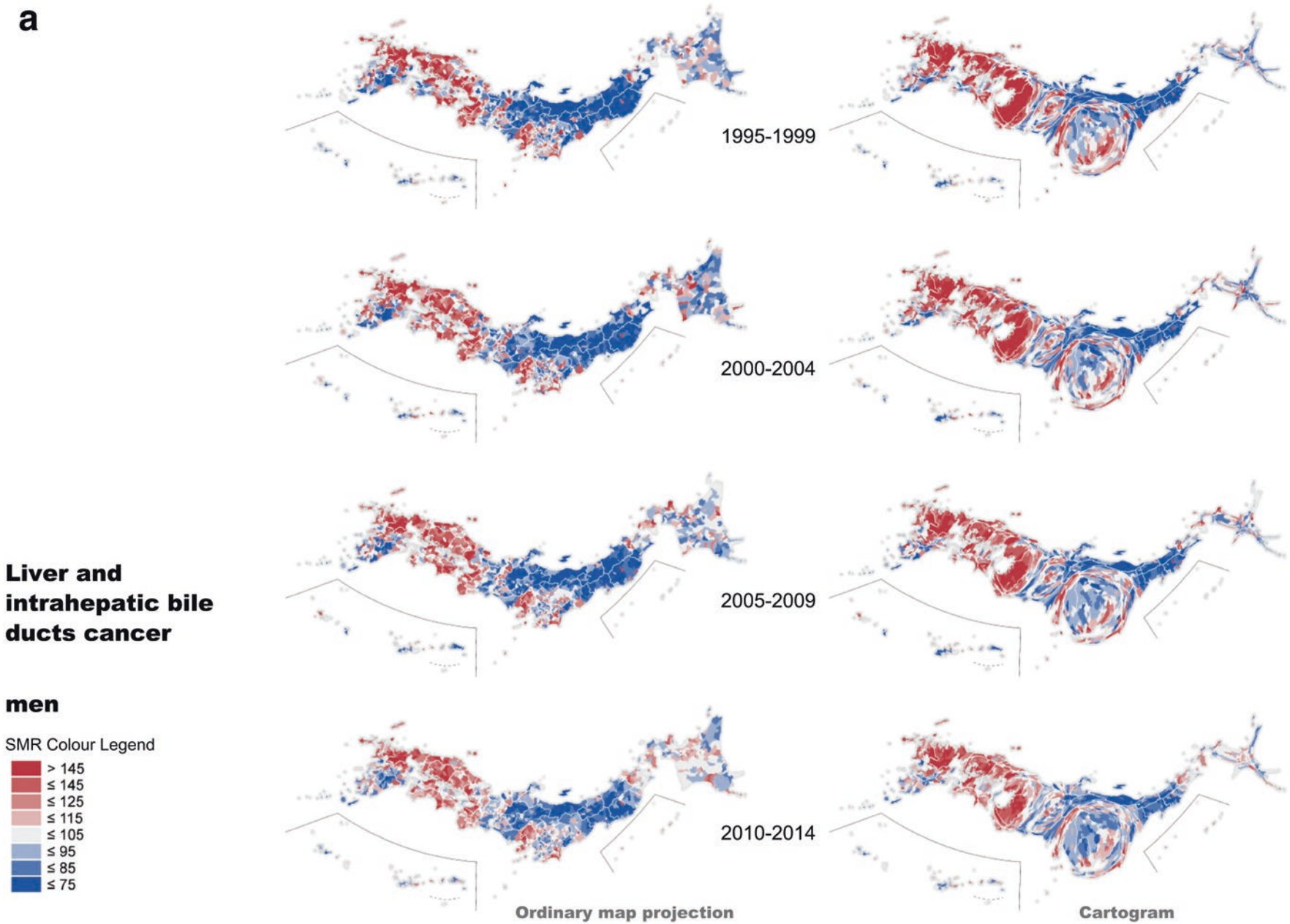


Fig. 4.21 SMR distribution of liver and intrahepatic bile ducts cancer, 2010–2014. (**a**) Men. (**b**) Women


a
Liver and intrahepatic bile ducts cancer
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
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≤ 85
≤ 75
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

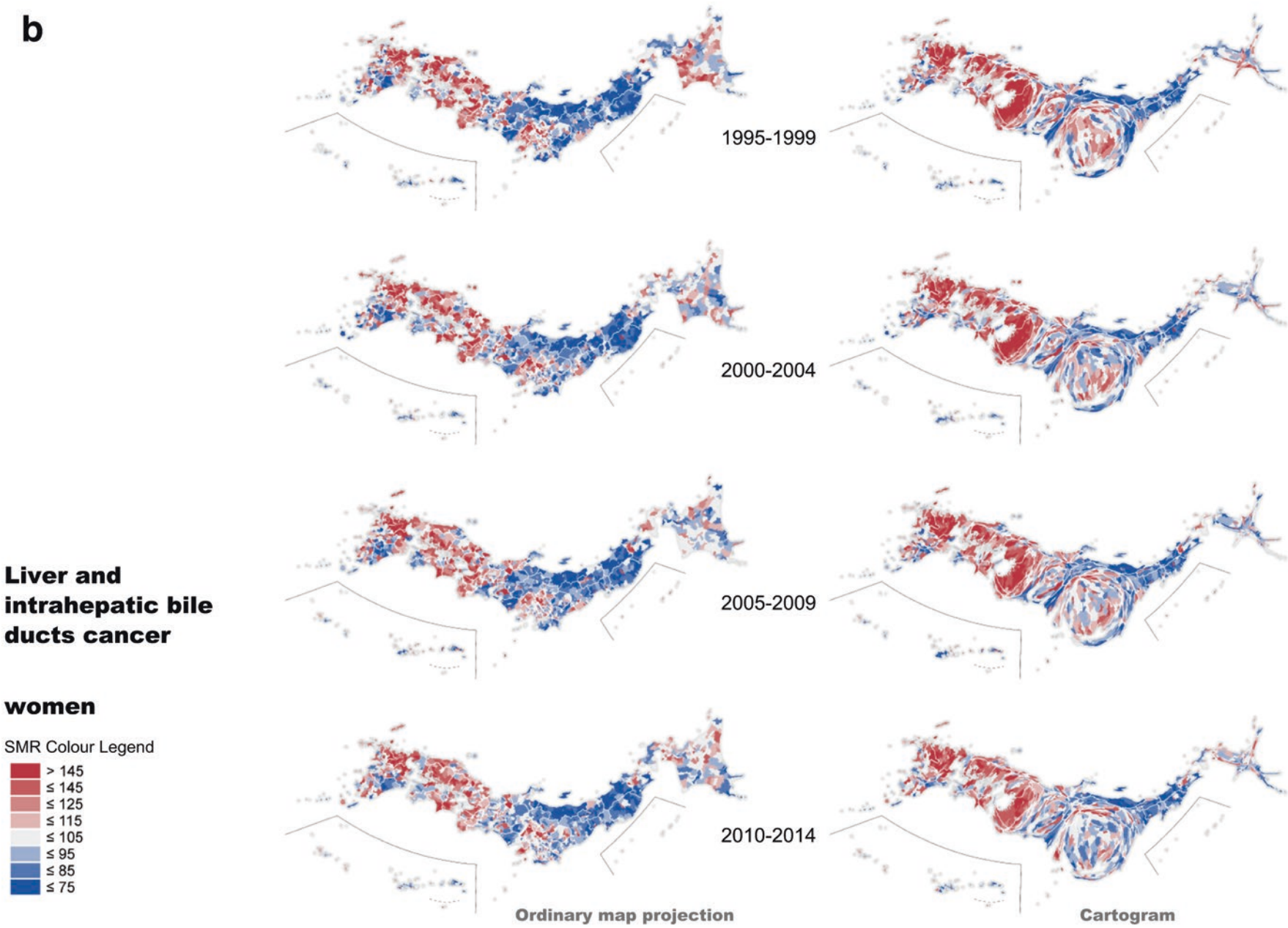


Fig. 4.22 Transition of SMR distribution of liver and intrahepatic bile ducts cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

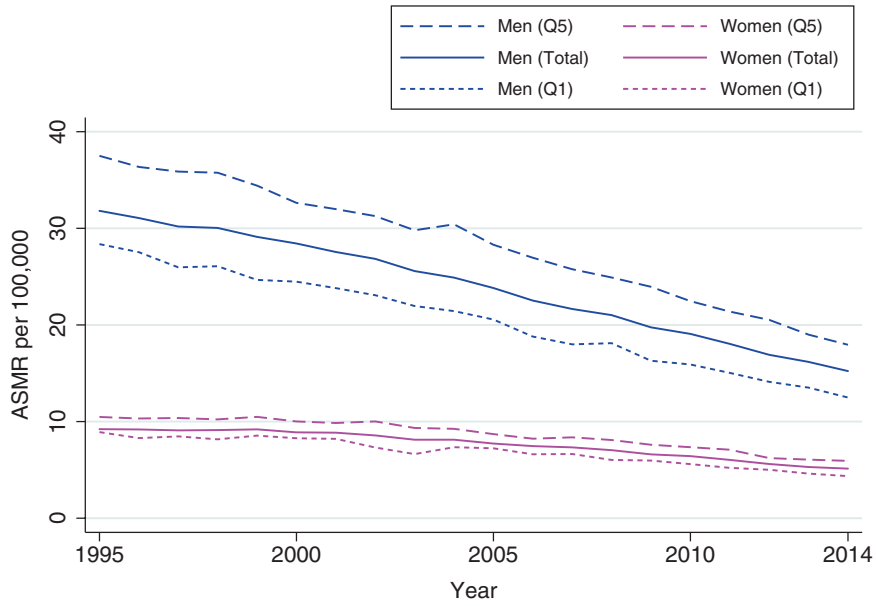


Fig. 4.23 Annual transition in the ASMR of liver and intrahepatic bile ducts cancer from 1995 to 2014

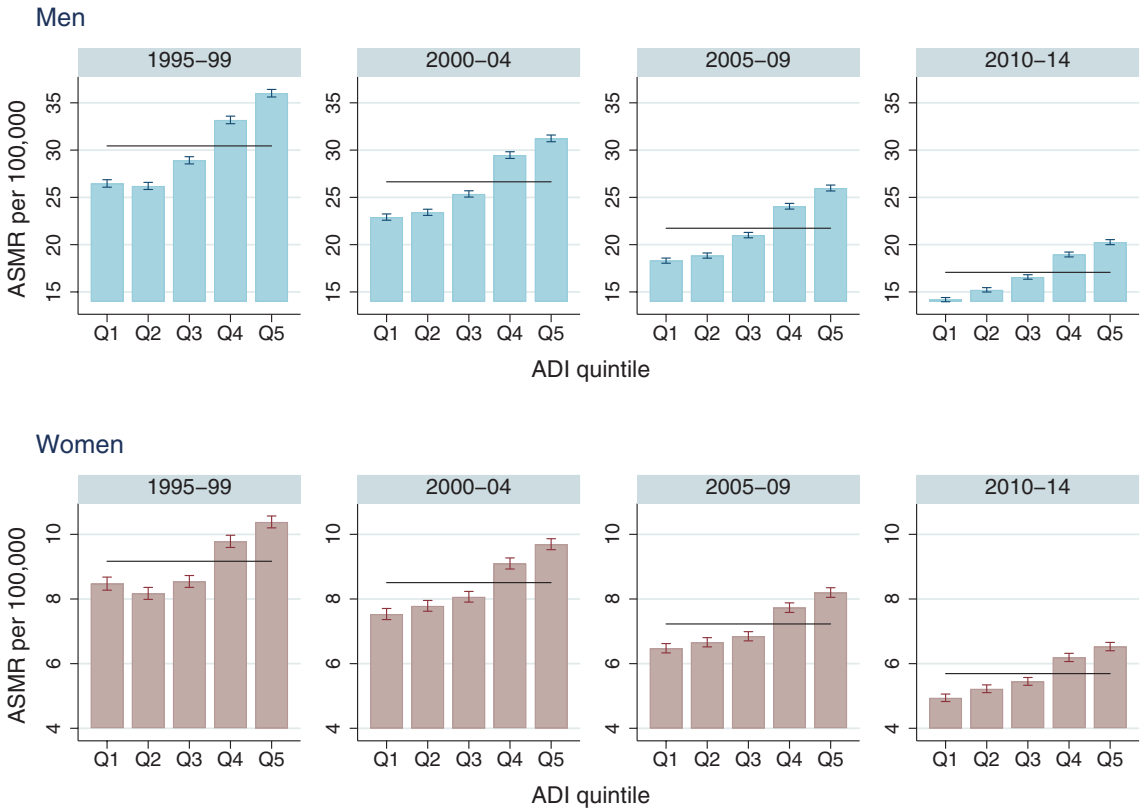


Fig. 4.24 The transition in the ASMR distribution of liver and intrahepatic bile ducts cancer by ADI quintile (top: men, bottom: women)

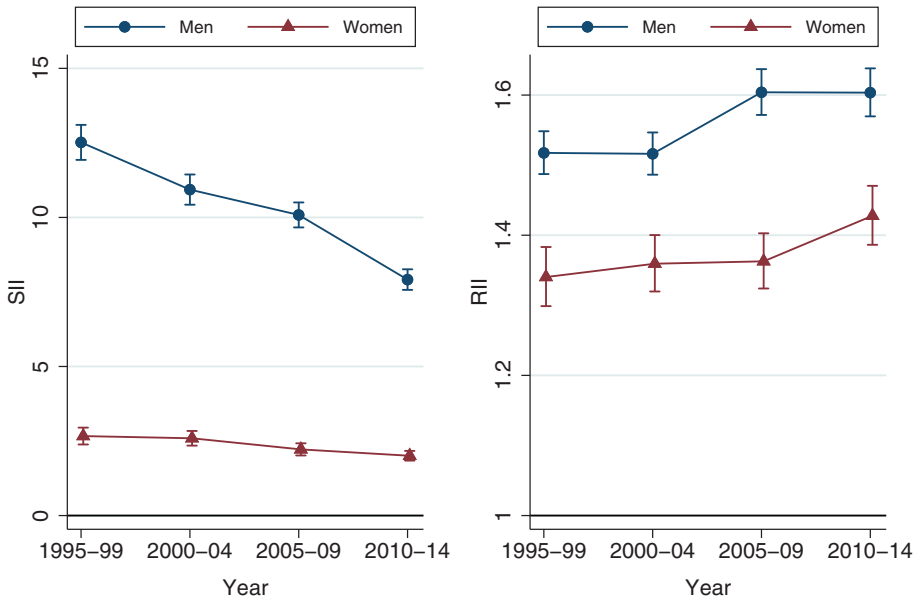


Fig. 4.25 Transition in SII and RII of liver and intrahepatic bile duct cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

of the largest issues in Japan, and despite decreasing in absolute terms, it still exists. After World War II, HCV infection spread mainly in western Japan and deprived people were more likely to transmit the viruses, due to unsafe practices (use of unsterilised needles and syringes) during illegal plasma donation. In addition, the wide deprivation gap might be related to differences in access to treatment for HBV/HCV carriers and prevalence of other risk factors by deprivation group.

4.6 Gallbladder and Other Biliary Tract Cancer (ICD10: C23–C24): A Rural Cancer

Yoshikazu Nishino

Overview

Gallbladder and other biliary tract cancer (hereafter called gallbladder cancer) is the eighth most common cause of cancer death in men and the seventh in women, which equates to 4% and 6% of all cancer deaths, respectively.

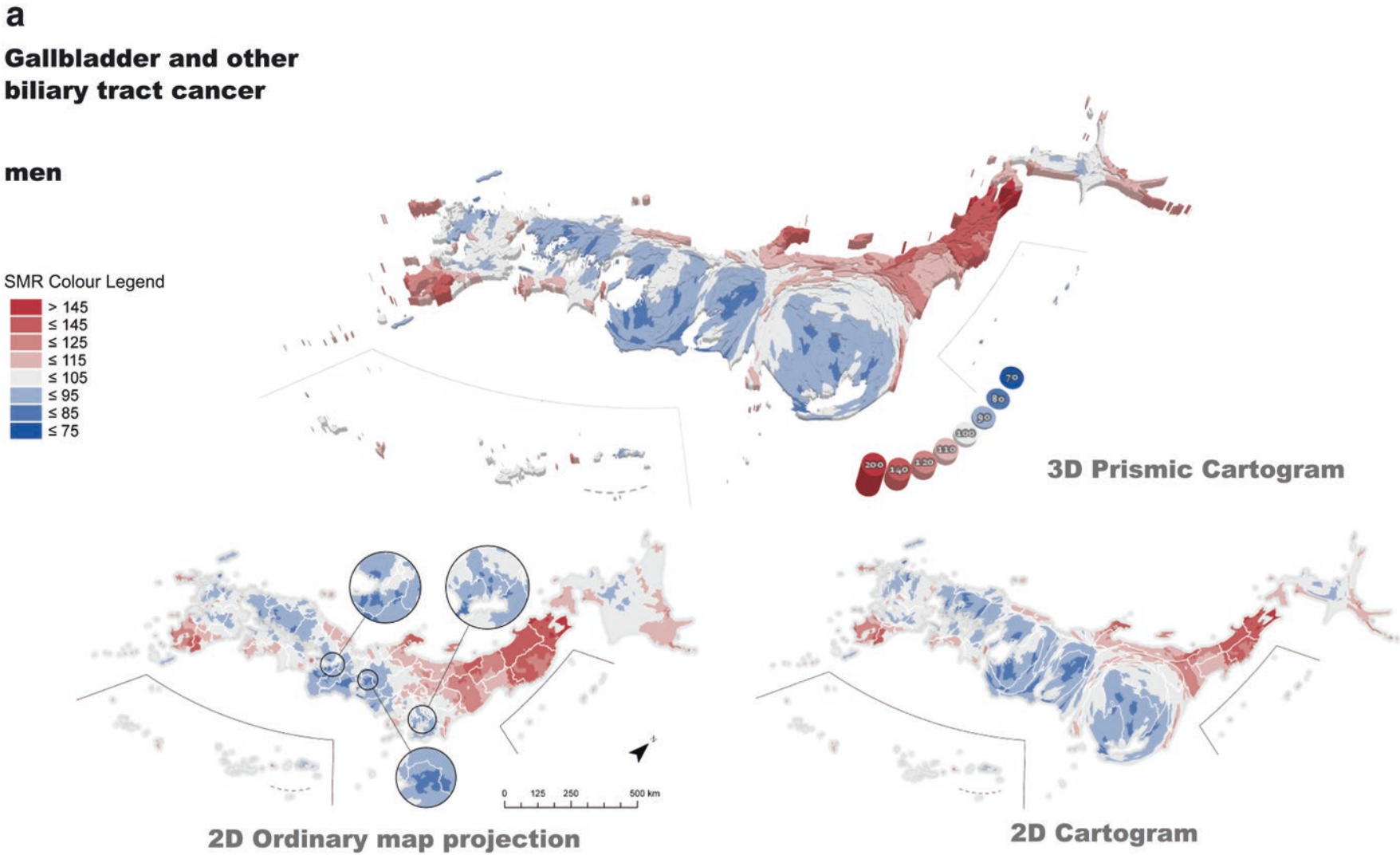
High SMRs for gallbladder cancer in both sexes were observed in the northern part of mainland Japan centred on the Tohoku region, the south of the Kyusyu region, the Noto Peninsula in the Hokuriku region and the Gotoh islands of Nagasaki Prefecture (Fig. 4.26). Among women, high SMRs were also observed in the west of the Kyushu region including Nagasaki and Kumamoto Prefectures. Low SMRs were mainly observed along the so-called Taiheiyo (Pacific) belt, a huge conurbation stretching from the Tokyo metropolitan area to northern Kyusyu through the Nagoya and Osaka metropolitan areas and the industrialised cities of the Chugoku region.

High SMR areas are located in the agricultural area (mainly rice growing) in northern Japan. High SMRs for gallbladder cancer in Niigata prefecture, in the northern rice growing area, were found to be related to the high concentration of the chemical herbicide, chlornitrofen (CNP), in tap water (Yamamoto et al. 1993). Following publication of this study, use of CNP as a chemical herbicide has been prohibited.

Transitions and Socioeconomic Disparities

For the 20 years from 1995 to 2014, high SMRs were consistently observed in the north of the main island of Japan (Fig. 4.27). During the 20 years, low SMRs have been observed among men in the Tokyo, Chukyo/Nagoya and Keihanshin metropolitan areas. Similar trends were observed for women in the Tokyo and Keihanshin/Osaka metropolitan areas. While high SMRs were observed in 1995–2000 in the Chukyo region, they decreased after 2000.

The ASMR of this cancer has decreased during the 20 years (Fig. 4.28). Both absolute and relative deprivation gaps between Q1 and Q5 were large for both sexes (Fig. 4.29). According to the trends in RII, the relative socioeconomic inequalities of ASMR have widened in women, but sex difference in RII has disappeared (Fig. 4.30).


a
Gallbladder and other biliary tract cancer
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
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3D Prismic Cartogram
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2D Ordinary map projection
2D Cartogram

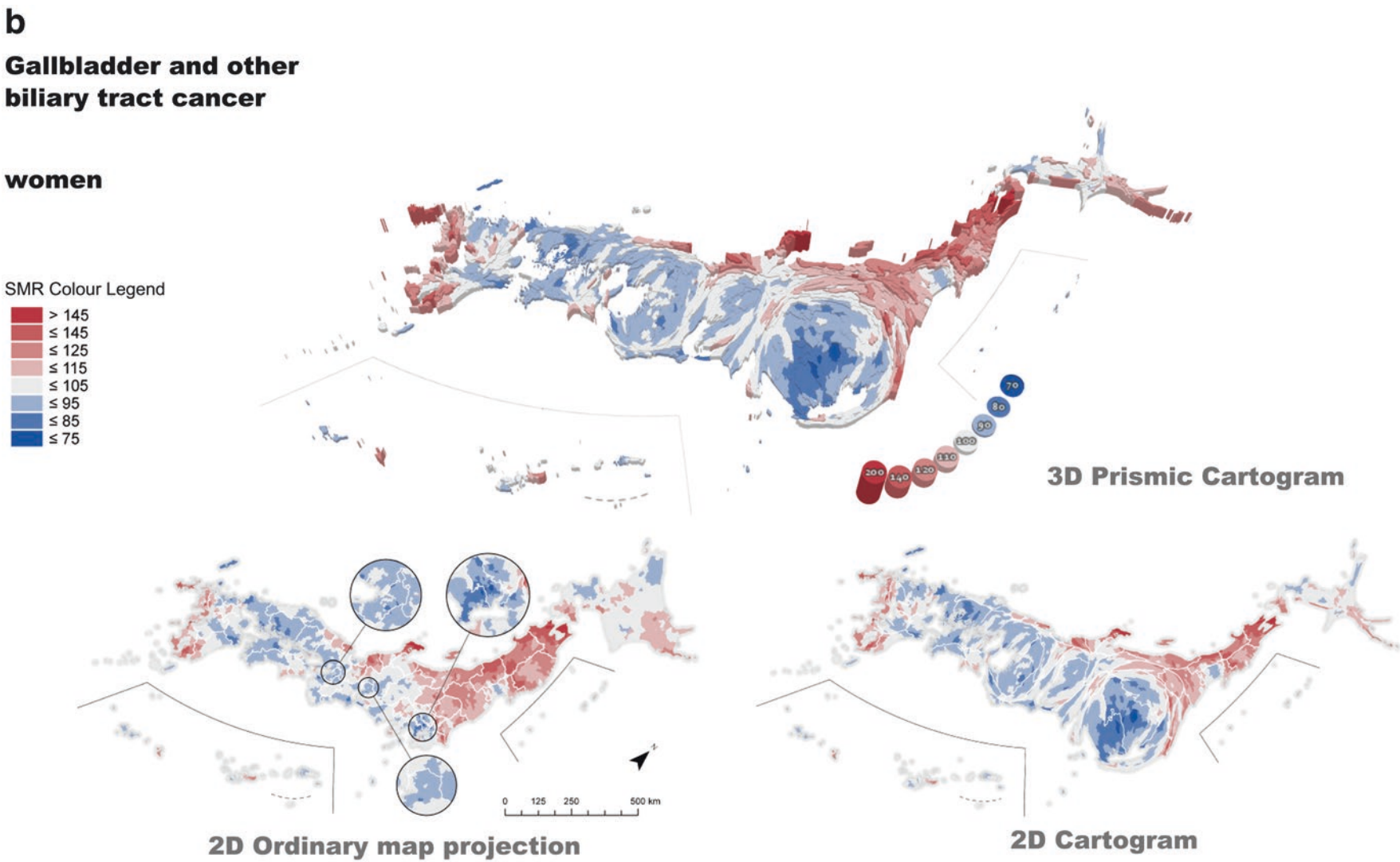
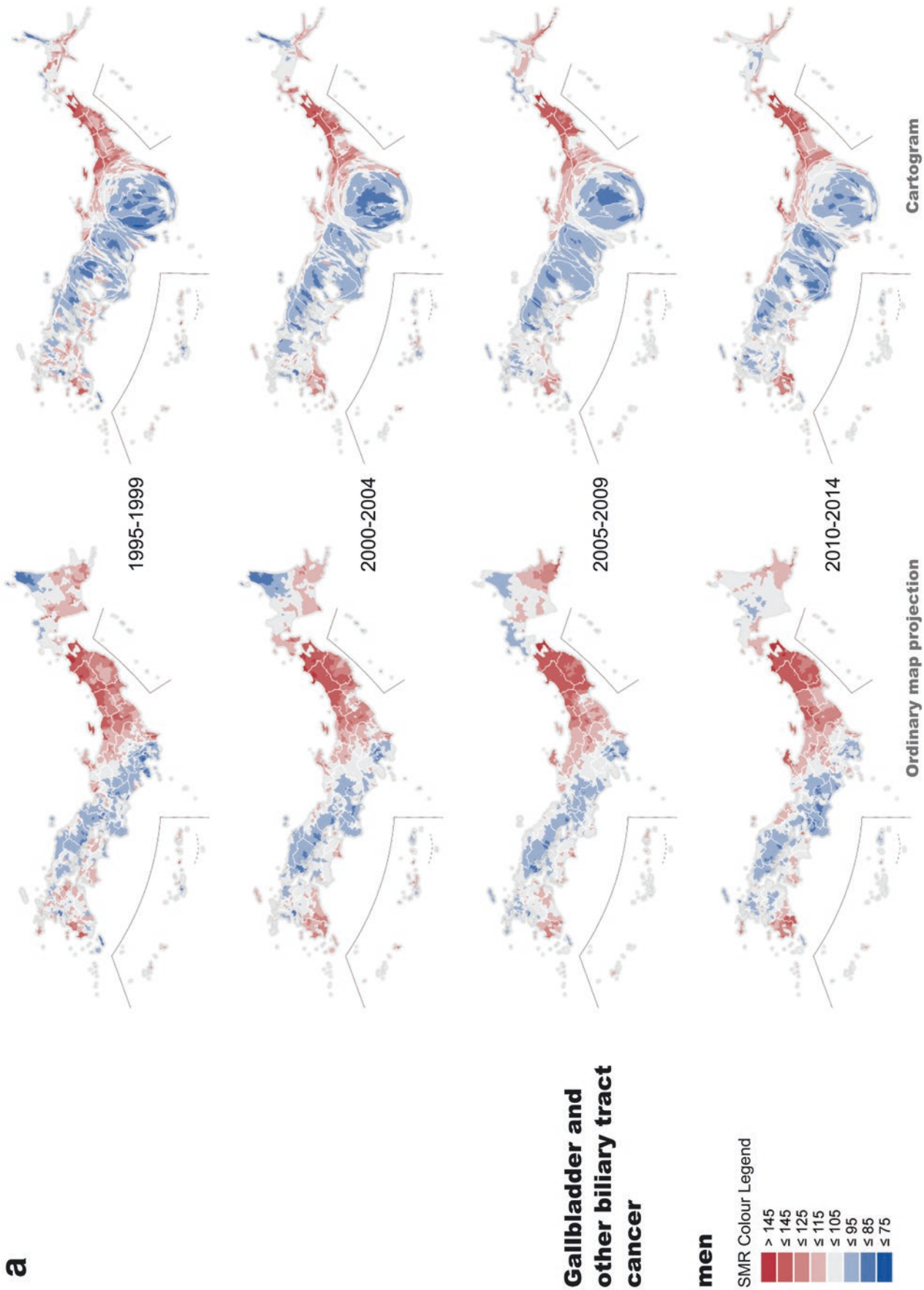


Fig. 4.26 SMR distribution of gallbladder and other biliary tract cancer, 2010–2014. (**a**) Men. (**b**) Women


a
Gallbladder and other biliary tract cancer
men
SMR Colour Legend
> 145
≤ 145
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≤ 115
≤ 105
≤ 95
≤ 85
≤ 75
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

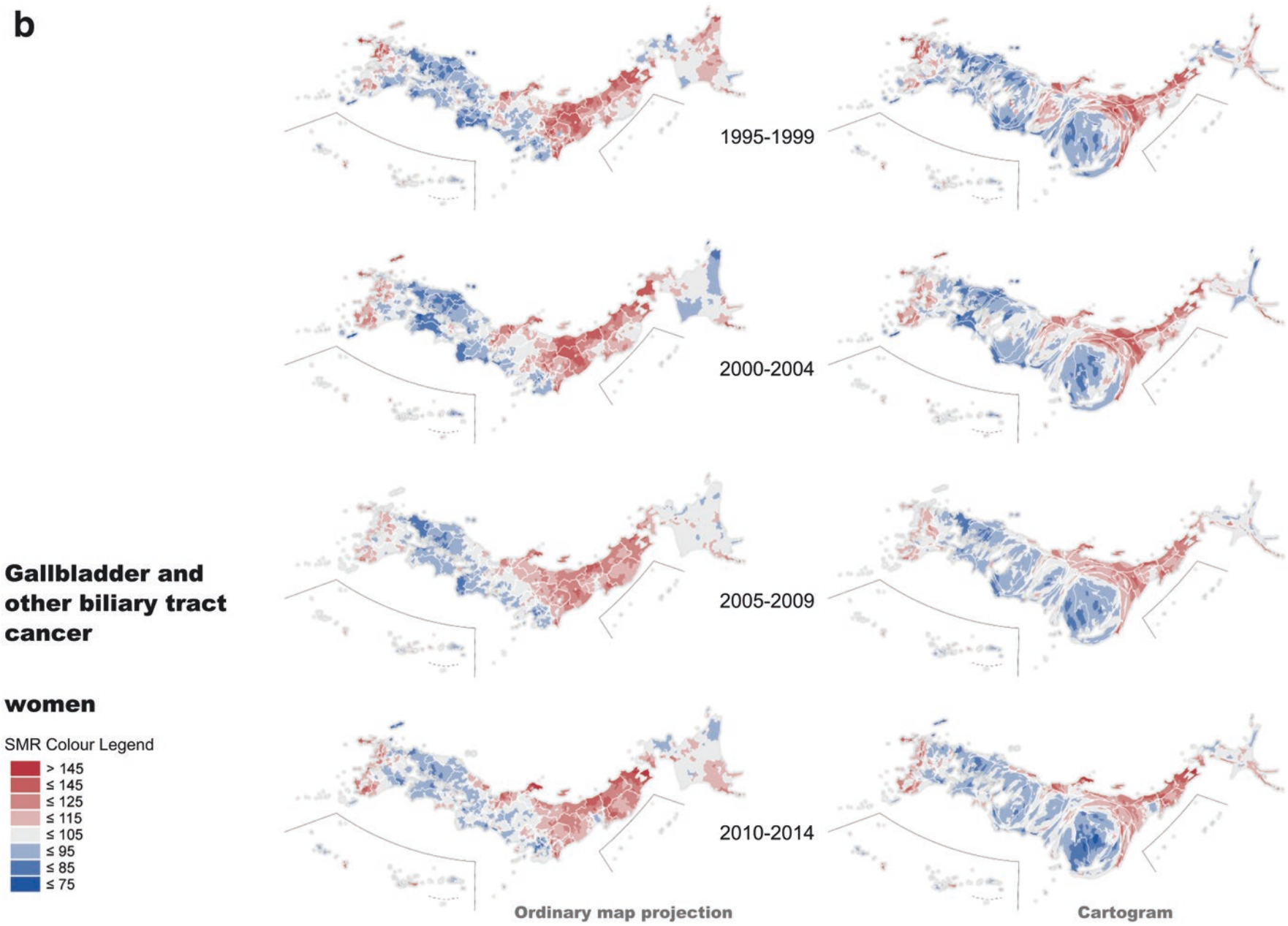


Fig. 4.27 Transition of SMR distribution of gallbladder and other biliary tract cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

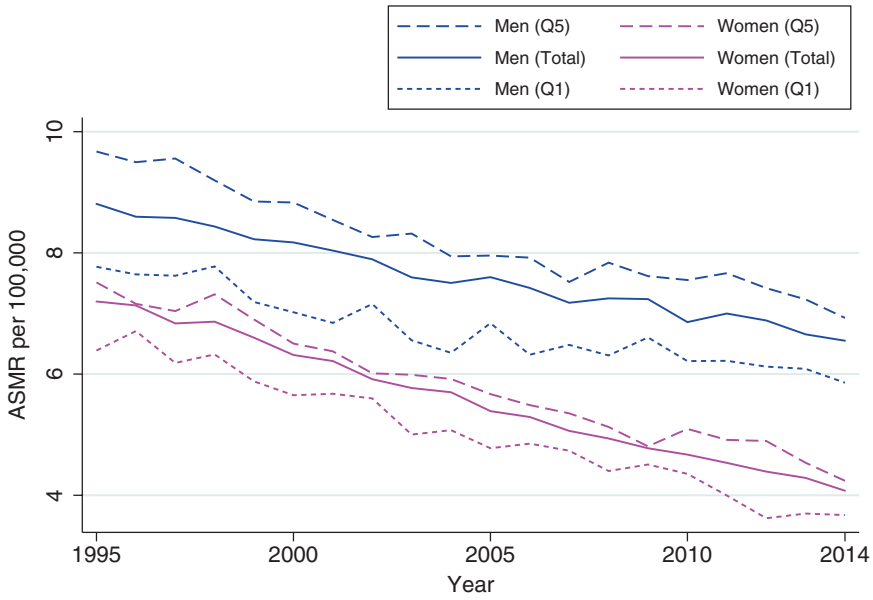


Fig. 4.28 Annual transition in the ASMR of gallbladder and other biliary tract cancer from 1995 to 2014

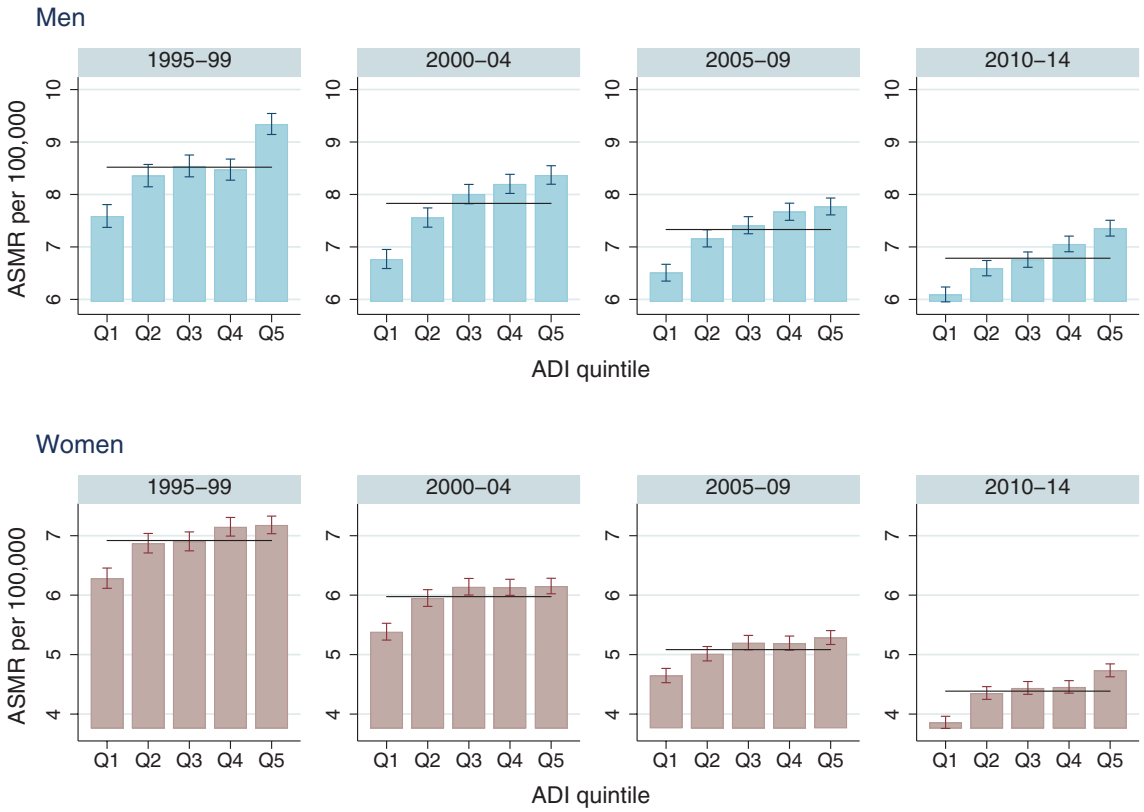


Fig. 4.29 The transition in the ASMR distribution of gallbladder and other biliary tract cancer by ADI quintile (top: men, bottom: women)

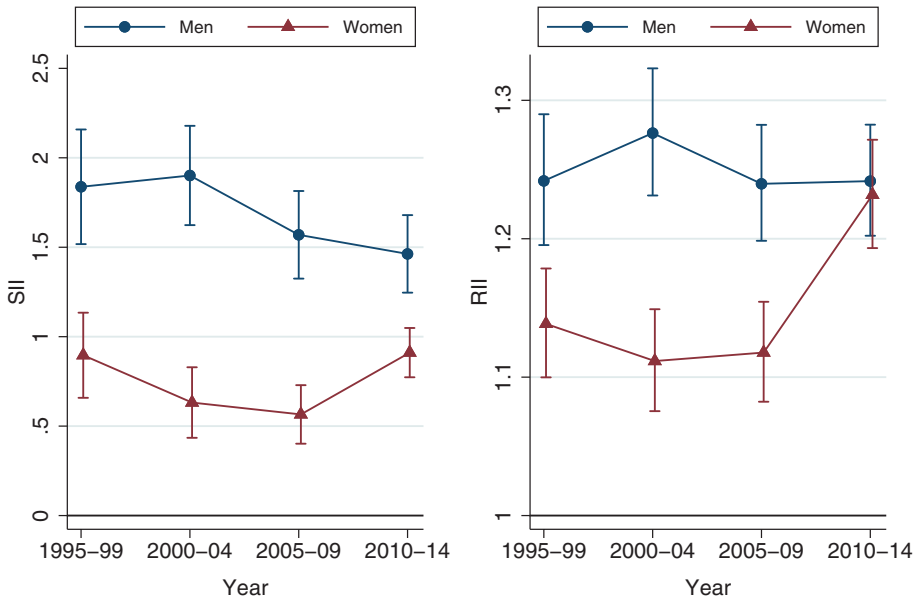


Fig. 4.30 Transition in SII and RII of gallbladder and other biliary tract cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.7 Pancreatic Cancer (ICD10: C25): The Rise of a Killer Without Symptoms

Yoshikazu Nishino

Overview

Pancreatic cancer is the fifth most common cause of cancer death in men and the third in women, equating 8% and 10% of all cancer deaths, respectively. The ASMR of pancreatic cancer in Japan is at the same level as in Western countries.

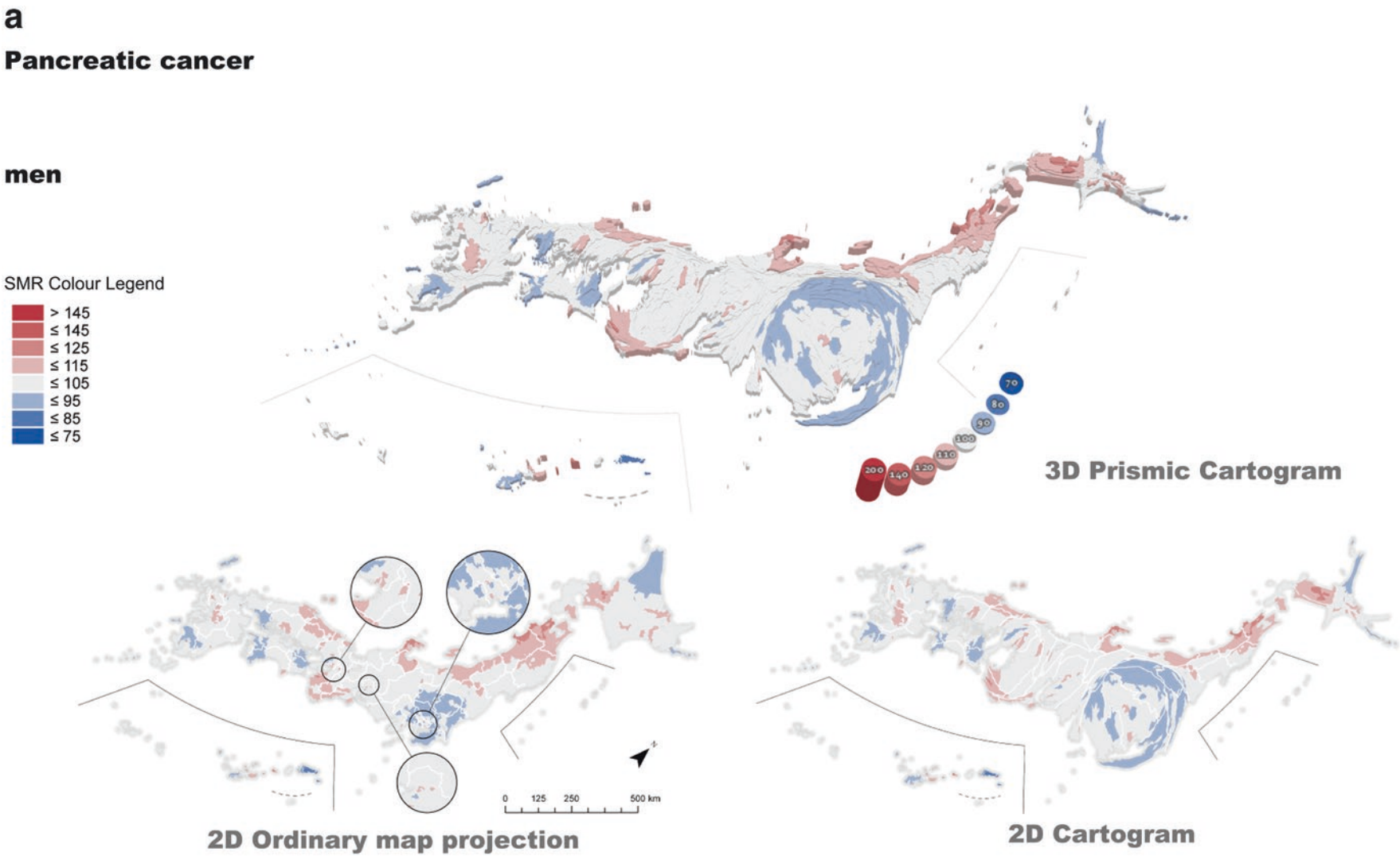
High SMRs of pancreatic cancer were observed in central Hokkaido and the Tohoku regions centred in Aomori Prefecture for both sexes and in the Hokuriku region for men (Fig. 4.31). Conversely, low SMRs were observed in the marginal areas of the Kanto region, the west of the Chugoku region and the east of the Shikoku region.

The risk factors for pancreatic cancer in Japan are tobacco smoking and diabetes. High smoking prevalence has been reported in Hokkaido and Aomori Prefectures for both sexes (Ministry of Health Labour and Welfare 2016). A high mortality rate due to diabetes was also reported in Aomori Prefecture.

Transitions and Socioeconomic Disparities

In the period 1995–1999, high SMRs were observed throughout the entire Tohoku region; they were especially high among men in Aomori and the north of Akita Prefecture. SMRs in the Tohoku region have decreased since 2000 (Fig. 4.32). The high SMR areas were limited to the north and the Sea of Japan side of the Tohoku region. Among women, the regional variation was small compared with men, but a similar distribution pattern of SMRs was observed.

The ASMR of pancreatic cancer increased during the 20 years from 1995 to 2014 (Fig. 4.33). Although wide gaps in ASMR between Q5 and Q1 were observed in men, the trend has not changed (Fig. 4.34). Among women, both absolute and relative socioeconomic inequalities have widened in the most recent period, according to RII and SII trends (Fig. 4.35).


a
Pancreatic cancer
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
≤ 85
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3D Prismic Cartogram
0 125 250 500 km
2D Ordinary map projection
2D Cartogram

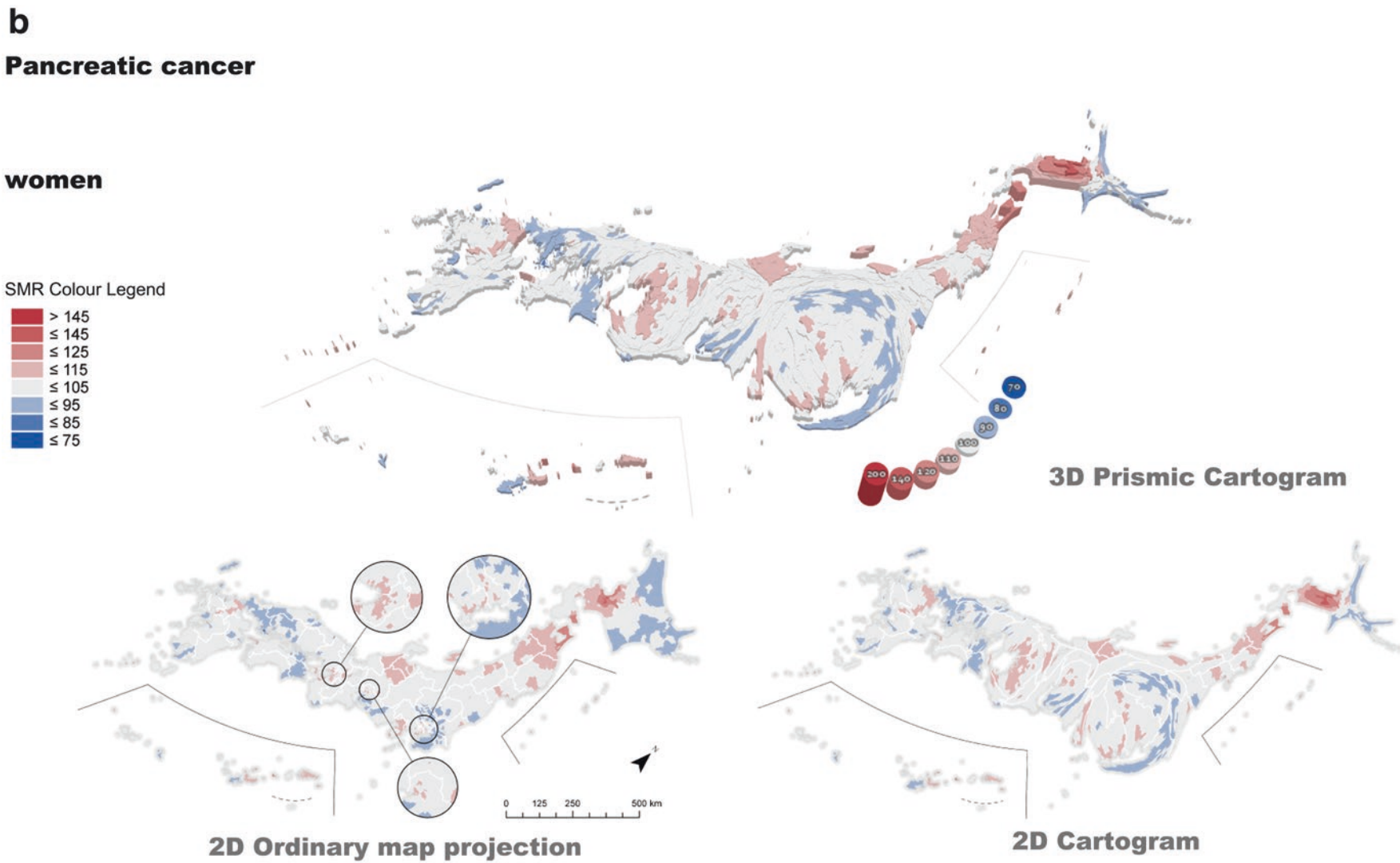
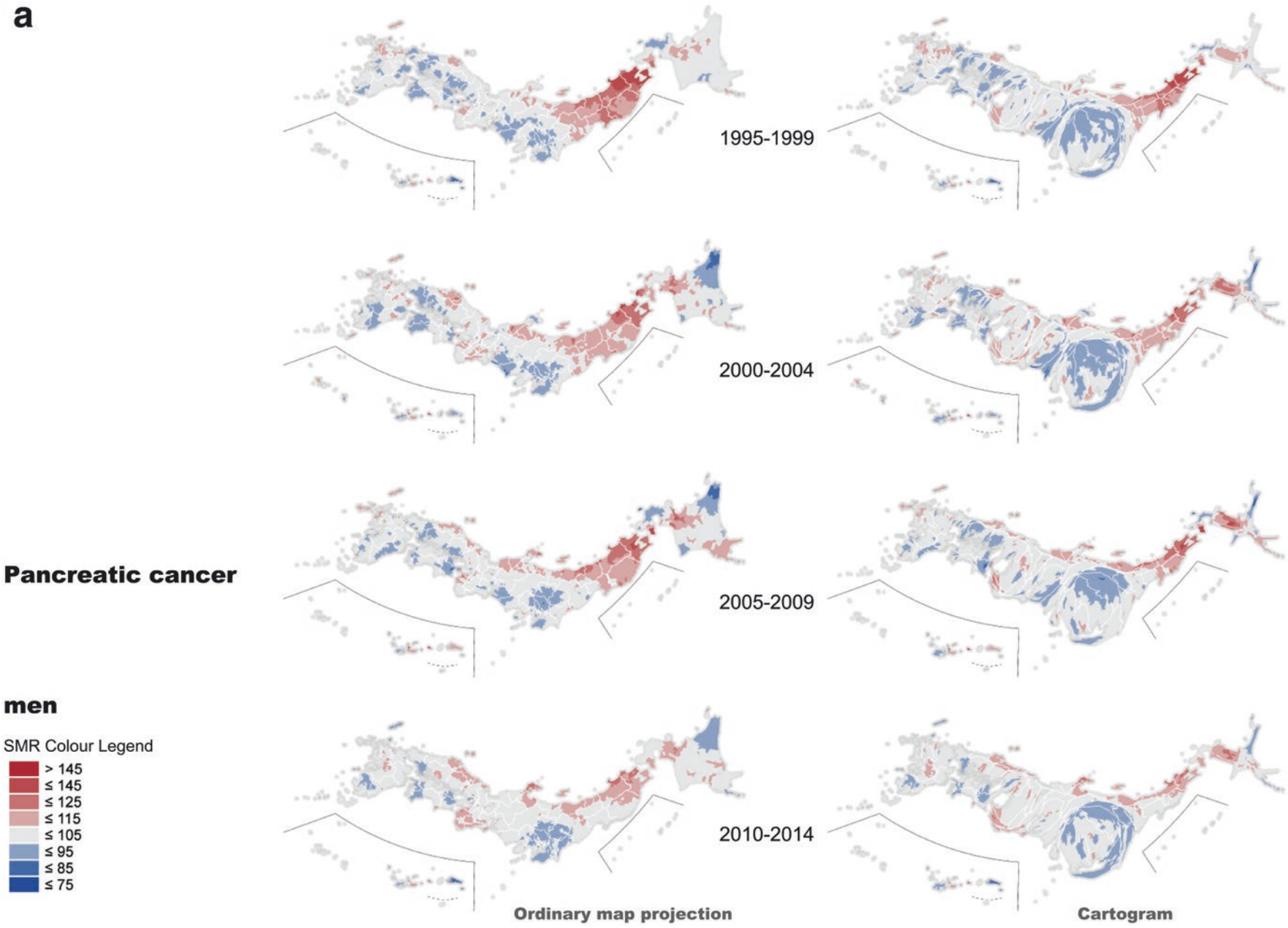


Fig. 4.31 SMR distribution of pancreatic cancer, 2010–2014. (**a**) Men. (**b**) Women


a
Pancreatic cancer
men
SMR Colour Legend
> 145
≤ 145
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≤ 85
≤ 75
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

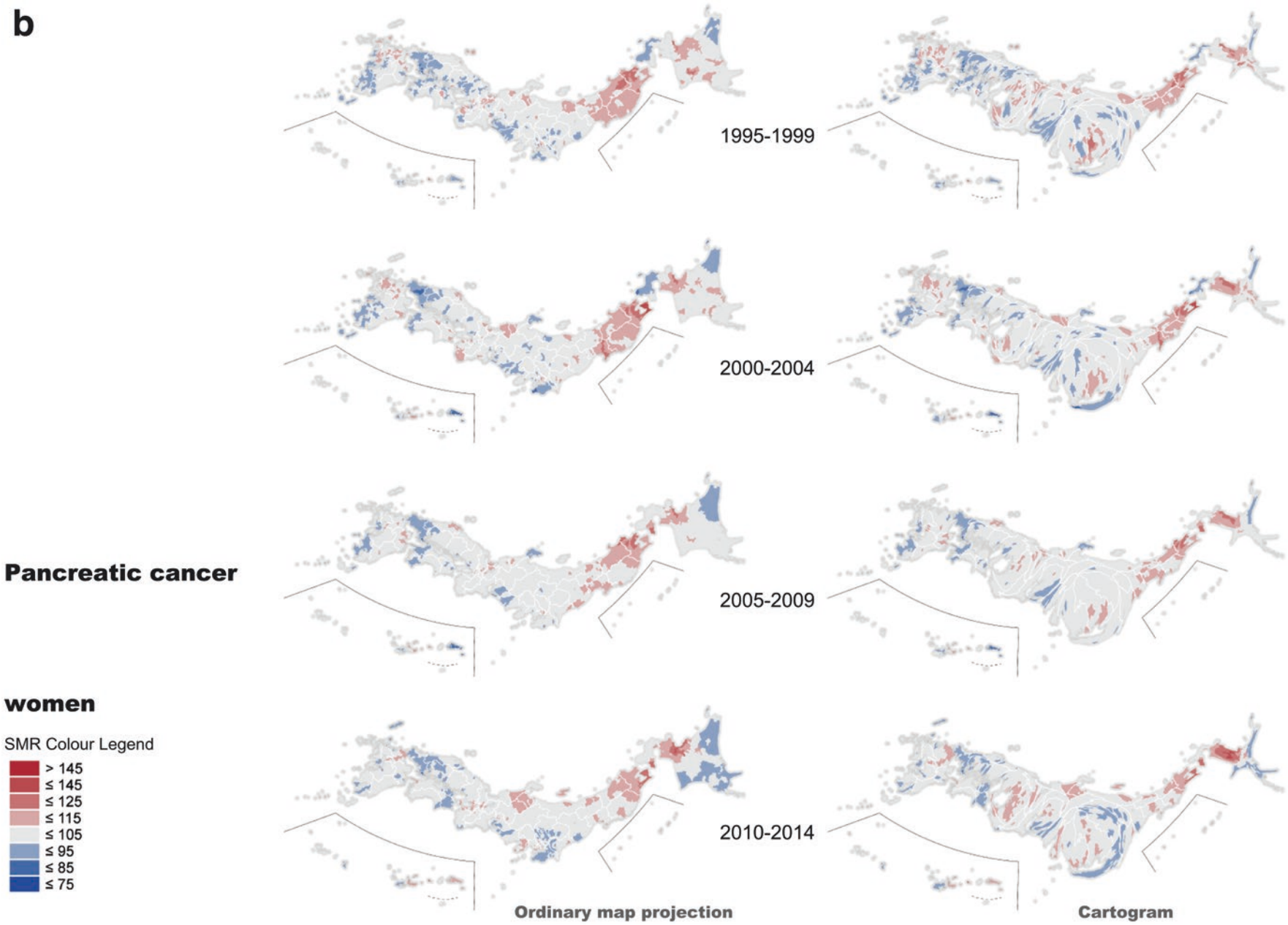


Fig. 4.32 Transition of SMR distribution of pancreatic cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

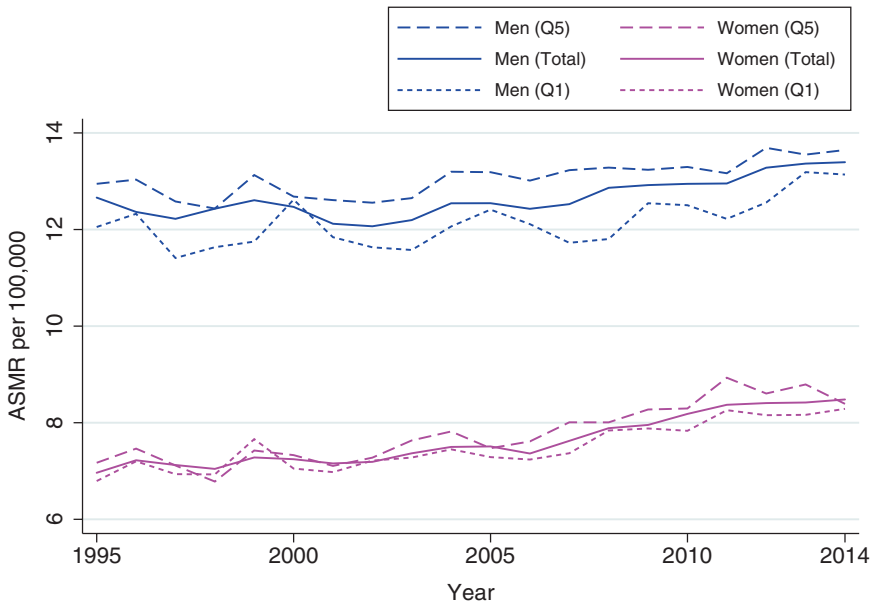


Fig. 4.33 Annual transition in the ASMR of pancreatic cancer from 1995 to 2014

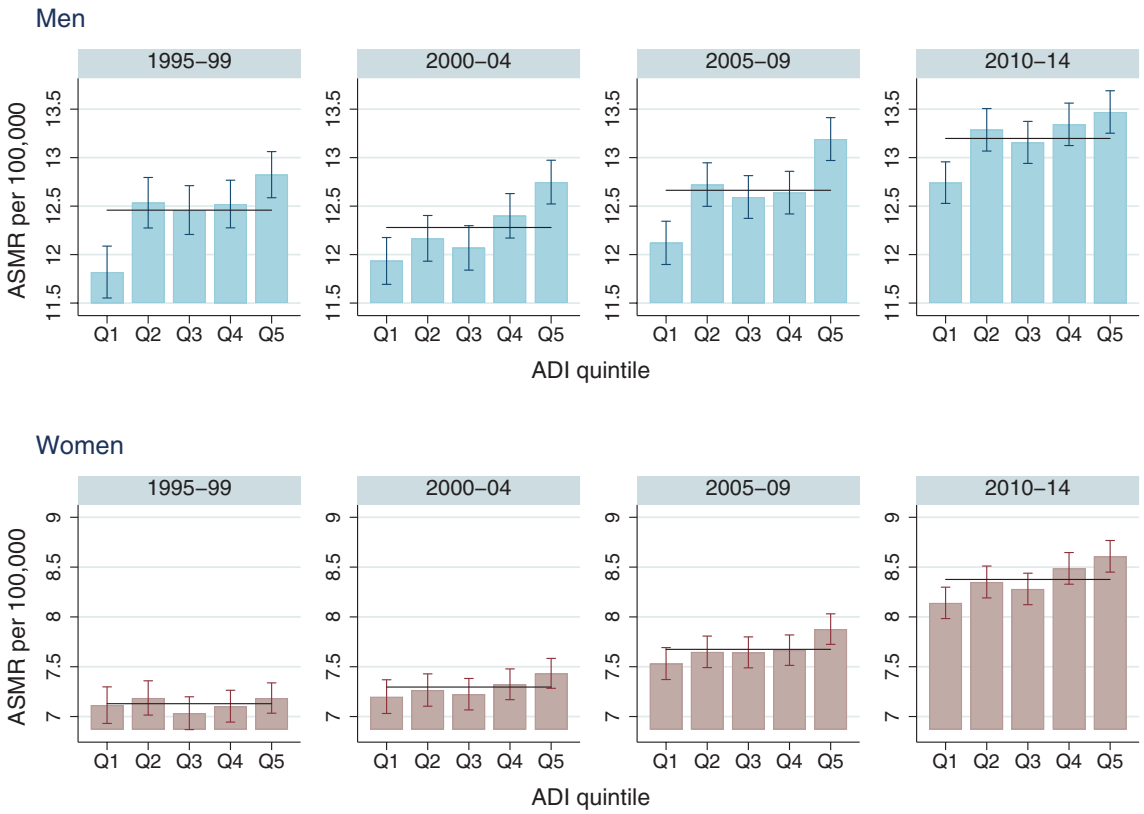


Fig. 4.34 The transition in the ASMR distribution of pancreatic cancer by ADI quintile (top: men, bottom: women)

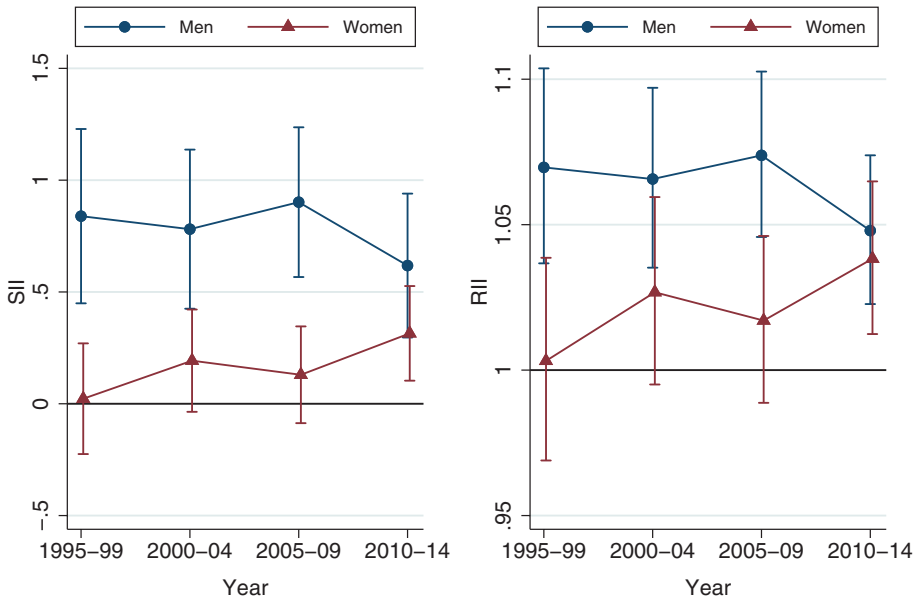


Fig. 4.35 Transition in SII and RII of pancreatic cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.8 Trachea, Bronchus and Lung Cancer (ICD10: C33–C34): A Big Killer Cancer

Yoshikazu Nishino

Overview

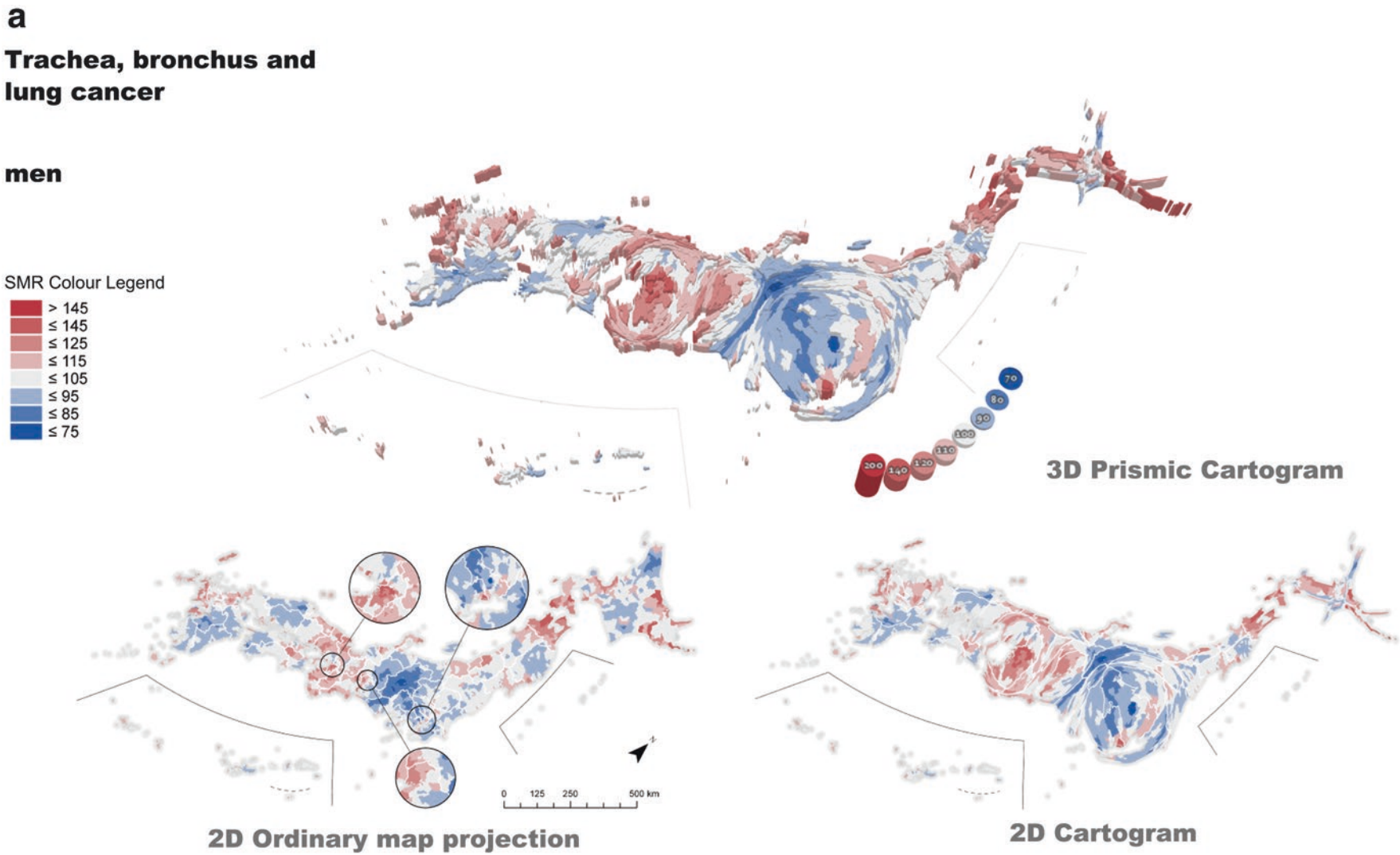
Trachea, bronchus and lung cancer (hereafter called lung cancer) is the most common cause of cancer death for men and the second most common for women equating to 24% and 14% of all cancer deaths, respectively.

Regional clusters with high SMRs of lung cancer in men were observed in metropolitan areas including Tokyo, Nagoya and Osaka as well as non-metropolitan areas including eastern and central Hokkaido, Aomori Prefecture in the Tohoku region, Nagasaki Prefecture in the Kyushu region and the coastal areas of the main island of Japan (Fig. 4.36). Conversely, low SMRs were observed in the mountainous central part of the main island around Nagano Prefecture and the eastern and southern areas of the Kyushu region. Among women, SMRs were more clearly visible in the metropolitan areas including Tokyo, Nagoya and Osaka as well as Kitakyushu-Fukuoka in northern Kyusyu, Sapporo City and several coastal areas of Hokkaido.

The main risk factor for lung cancer is smoking tobacco. About 69.1% of lung cancer deaths were attributed to smoking in men and 36.5% in women (Inoue et al. 2012). A high smoking prevalence has been reported in Hokkaido and Aomori Prefectures for both sexes (Ministry of Health Labour and Welfare 2016).

Transitions and Socioeconomic Disparities

There was no fundamental change of SMR distribution during the 20 years from 1995 to 2014 (Fig. 4.37). The ASMR of lung cancer has decreased (Fig. 4.38). The deprivation gap in ASMR between Q1 and Q5 was large (Fig. 4.39). In 2010–2014, the SII of lung cancer was 9.8 deaths per 100,000, contributing 31% to the SII of all cancers, 31.6 deaths per 100,000, which is the largest among major cancer sites (Fig. 4.40). The socioeconomic gradient of ASMR by deprivation group was different between men and women. Among men, a clear socioeconomic gradient in ASMR was observed, but among women, 'J-shape' gradients in which Q2 and Q3 had the lowest ASMRs were observed (Fig. 4.39). This was due, in part, to the high prevalence of smoking among women in urban areas (see Fig. 3.31). The RII for lung cancer was increasing in both sexes.


a
Trachea, bronchus and lung cancer
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
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3D Prismic Cartogram
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2D Cartogram

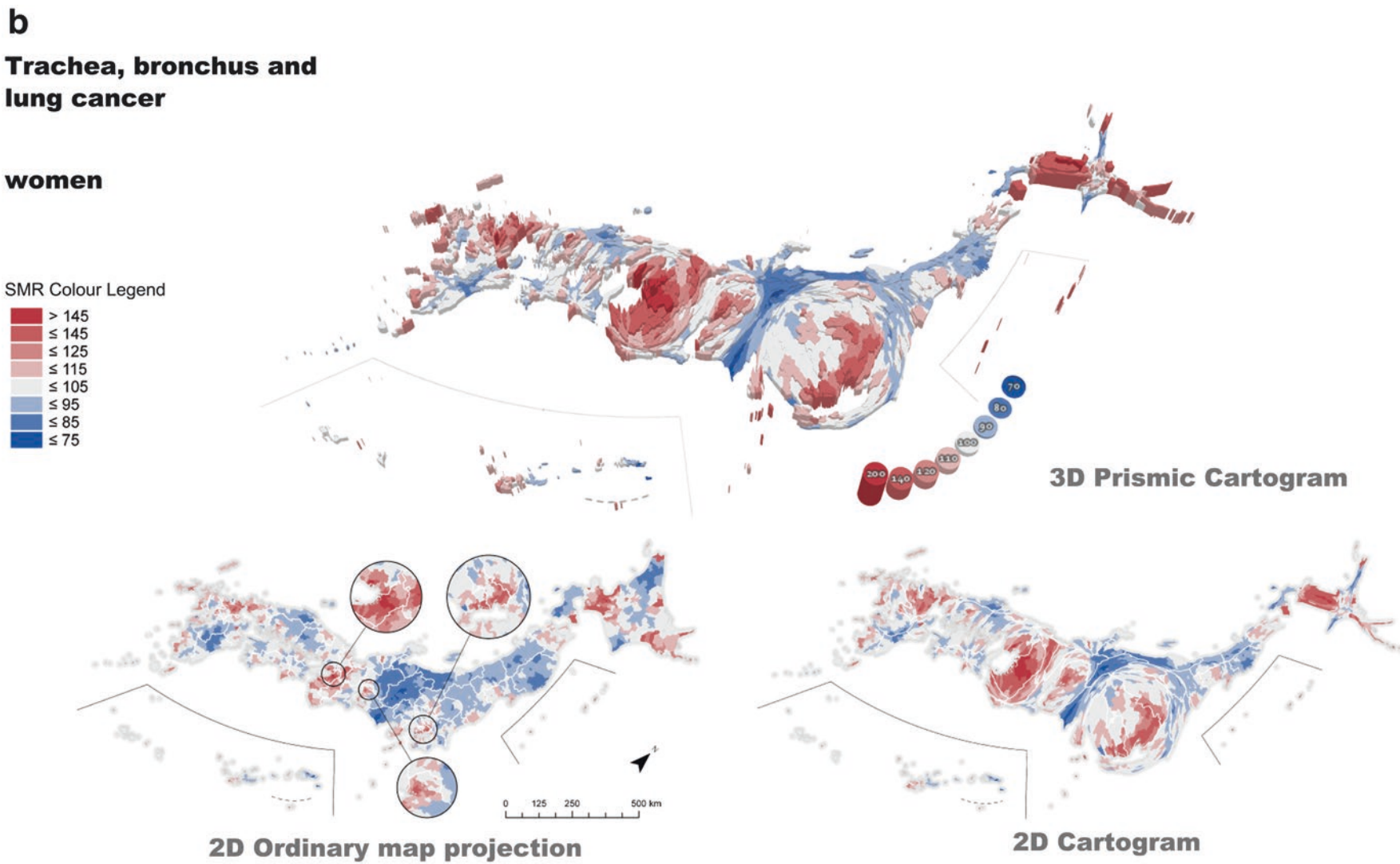
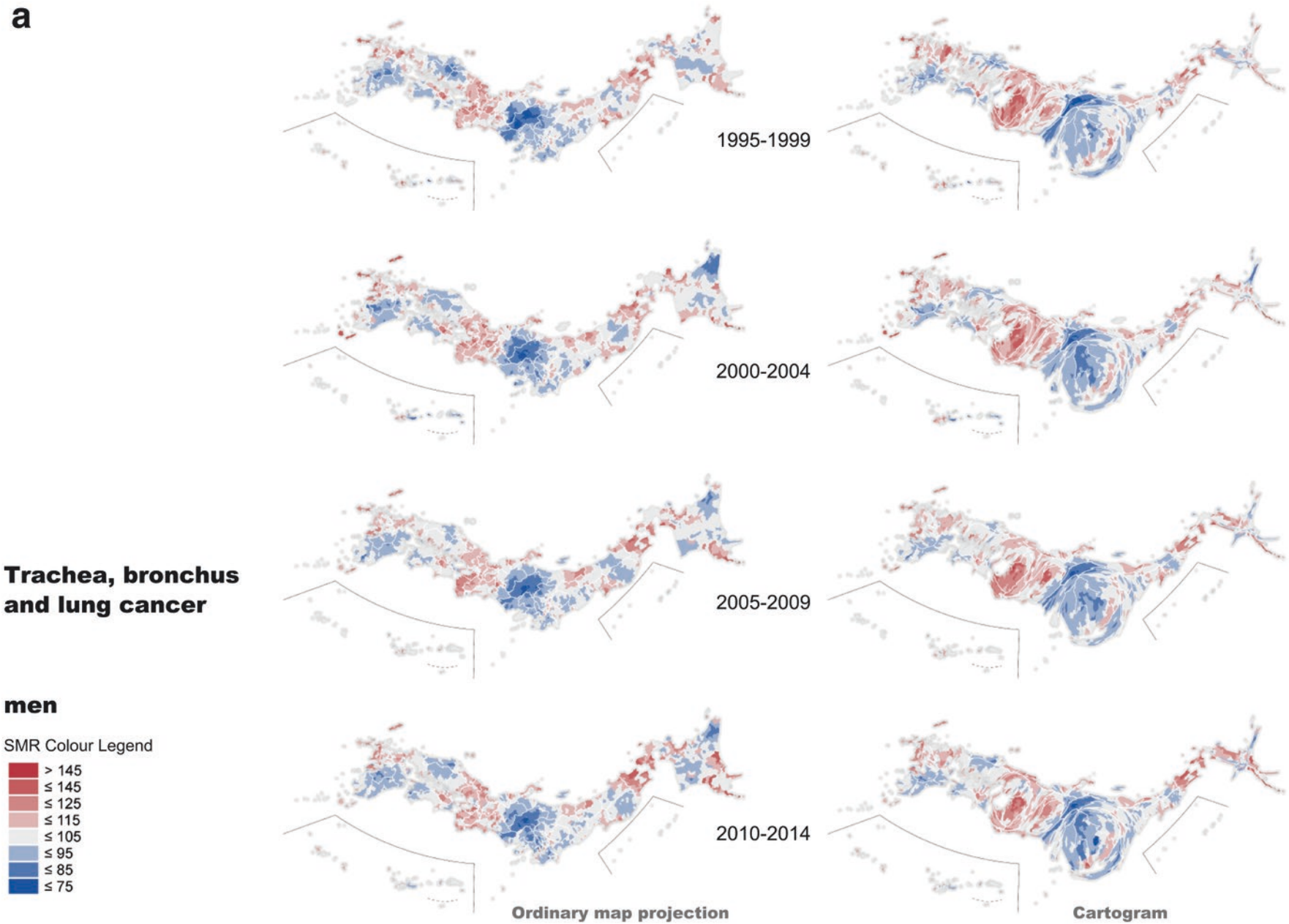


Fig. 4.36 SMR distribution of trachea, bronchus and lung cancer, 2010–2014. (**a**) Men. (**b**) Women


a
1995-1999
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Trachea, bronchus and lung cancer
men
SMR Colour Legend
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≤ 125
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≤ 105
≤ 95
≤ 85
≤ 75
Ordinary map projection
Cartogram

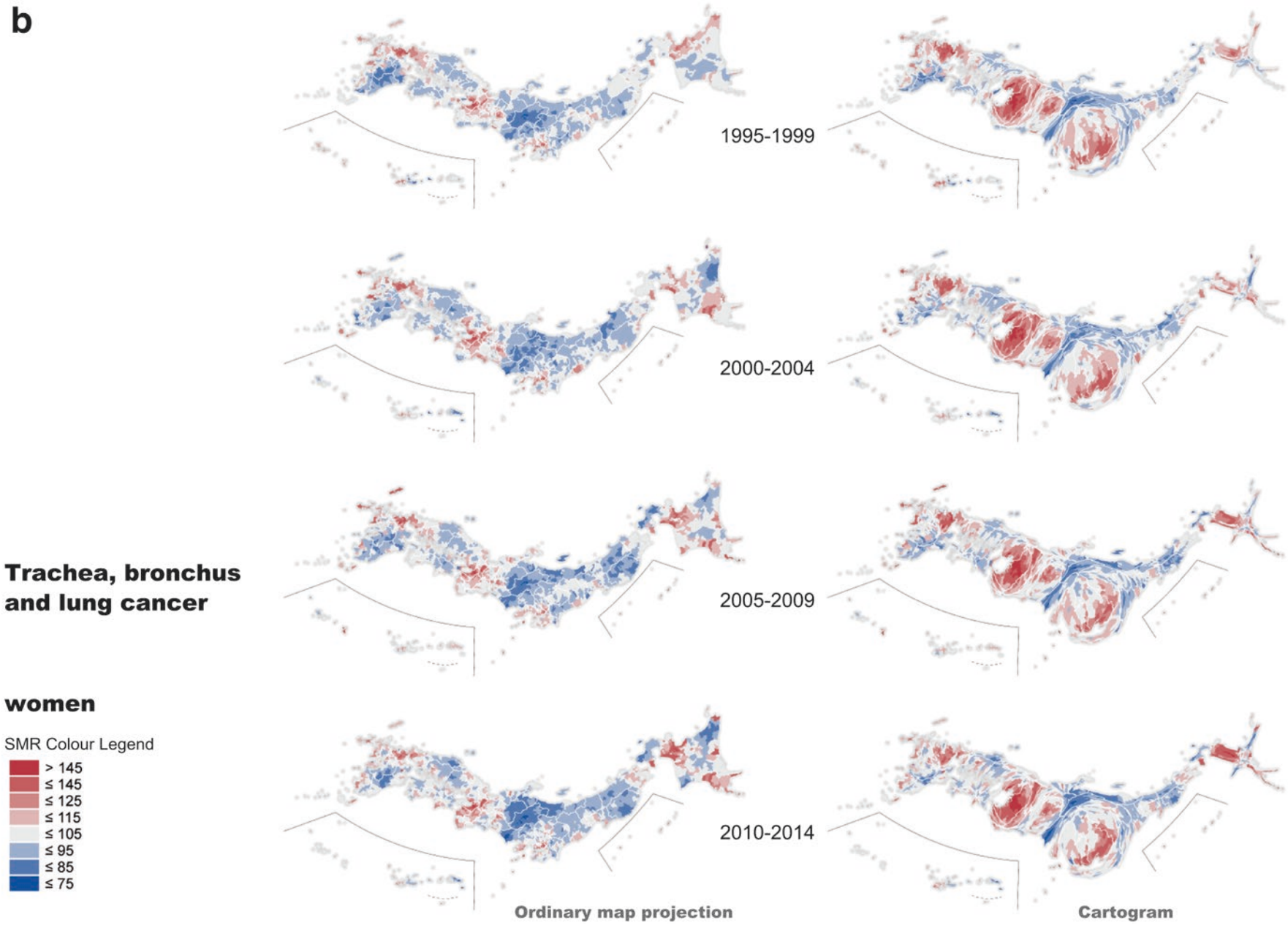


Fig. 4.37 Transition of SMR distribution of trachea, bronchus and lung cancer from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

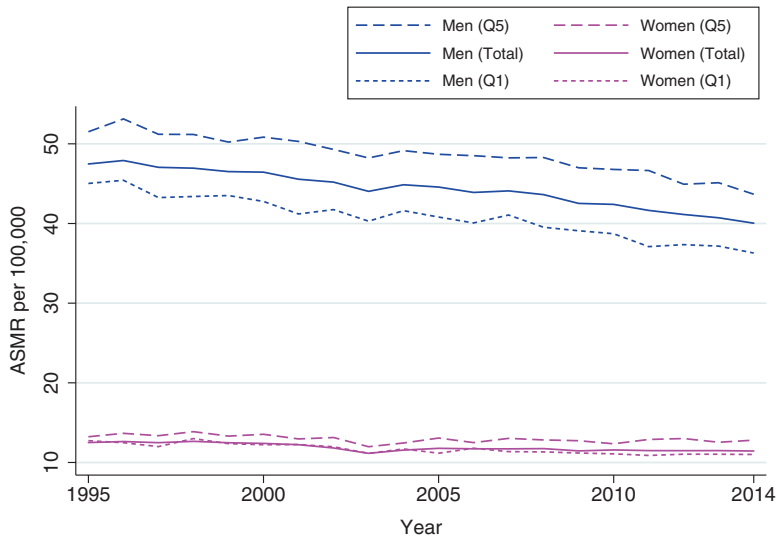


Fig. 4.38 Annual transition in the ASMR of trachea, bronchus and lung cancer from 1995 to 2014

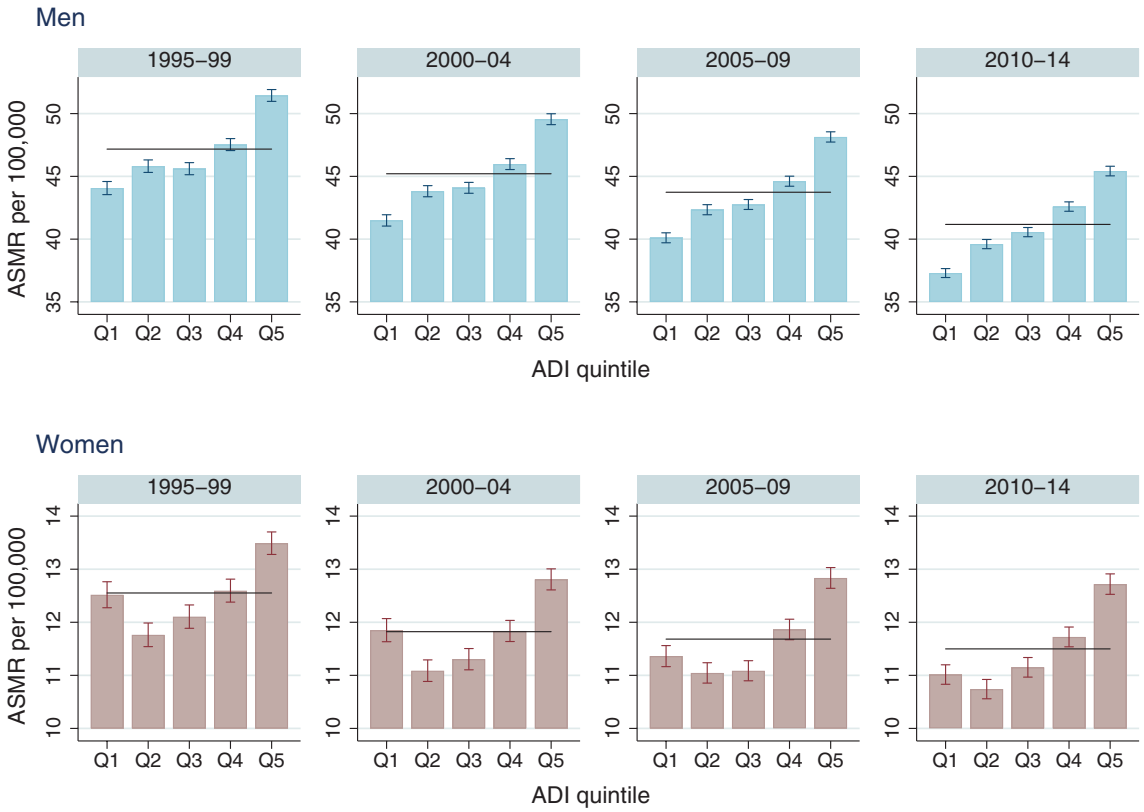


Fig. 4.39 The transition in the ASMR distribution of trachea, bronchus and lung cancer by ADI quintile (top: men, bottom: women)

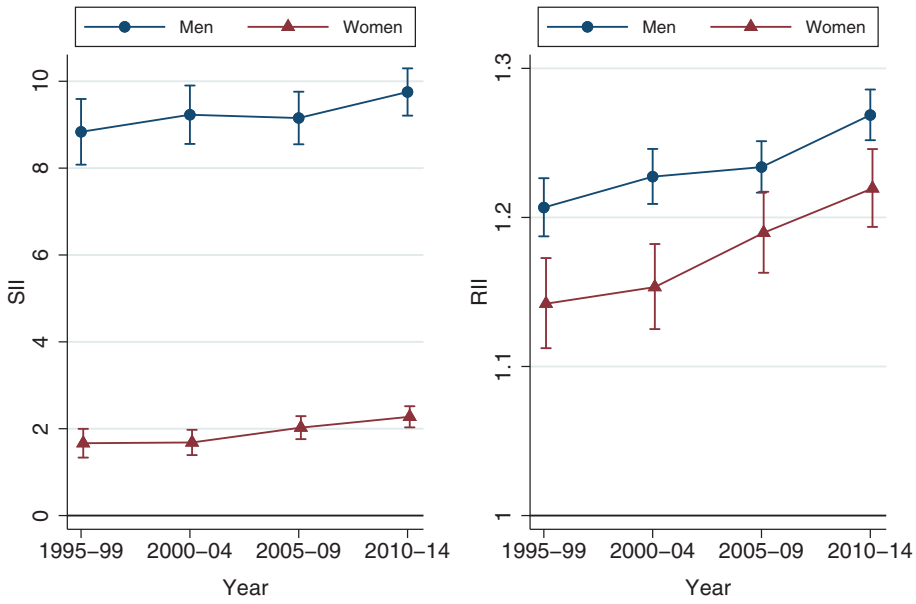


Fig. 4.40 Transition in SII and RII of trachea, bronchus and lung cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.9 Malignant Mesothelioma (ICD10: C45): Time Bomb

Tomoki Nakaya

Overview

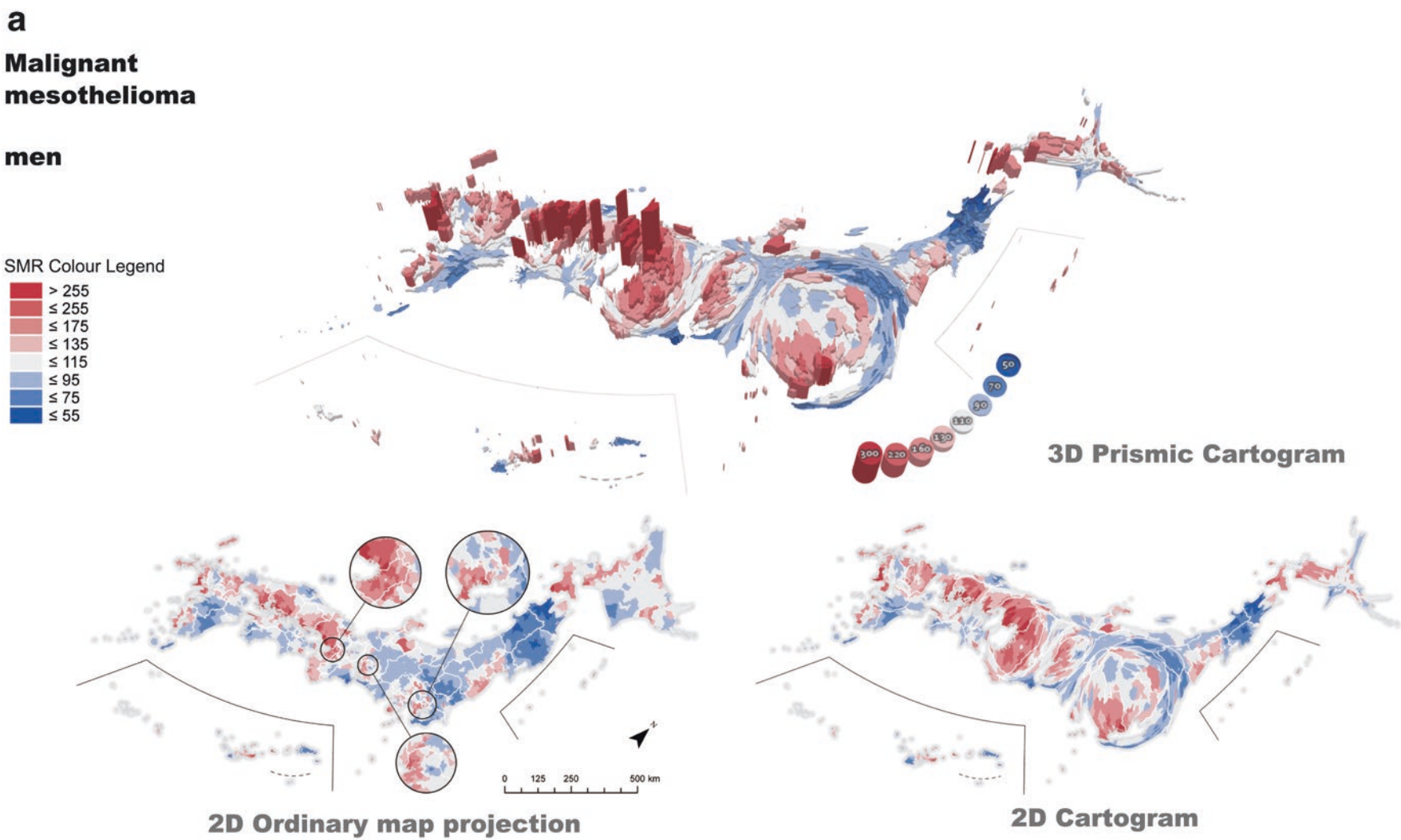
Asbestos, a natural mineral with excellent fire resistance and heat insulation properties, has been used for a variety of industrial purposes. In particular, between 1970 and 1990, large quantities of asbestos were imported and used extensively in building materials. Asbestos microfilaments are easily scattered in the air and, if inhaled, can cause pulmonary disease. Malignant mesothelioma is a cancer that is specifically caused by exposure to asbestos and is referred to as a 'time bomb' as the disease is not usually diagnosed until 10–50 years after exposure.

Among men who are likely to be heavily exposed in the workplace, areas with high SMRs are biased towards western Japan (Fig. 4.41). Markedly high SMRs are observed in areas where asbestos-related factories and shipbuilding industries flourished in the past (Nakaya 2015). On the other hand, among women, the SMR in Amagasaki City, Hyogo Prefecture is unusually high. It is known that asbestos diffused from a former asbestos cement pipe manufacturer in the region has caused a large number of malignant mesotheliomas among neighbouring residents and that women were more likely than men to be at home and thus exposed to the diffused asbestos winds (Kurumatani and Kumagai 2008).

Transitions and Socioeconomic Disparities

Overall, the mortality rate is high in western Japan and low in the Tohoku region. However, in the Tohoku region, the SMRs in the coastal areas of Miyagi and Fukushima Prefectures have gradually increased (Fig. 4.42). According to the cartogram, the SMRs are generally high in metropolitan areas. The increase in the mortality ratio in Aichi Prefecture, which is the core prefecture of the Chukyo metropolitan area, is notable.

Mortality from malignant mesothelioma is expected to continue to rise (Fig. 4.43), reflecting past exposure to asbestos (Murayama et al. 2006). The higher the level of deprivation, the higher the mortality rate tended to be in men between 1995 and 1999, but this tendency seems to have diminished since then (Figs. 4.44 and 4.45). There may be geographical differences in the magnitude and timing of exposure to asbestos. In addition, considering the long incubation period, those who have been exposed to asbestos may migrate to other locations, mainly in metropolitan areas. These situations might hide the regional socioeconomic inequalities in asbestos exposure.


a
Malignant mesothelioma
men
SMR Colour Legend
> 255
≤ 255
≤ 175
≤ 135
≤ 115
≤ 95
≤ 75
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50
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3D Prismic Cartogram
0 125 250 500 km
2D Ordinary map projection
2D Cartogram

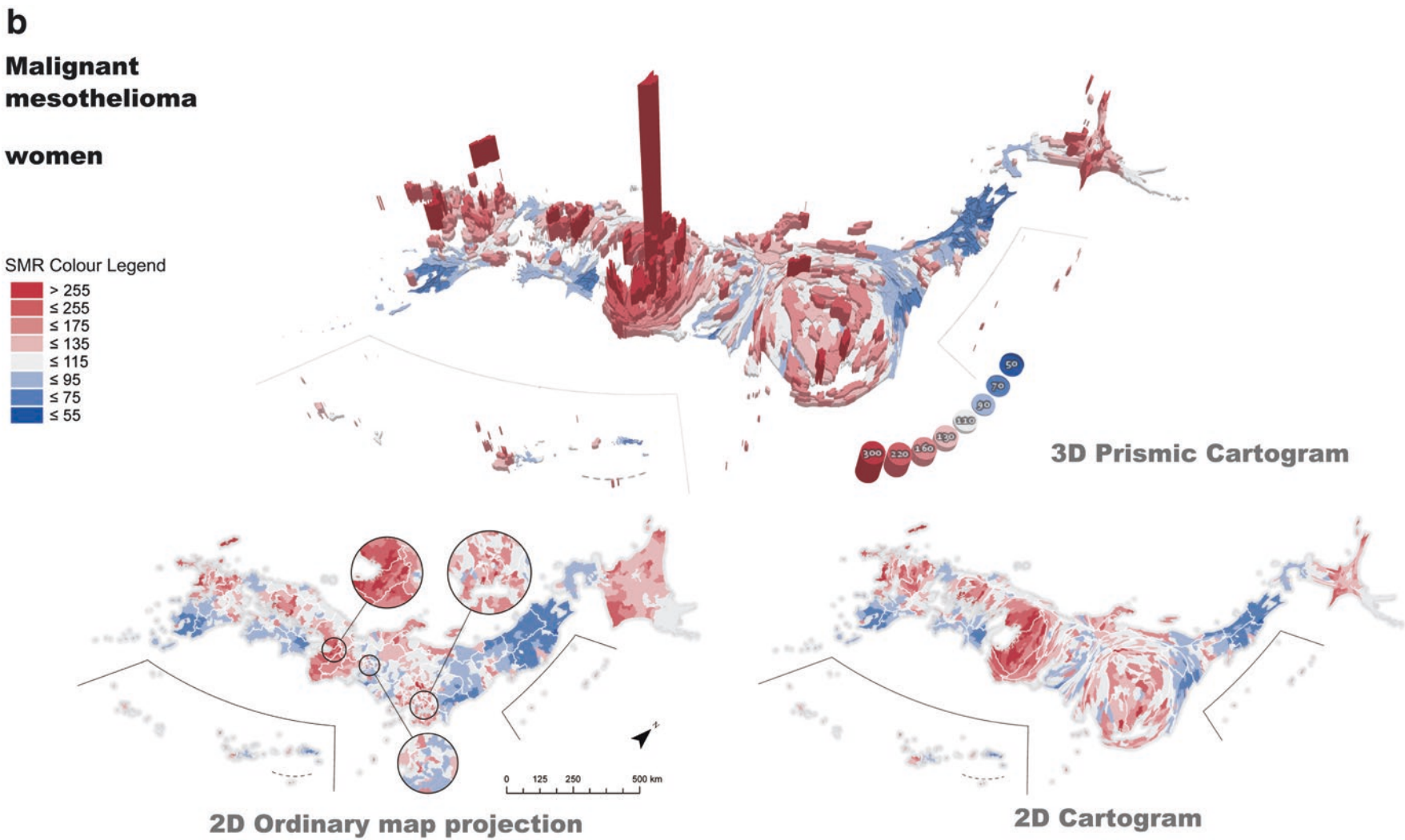
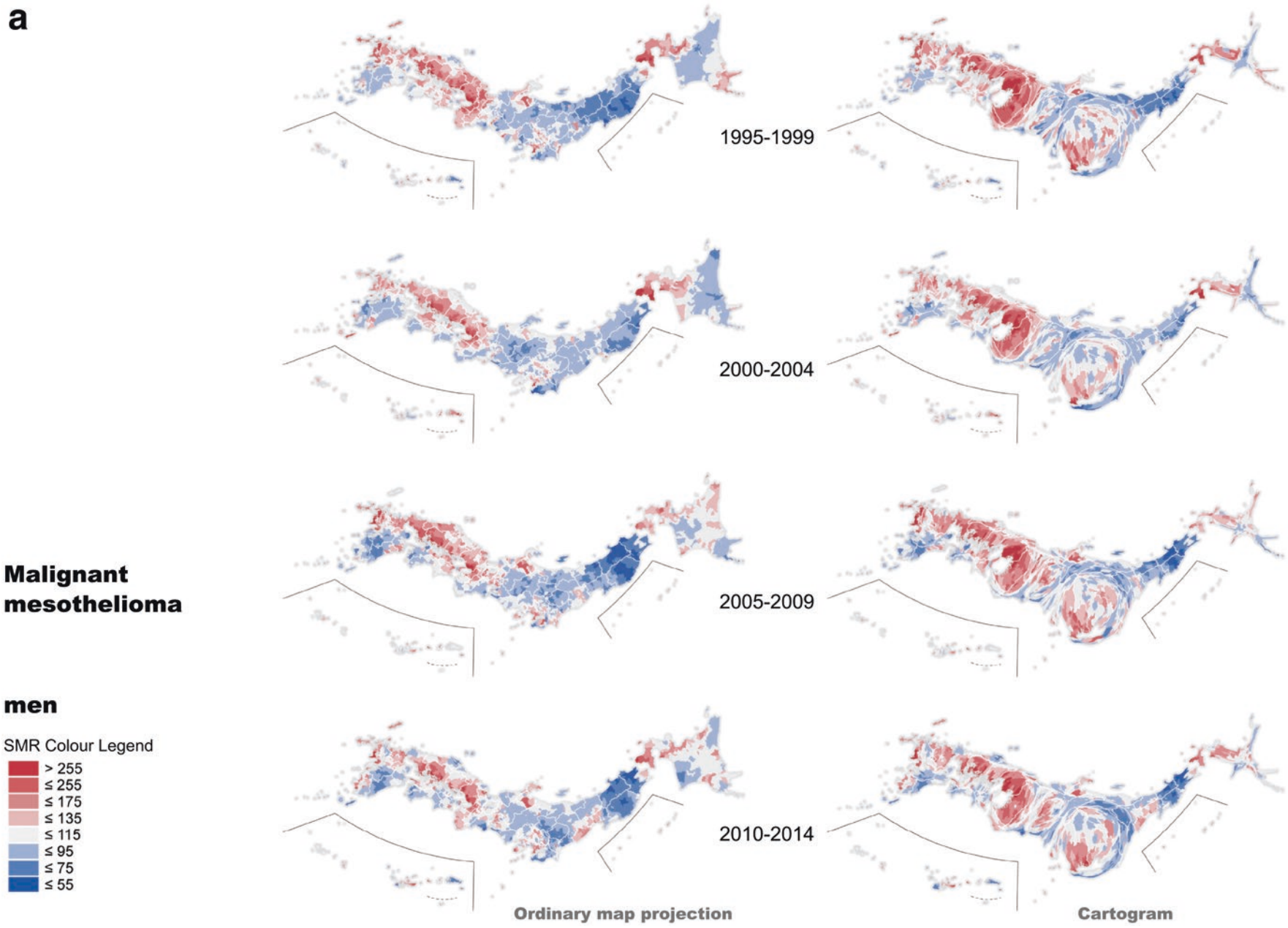


Fig. 4.41 SMR distribution of malignant mesothelioma, 2010–2014. (**a**) Men. (**b**) Women


a
Malignant mesothelioma
men
SMR Colour Legend
> 255
≤ 255
≤ 175
≤ 135
≤ 115
≤ 95
≤ 75
≤ 55
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

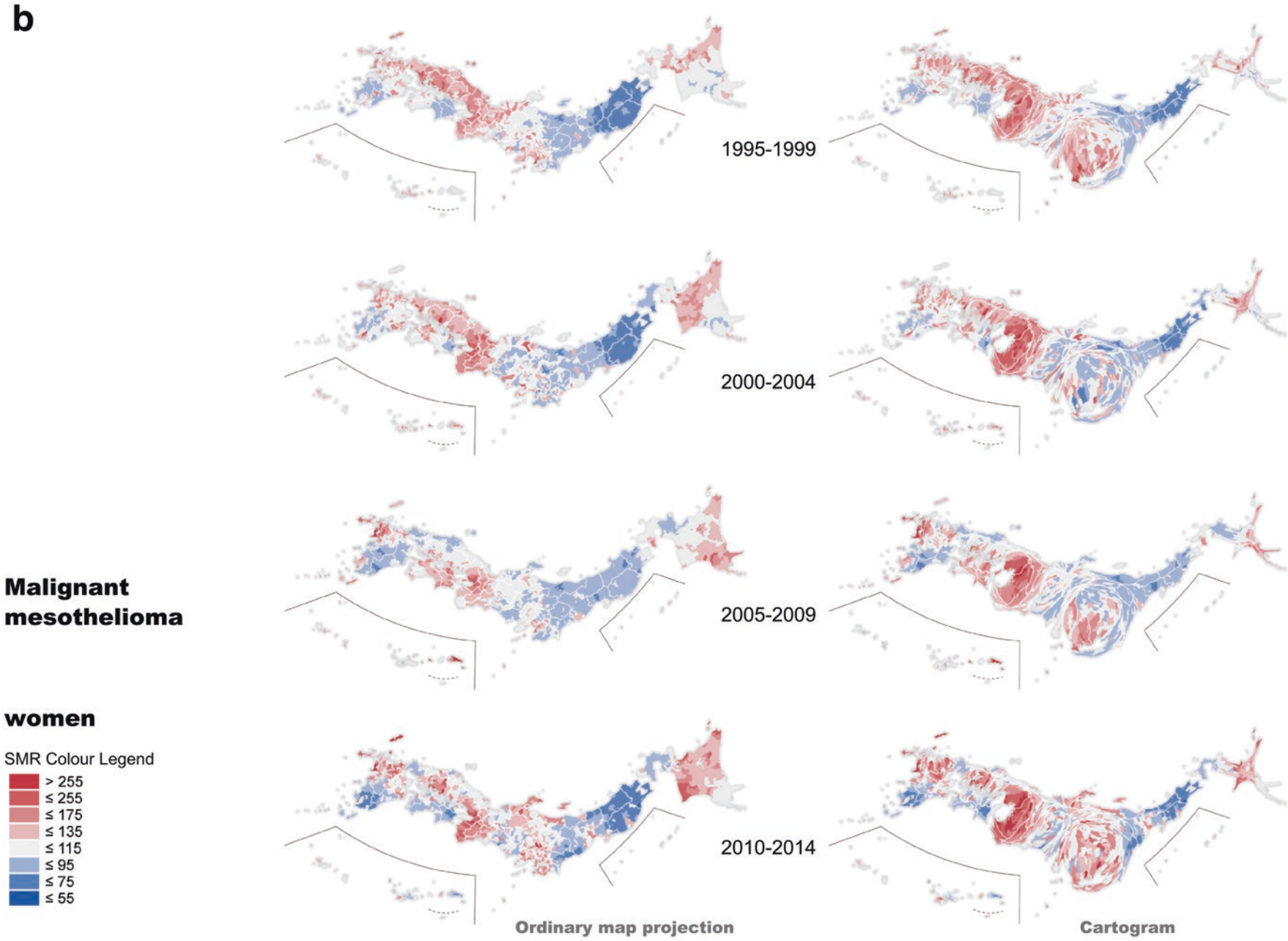


Fig. 4.42 Transition of SMR distribution of malignant mesothelioma from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

Fig. 4.43 Annual transition in the ASMR of malignant mesothelioma from 1995 to 2014

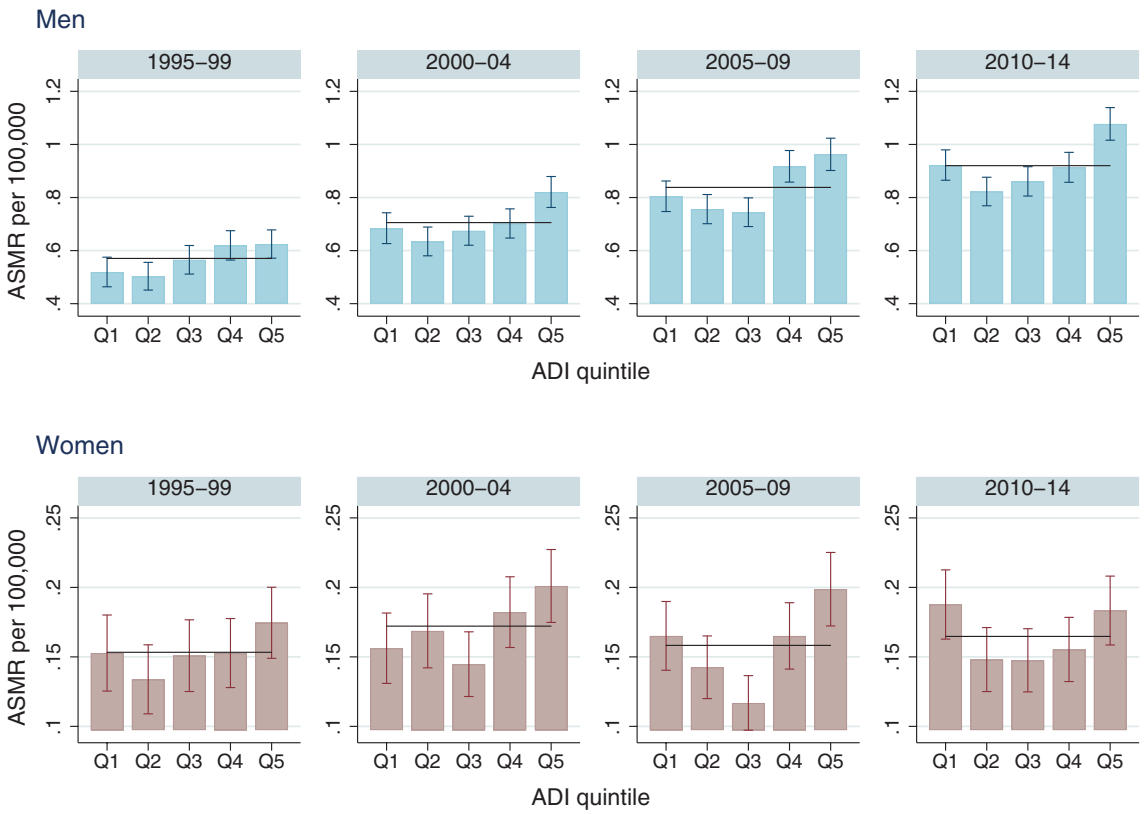


Fig. 4.44 The transition in the ASMR distribution of malignant mesothelioma by ADI quintile (top: men, bottom: women)

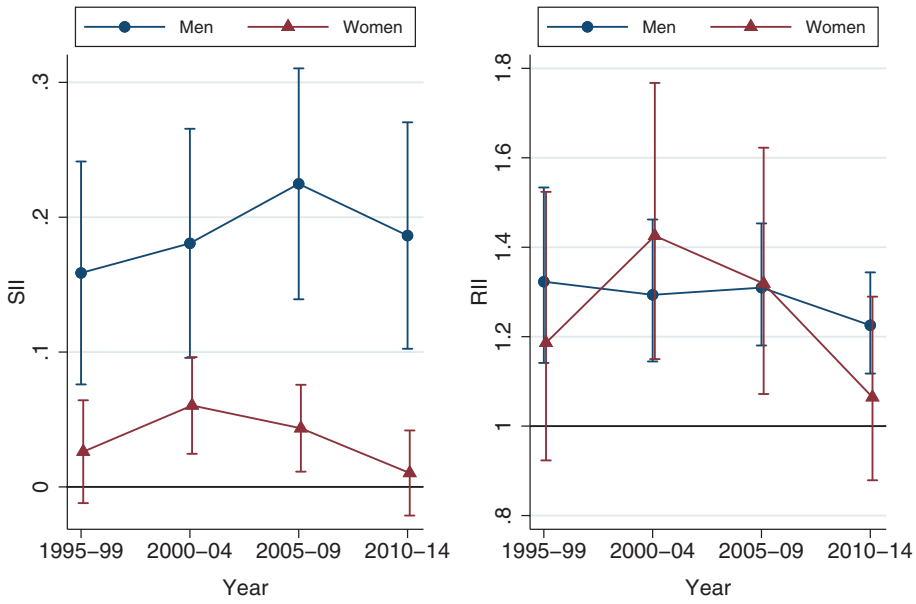


Fig. 4.45 Transition in SII and RII of malignant mesothelioma from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.10 Breast Cancer (ICD10: C50): The most Common Cancer for Women

Seiki Kanemura

Overview

Breast cancer is the most common cancer in women in Japan. In 2014, one in five newly diagnosed cancer cases among women was breast cancer (Cancer Information Service 2018). The ASMR of breast cancer has steadily increased since the 1960s. It is now the fifth most common cause of death among all cancer deaths in women in Japan.

Higher SMRs of breast cancer were mainly observed in Sapporo, Tokyo, Nagoya, Osaka and Fukuoka cities, which are the major high-density urban areas in Japan (Fig. 4.46). Small clusters of high SMR regions in non-metropolitan areas were found in some parts of the Hokkaido, Tohoku and Kyushu regions. According to the cartogram, almost all of the Tokyo, Nagoya and Osaka Prefectures, core regions of the three largest metropolitan areas, clearly showed high breast cancer mortality.

Transitions and Socioeconomic Disparities

While there was no fundamental change in the spatial patterns of breast cancer SMRs between 1995 and 2014, the regional gap has gradually diminished as the dark red colour representing high SMRs in metropolitan regions has faded to a lighter shade (Fig. 4.47).

The ASMR of breast cancer has increased during the period from 1995 to 2014 (Fig. 4.48). An inverse socioeconomic gradient was observed in the breast cancer mortality. The highest ASMR was observed in the least deprived group (Q1) and the lowest ASMR in the most deprived group (Q5) (Fig. 4.49). The pattern is quite different from those of other cancer sites. An inverse gradient in ASMR for breast cancer has also been reported in other countries (Lundqvist et al. 2016; Strand et al. 2007). More highly educated women or those of higher socioeconomic status had a greater risk of death from breast cancer, which could be related to the risk factors for breast cancer including reproductive factors. During the two decades from 1995 to 2014, the ASMR of breast cancer has increased, while both the absolute and relative inverse gaps in ASMR shrank according to the SII and RII trends (Fig. 4.50).

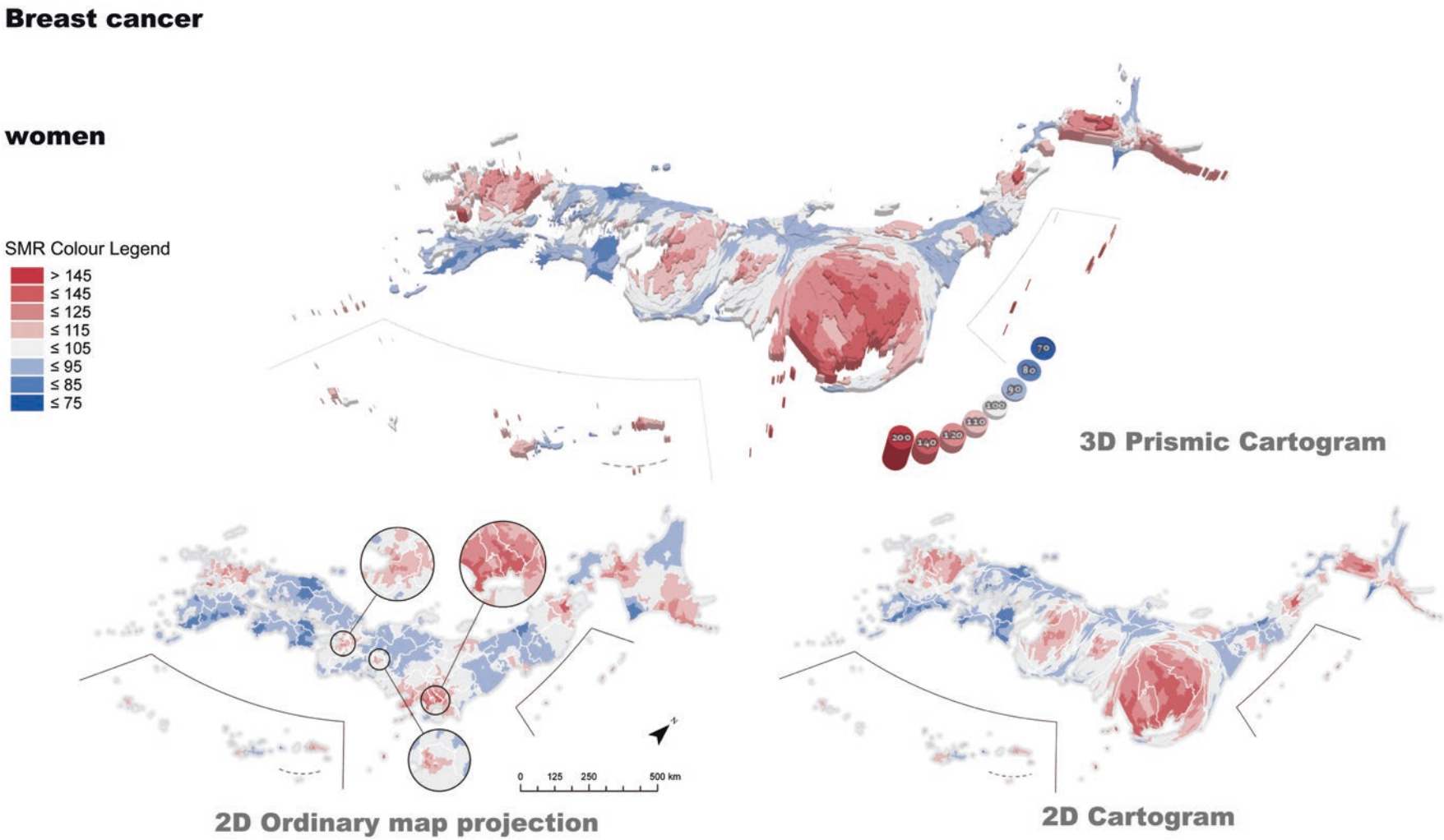


Fig. 4.46 SMR distribution of breast cancer, women, 2010–2014

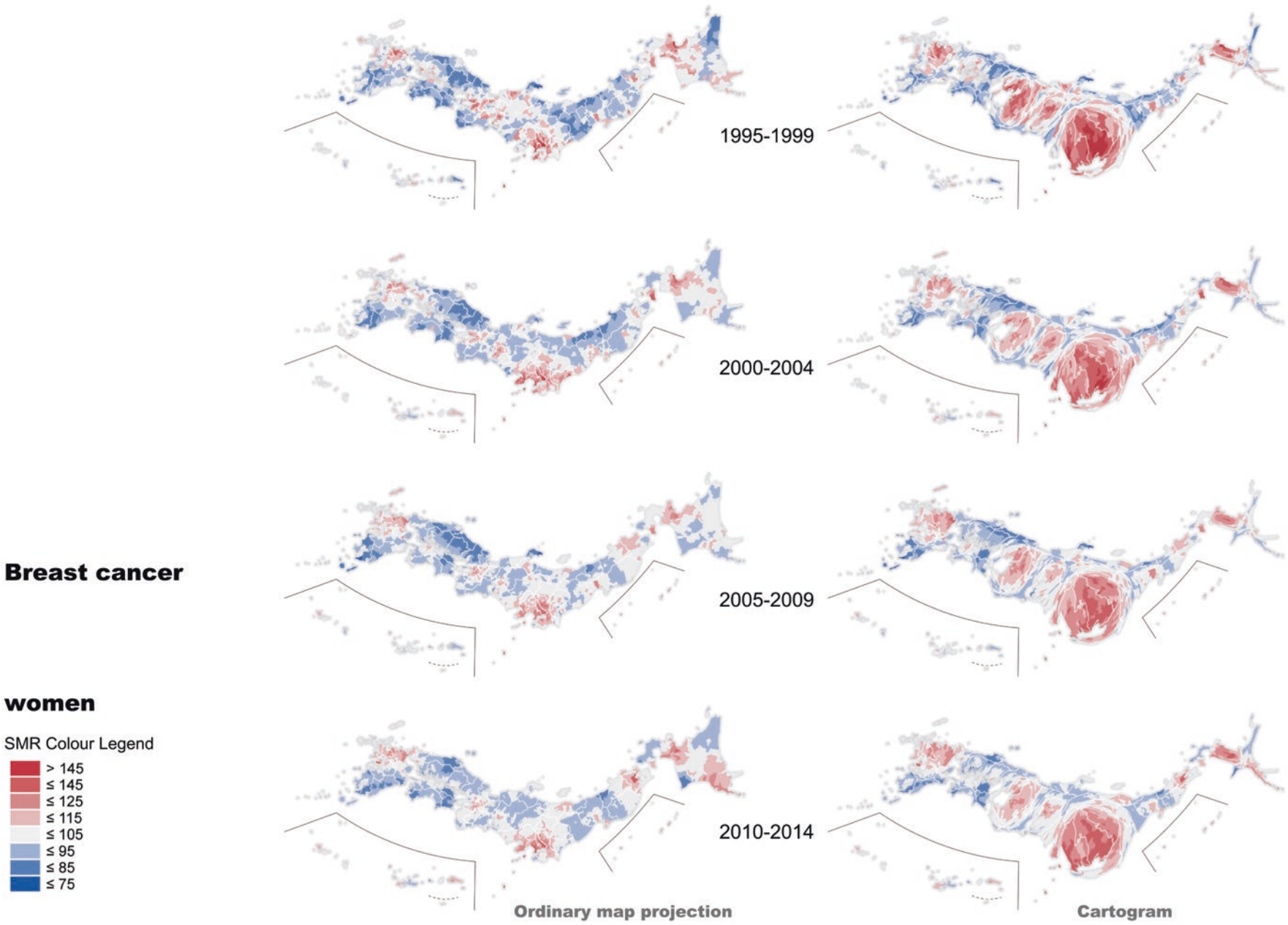


Fig. 4.47 Transition of SMR distribution of breast cancer, women, from 1995 to 2014 by 5-year period

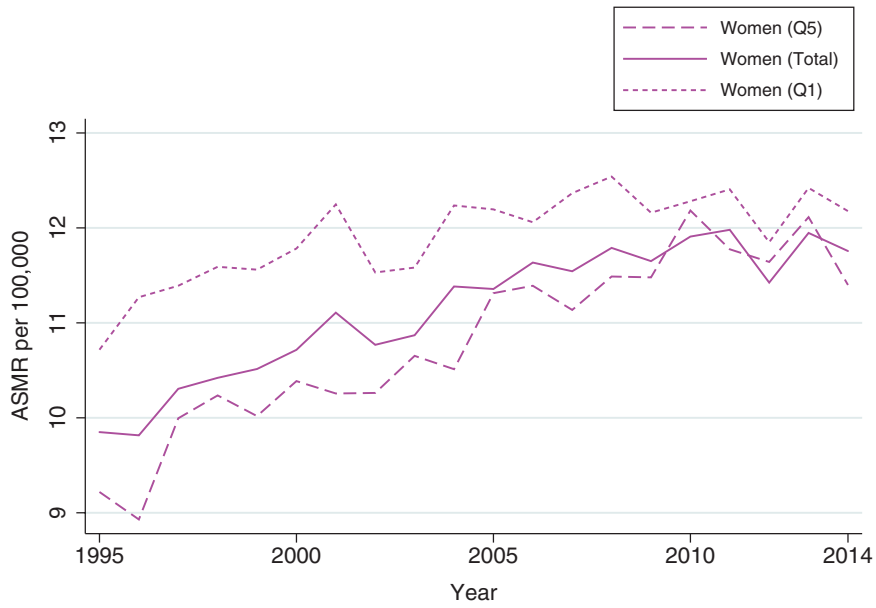


Fig. 4.48 Annual transition in the ASMR of breast cancer from 1995 to 2014

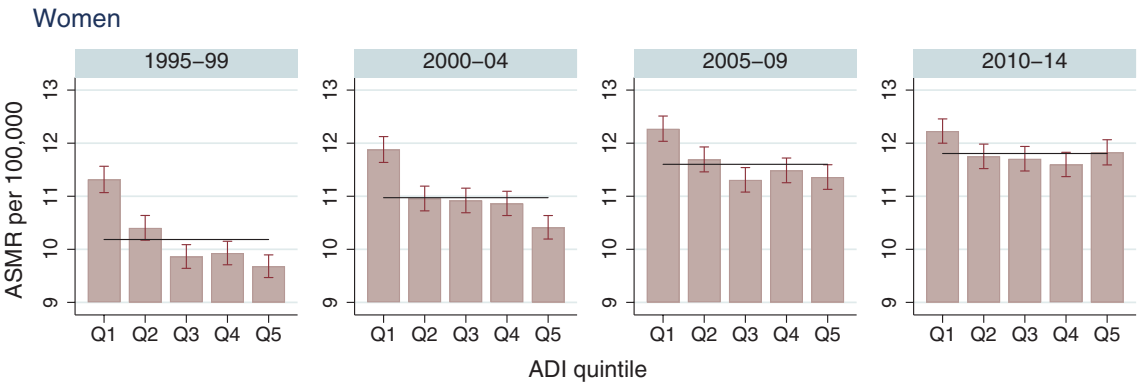


Fig. 4.49 The transition in the ASMR distribution of breast cancer by ADI quintile (top: men, bottom: women)

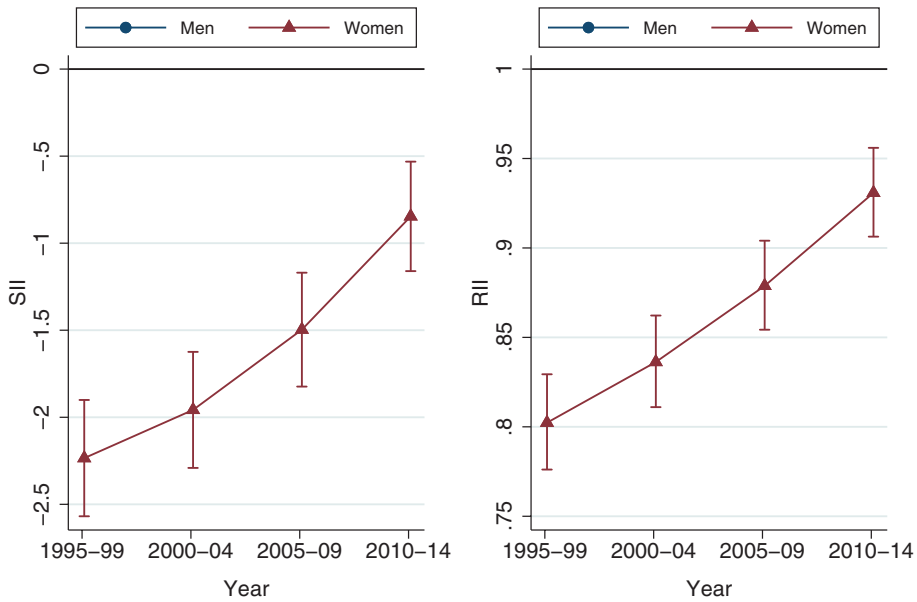


Fig. 4.50 Transition in SII and RII of breast cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.11 Cervical Cancer (ICD10: C53): A Preventable Female Cancer, but Inequalities Still Exist

Seiki Kanemura

Overview

Cervical cancer incidence is associated with persistent human papillomavirus (HPV) infection. Higher incidence is observed in young women aged in their late 20s to 40s, and it is an urgent priority to control this cancer among young women in Japan. Universal vaccination programmes for HPV have been implemented in many high-income countries. In Japan, the HPV vaccination programme was implemented in 2010; however, it was stopped in 2013, due to complaints of post-vaccination pain and other disorders. In addition, the screening uptake was quite low in Japan. Cervical cancer is a preventable cancer in women, and scaling up of the vaccination and screening programme is essential in Japan.

While lower SMRs were observed in the Tohoku and Chugoku regions, higher SMRs were observed in some parts of the Hokkaido, Kanto, Tokai, Hokuriku and Kyushu regions (Fig. 4.51). The cartogram showed high SMR areas around the outer suburbs of the Tokyo and Nagoya/Chukyo metropolitan areas.

Transitions and Socioeconomic Disparities

According to the series of cartogram (Fig. 4.52), the higher SMR areas have spread from the core of the Tokyo and Osaka metropolitan areas to the outer suburbs of those cities during the two decades from 1995 to 2014. Within the metropolitan areas, while the ASMRs of the affluent suburbs have tended to become lower (coloured in blue), the inner city has tended to remain high (coloured in red).

The ASMR of cervical cancer is still increasing slightly, despite strategies for its elimination (Fig. 4.53). Several high-income countries have shown decreasing trends in the ASMR of cervical cancer. The highest ASMRs were observed in the most deprived group (Q5) and the lowest ASMRs were observed in the least deprived group (Q1) (Fig. 4.54). According to the trends in SII and RII (Fig. 4.55), both the absolute and relative socioeconomic inequalities of mortality widened slightly. Socioeconomic inequalities in cervical cancer incidence before the HPV vaccination era have been reported in some countries (Simard et al. 2012; Pukkala et al. 2010). Some evidence of a reduction in the deprivation gap in cervical cancer incidence following the introduction of a universal vaccination programme was also reported (Cameron et al. 2017; Malagon et al. 2015). Scaling up of HPV vaccination could help to reduce the gap in the future in Japan and other countries (Simms et al. 2019).

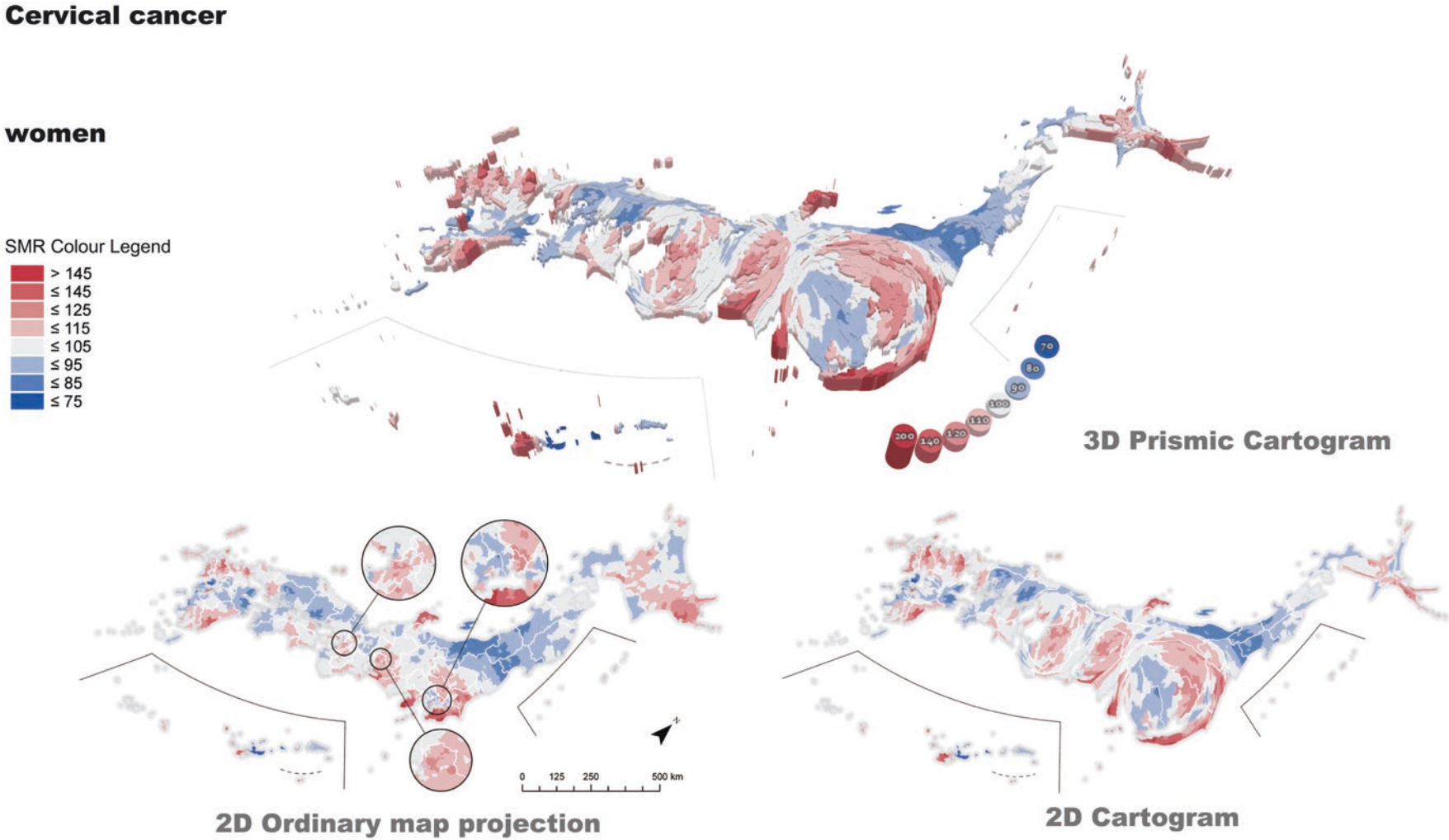


Fig. 4.51 SMR distribution of cervical cancer, women, 2010–2014

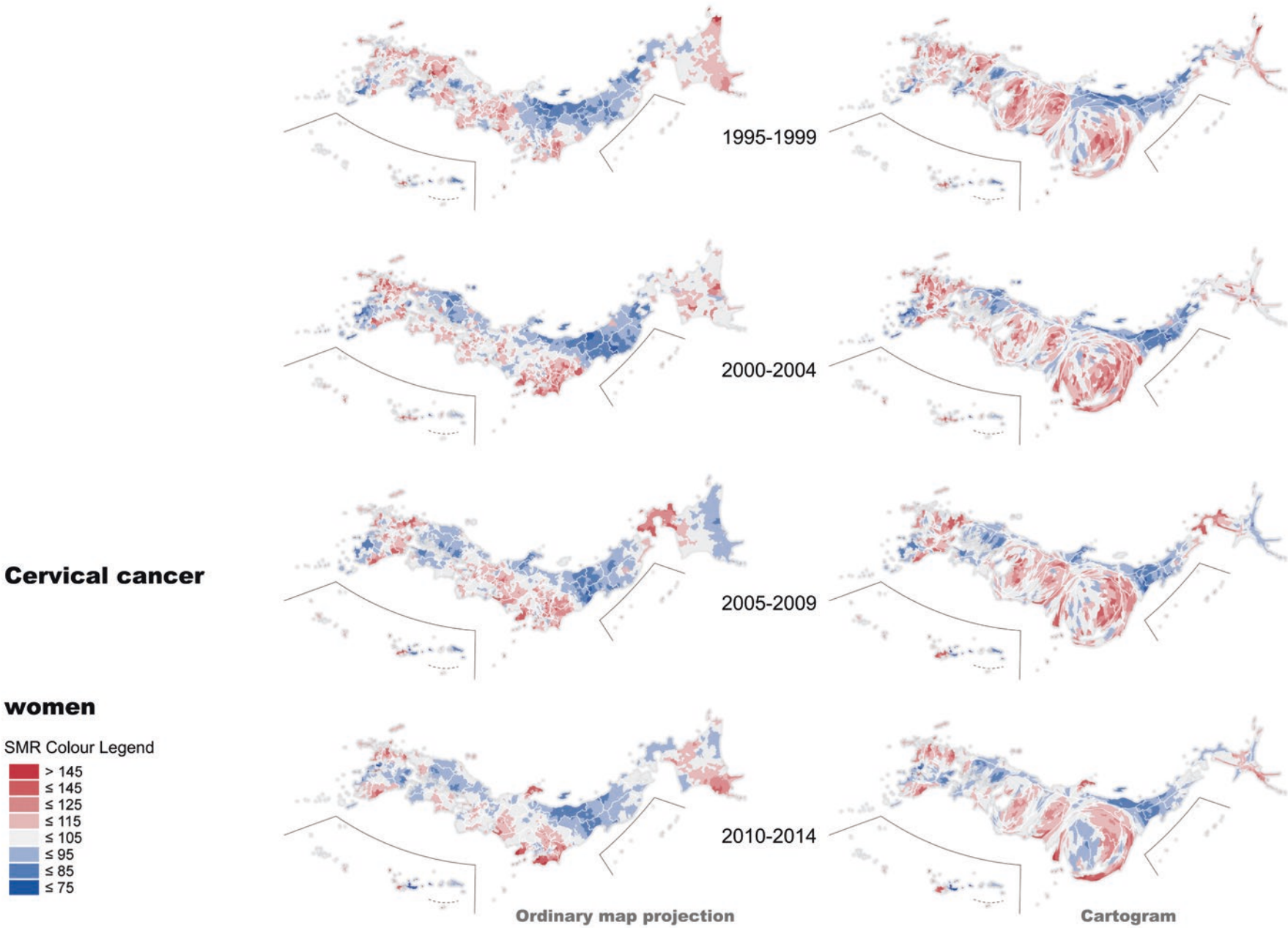


Fig. 4.52 Transition of SMR distribution of cervical cancer, women, from 1995 to 2014 by 5-year period

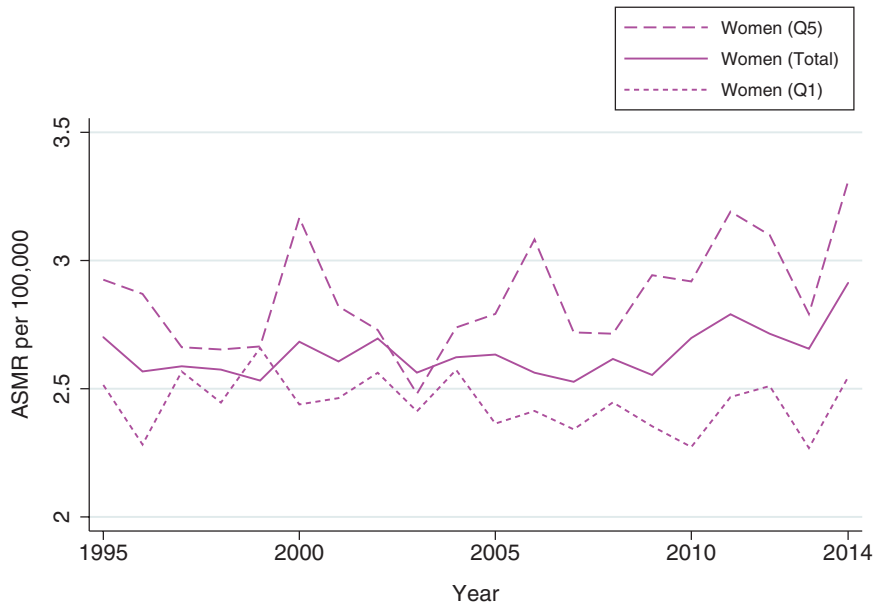


Fig. 4.53 Annual transition in the ASMR of cervical cancer from 1995 to 2014

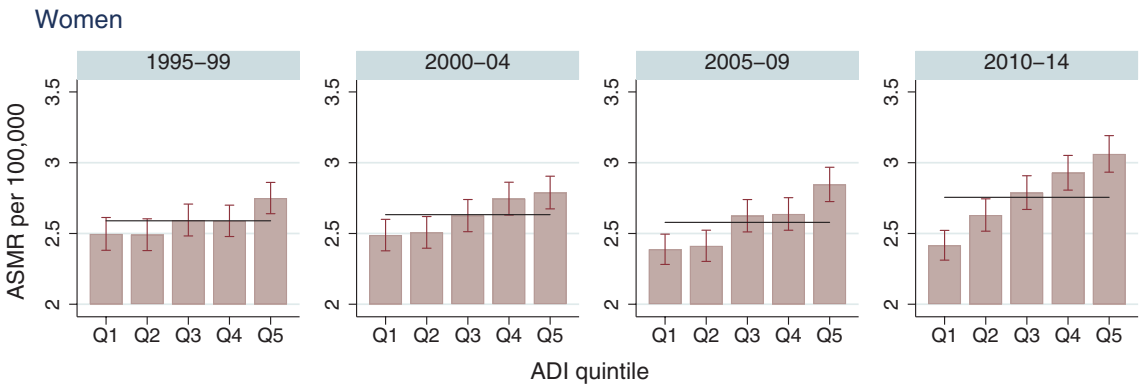


Fig. 4.54 The transition in the ASMR distribution of cervical cancer by ADI quintile (top: men, bottom: women)

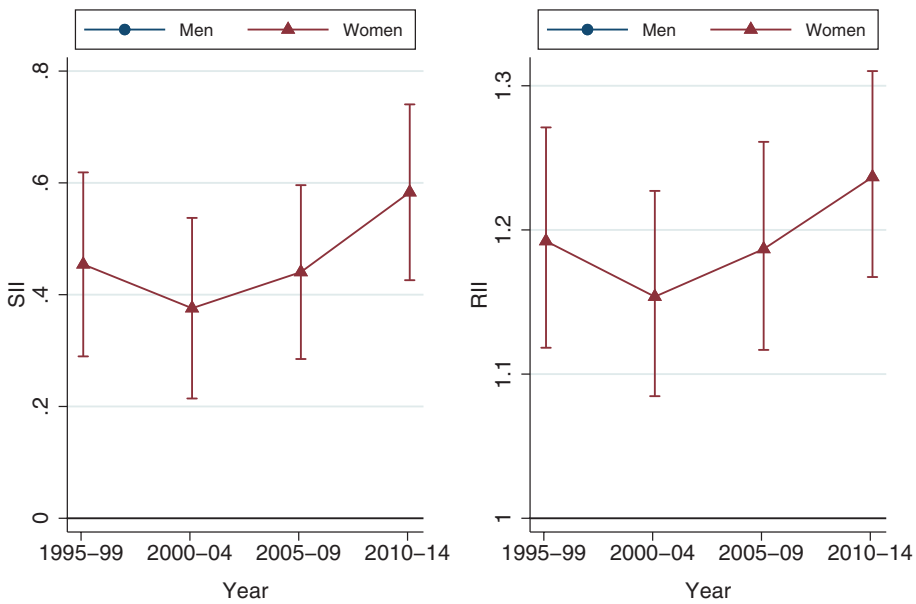


Fig. 4.55 Transition in SII and RII of cervical cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.12 Uterine Corpus Cancer (ICD10: C54): An Increasingly Common Female Cancer

Seiki Kanemura

Overview

Incidence of uterine corpus cancer is associated with obesity and long-term exposure to the sex hormone (oestrogen). The peak of age at diagnosis for uterine corpus cancer is the 50s and 60s, whereas it is the 20s to 40s for cervical cancer. In Japan, screening was implemented for uterine corpus cancer, combined with cervical cancer screening in 1987, but since the scientific evidence for a reduction in mortality was poor, the government stopped this screening.

Overall geographical variations in the SMRs of uterine corpus cancer are small (Fig. 4.56). Lower SMR areas were observed in the mid-west of Japan and the Chugoku and Shikoku regions, while higher SMR areas were observed in the Kanto and Kyushu regions. There are no areas of extremely high or low SMRs.

Transitions and Socioeconomic Disparities

The regional inequality of SMR declined from 1995 to 2014. The series of cartogram shows that the high SMR in the Tokyo metropolitan area has clearly decreased (Fig. 4.57).

The ASMR of uterine neoplasms showed an increasing trend (Fig. 4.58), which might relate to dietary and reproductive factors in Japan. The socioeconomic inequalities in ASMR, based on the areal deprivation index, were not clear when compared with cervical cancer (Fig. 4.59). Inverse socioeconomic gradients of mortality were observed in 2000–2004, but these disappeared in the period from 2010 to 2014. The RII of uterine corpus cancer has been around 1 (Fig. 4.60), indicating that there is no clear sign of areal-based social inequality in death from uterine corpus cancer.

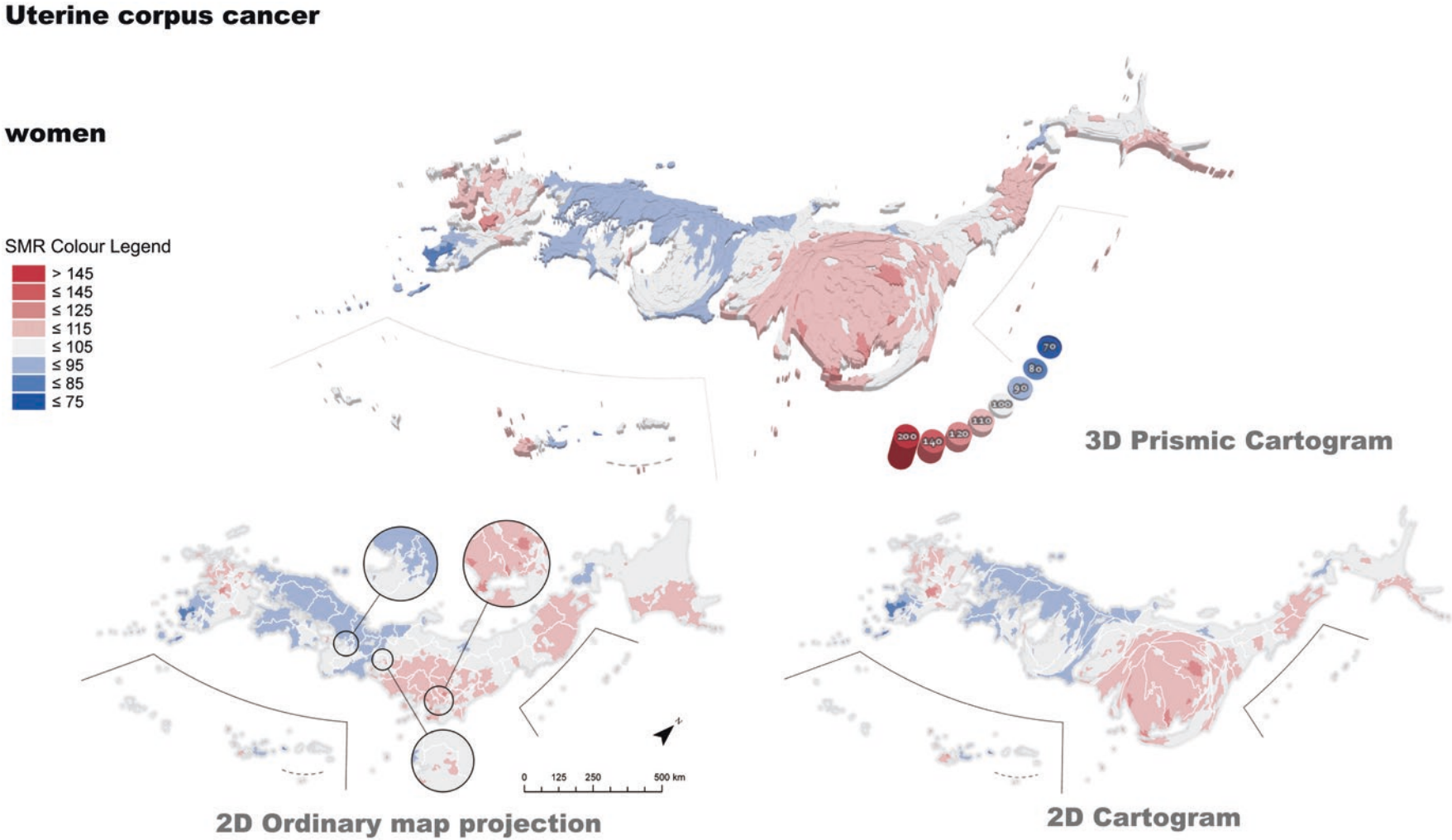


Fig. 4.56 SMR distribution of uterine corpus cancer, women, 2010–2014

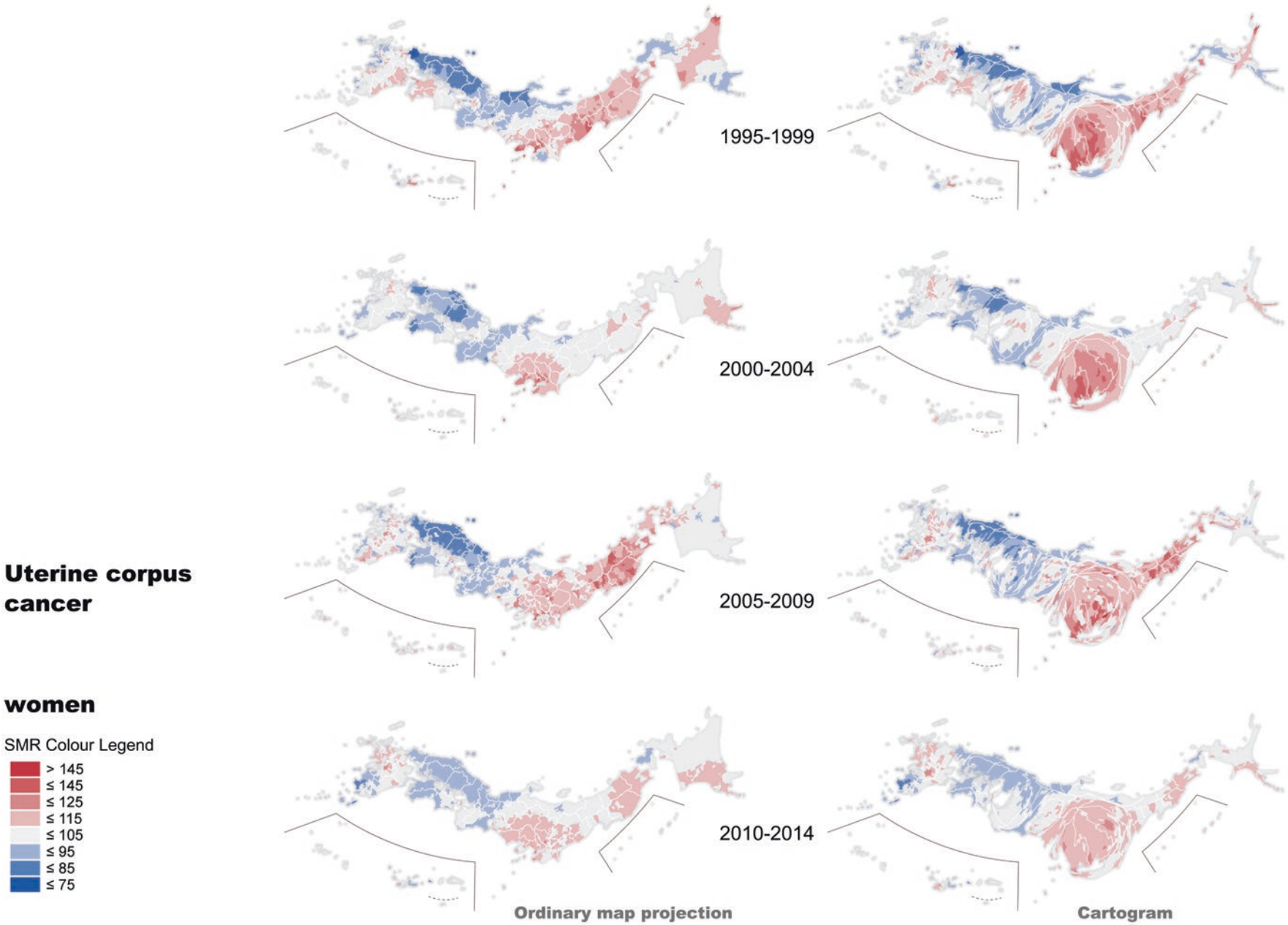


Fig. 4.57 Transition of SMR distribution of uterine corpus cancer, women, from 1995 to 2014 by 5-year period

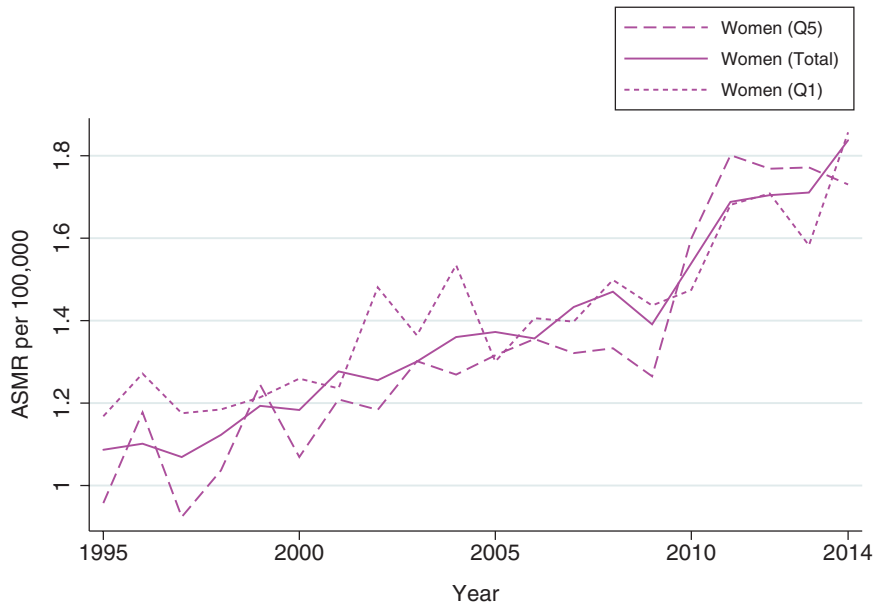


Fig. 4.58 Annual transition in the ASMR of uterine corpus cancer from 1995 to 2014

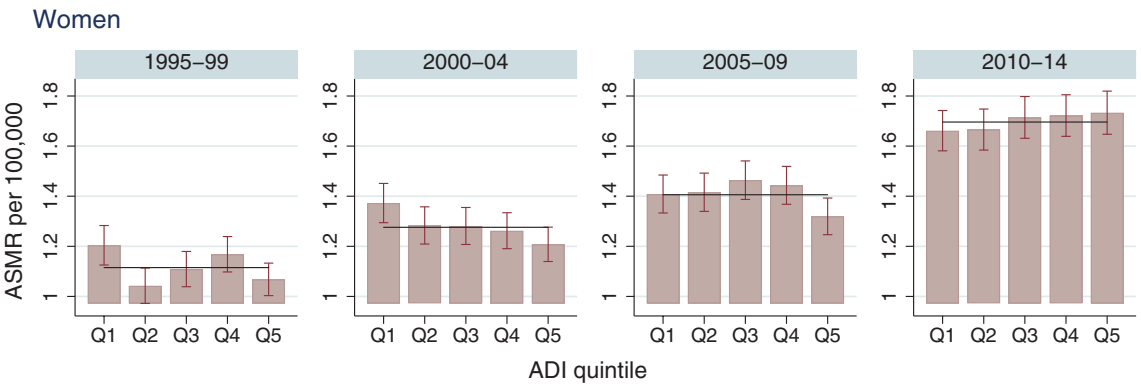


Fig. 4.59 The transition in the ASMR distribution of uterine corpus cancer by ADI quintile (top: men, bottom: women)

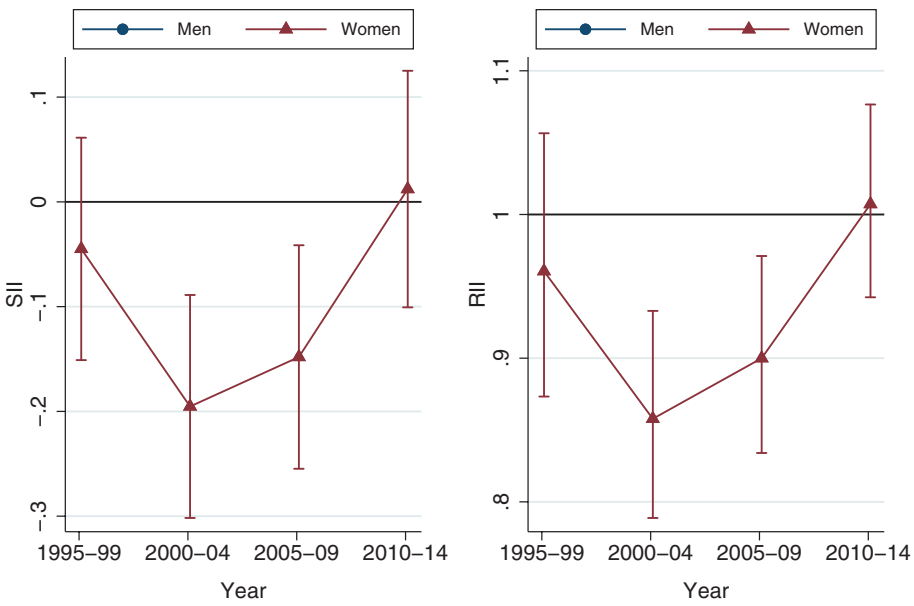


Fig. 4.60 Transition in SII and RII of uterine corpus cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.13 Ovarian Cancer (ICD10: C56): A Cancer with Inverse Socioeconomic Gradient

Seiki Kanemura

Overview

Multiple risk factors were related to ovarian cancer incidence and about 10% of these were attributed to genetics. Higher incidence was observed in 40–60 years old women; germ cell or gonadal tumours showed high incidence in women in their teens and 20s. The distribution of histological type in ovarian cancer varies in different countries of the world. Japanese incident cases varied, while the dominant histology type was serum cell cancer in other countries (Coburn et al. 2017). Sufficient evidence was found to suggest that the risk of ovarian cancer is increased by exposure to asbestos, oestrogen menopausal therapy, tobacco smoking (Cogliano et al. 2011) and adult attained height and body fatness. There is limited sufficient evidence to suggest that lactation may reduce the risk (World Cancer Research Fund 2018).

The geographical variation in the SMR of ovarian cancer is relatively small (Fig. 4.61). Low SMR areas were observed in the Chugoku and Shikoku regions, and high SMR areas were observed in the Hokkaido, Tohoku, Kanto and Kyushu regions. According to the cartogram, the Tokyo metropolitan area had a high SMR.

Transitions and Socioeconomic Disparities

While the spatial patterns of SMR were stable for the 20 years from 1995 to 2014, regional inequalities of SMR have decreased (Fig. 4.62). Although we can see darker shades of red (meaning higher SMR) in the northern Tohoku region and the Tokyo metropolitan area in 1995–1999, these areas now have less dark red meaning moderately high SMR in later years. The ASMRs of ovarian cancer were temporarily fluctuated but showed a slight decreasing trend (Fig. 4.63).

An inverse socioeconomic gradient in the ASMR based on the areal deprivation index was observed (Fig. 4.64). The highest and lowest ASMRs were observed in Q1 and Q5, respectively, as in the case of breast cancer. A small decrease in ASMR was observed, but the absolute and relative socioeconomic inequalities have not largely changed according to the trends in SII and RII (Fig. 4.65).

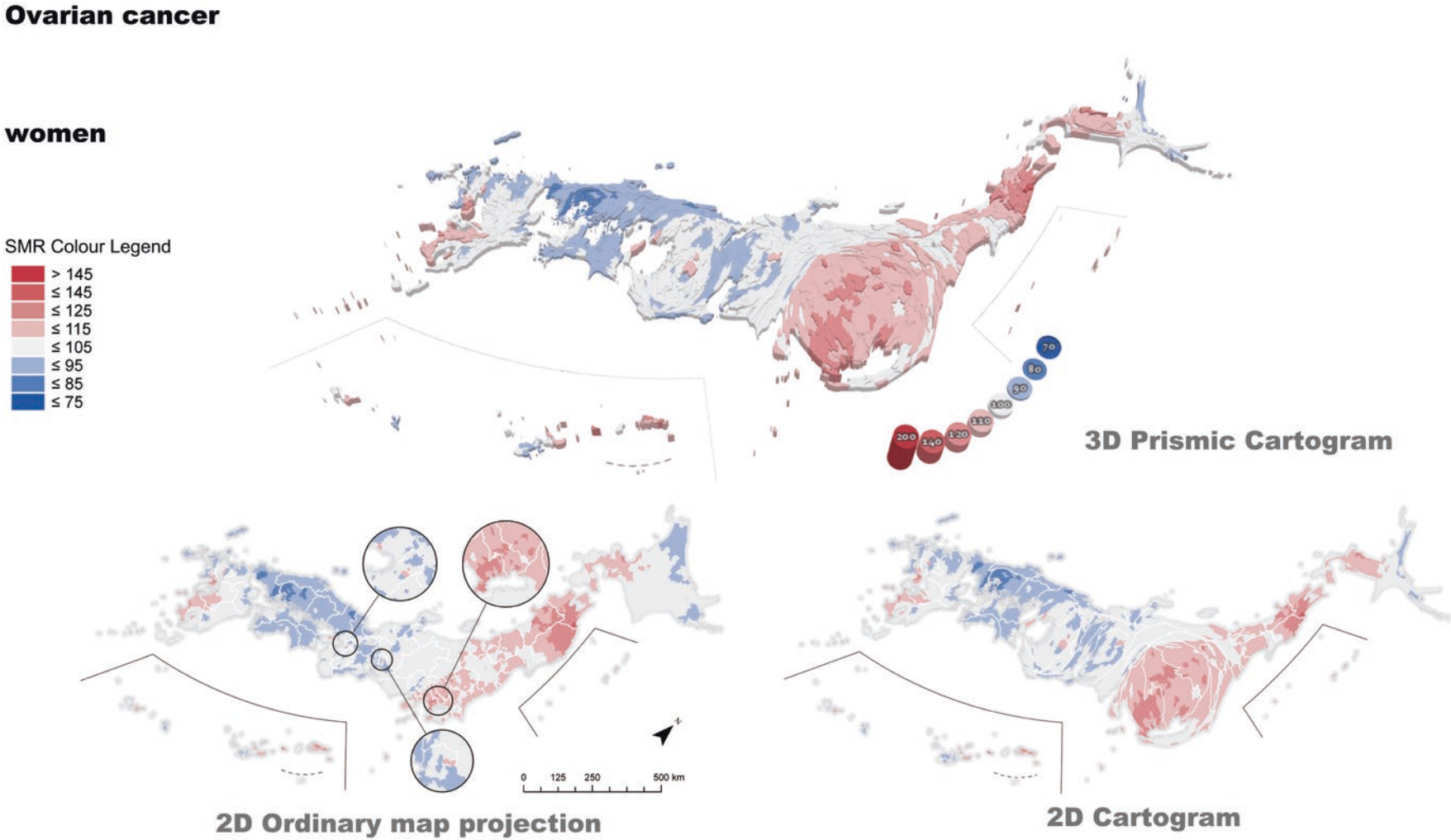


Fig. 4.61 SMR distribution of ovarian cancer, women, 2010–2014

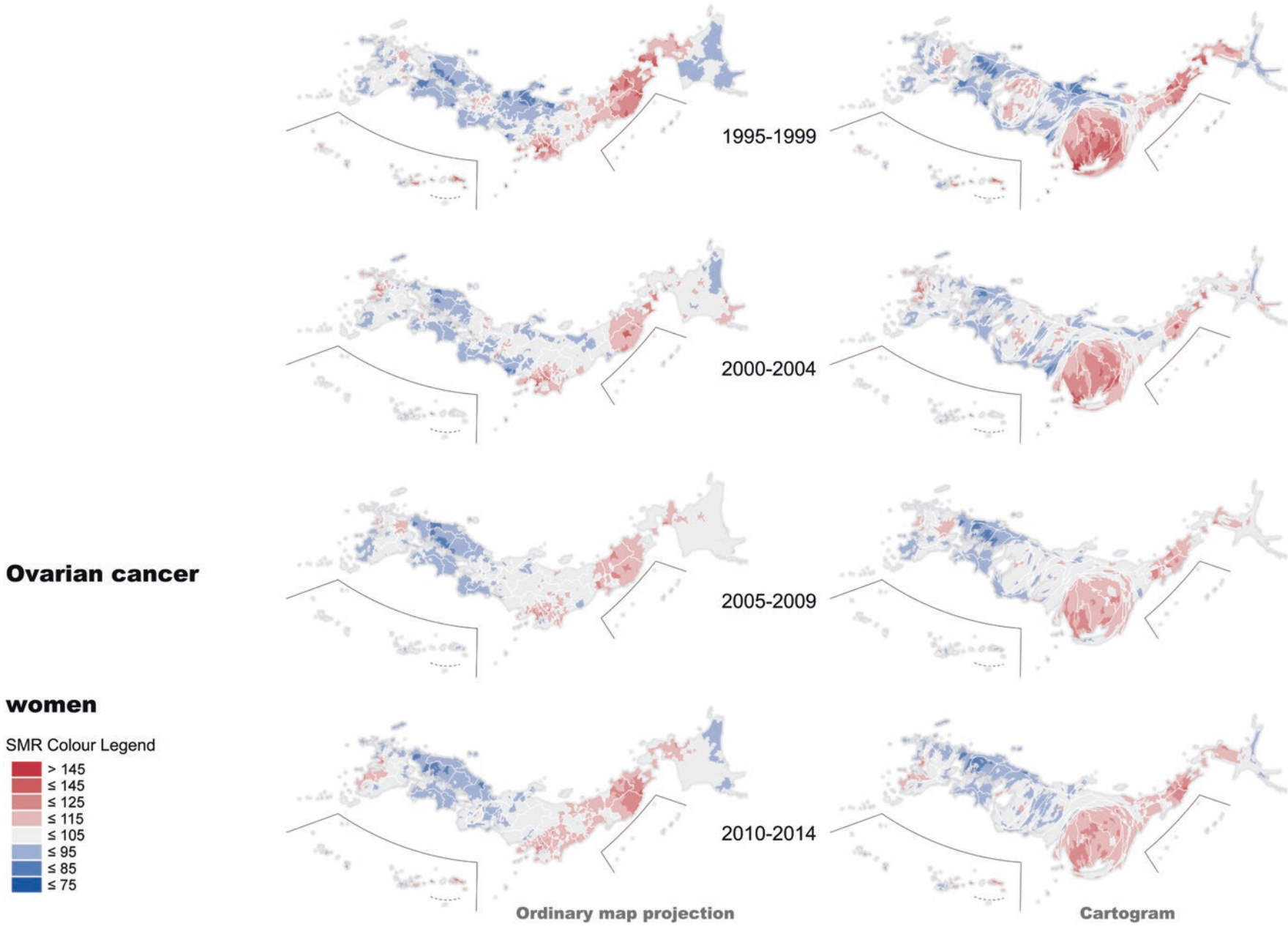


Fig. 4.62 Transition of SMR distribution of ovarian cancer, women, from 1995 to 2014 by 5-year period

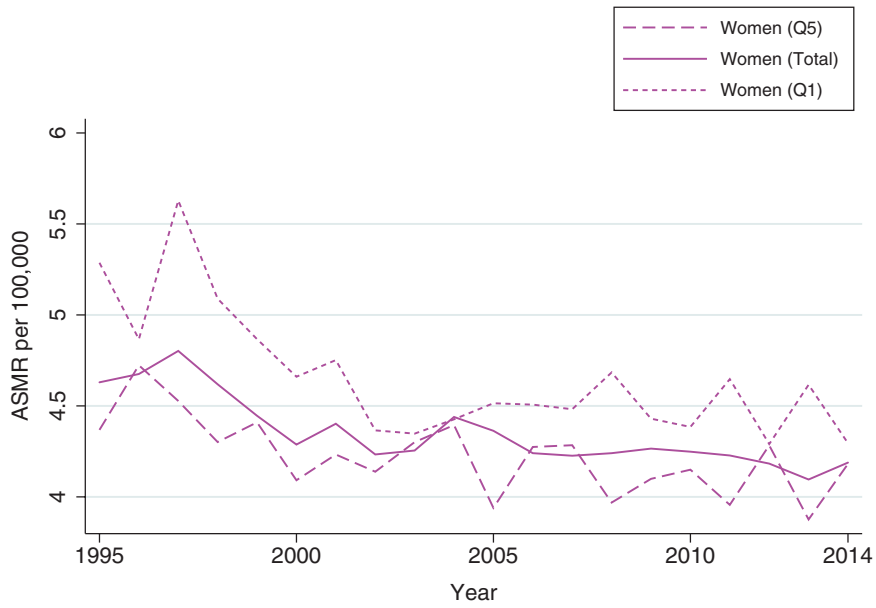


Fig. 4.63 Annual transition in the ASMR of ovarian cancer from 1995 to 2014

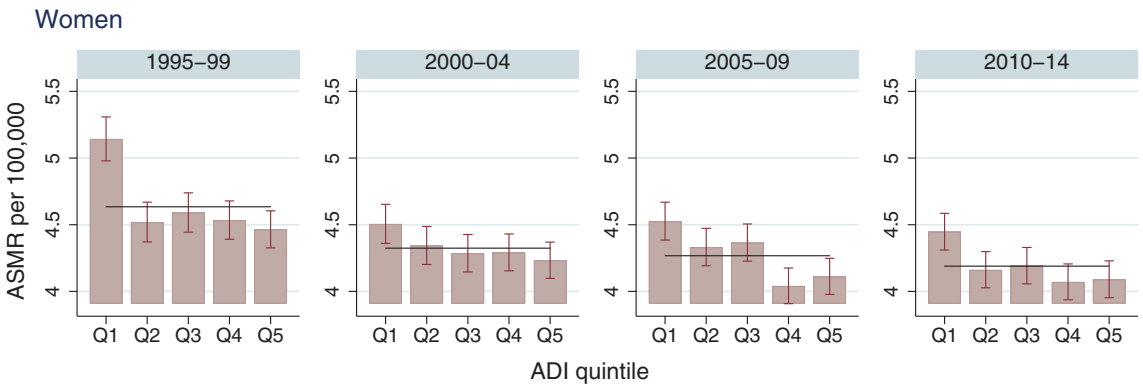


Fig. 4.64 The transition in the ASMR distribution of ovarian cancer by ADI quintile (top: men, bottom: women)

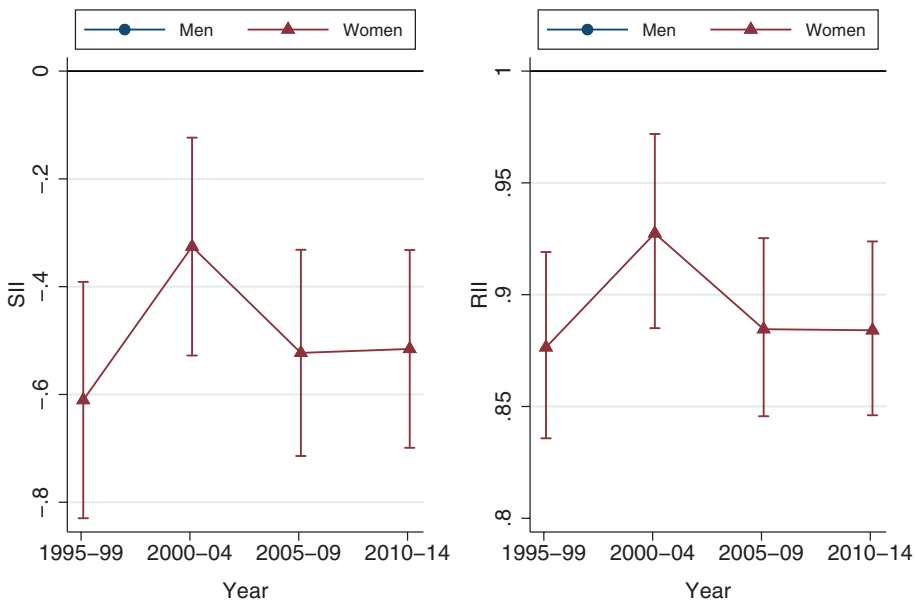


Fig. 4.65 Transition in SII and RII of ovarian cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.14 Prostate Cancer (ICD10: C61): Increasing Cancer due to Screening detection

Seiki Kanemura

Overview

Prostate cancer incidence and mortality are higher in older men. Recently, incidence has increased considerably, due to the spread of PSA-based screening, but the mortality rate has been quite stable. Despite government guidelines to the contrary, over 70% of municipalities in Japan have implemented PSA testing for population screening, and the increasing incidence has been linked to overdiagnosis due to this screening.

Areas with low SMR were observed in the Kinki, Chugoku and Shikoku regions and high SMR in the Hokkaido, Tohoku, Kanto and Kyushu regions (Fig. 4.66). According to the cartogram-based SMR maps, the Tokyo metropolitan area had high SMRs.

Transitions and Socioeconomic Disparities

The general geographical tendency of the SMR distribution has been unchanged but in the northern Tohoku region, the SMR was higher in 2005–2014 than in 1995–2004 (Fig. 4.67).

The ASMR of prostate cancer had increased slightly by 2000 but has decreased slightly since 2005 (Fig. 4.68). After 2000, the socioeconomic gradient in the ASMR based on ADI has become apparent (Fig. 4.69). Both the absolute and relative socioeconomic disparities in mortality have been widened as indicated by the trends in RII and SII (Fig. 4.70).

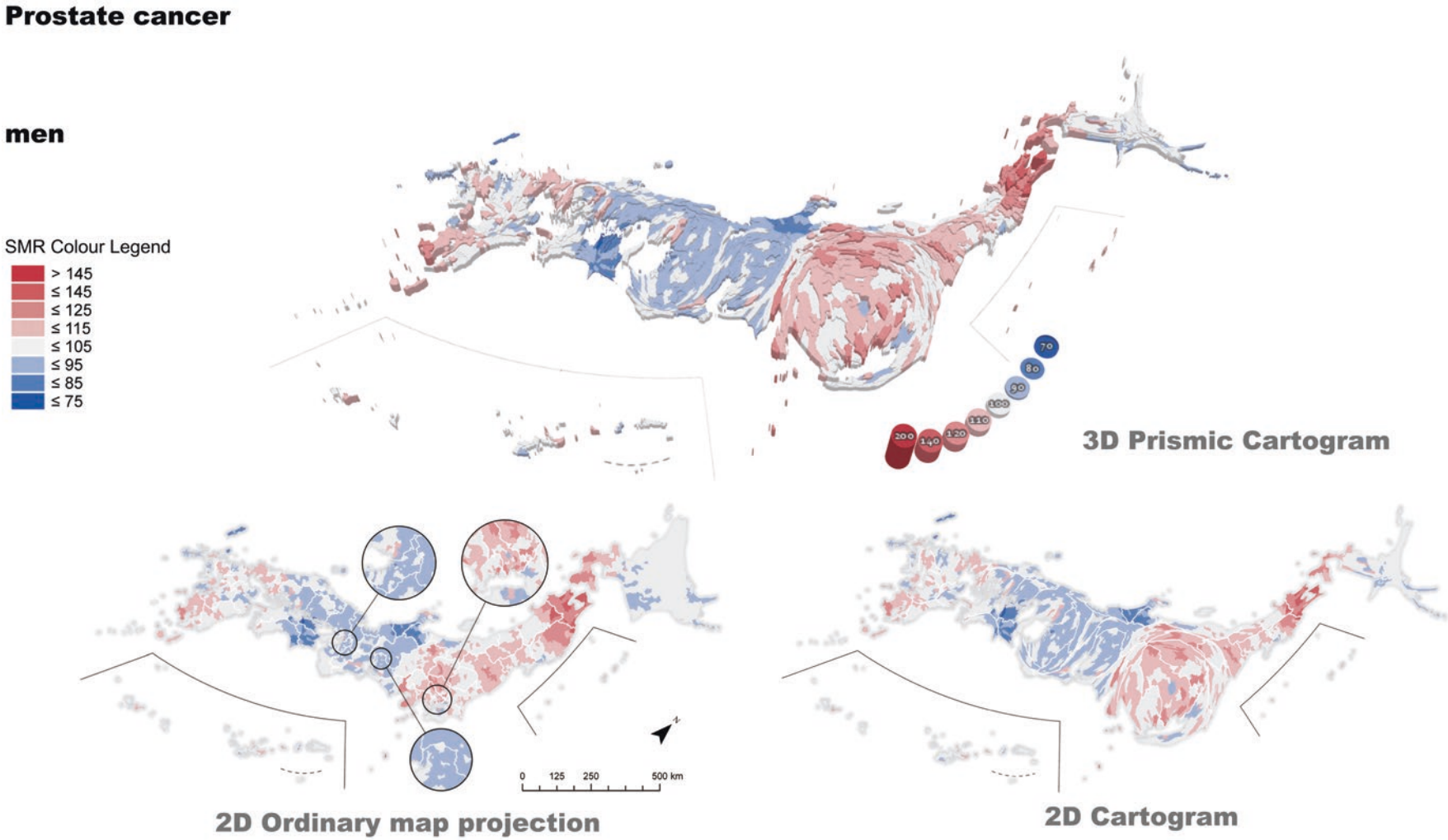


Fig. 4.66 SMR distribution of prostate cancer, men, 2010–2014

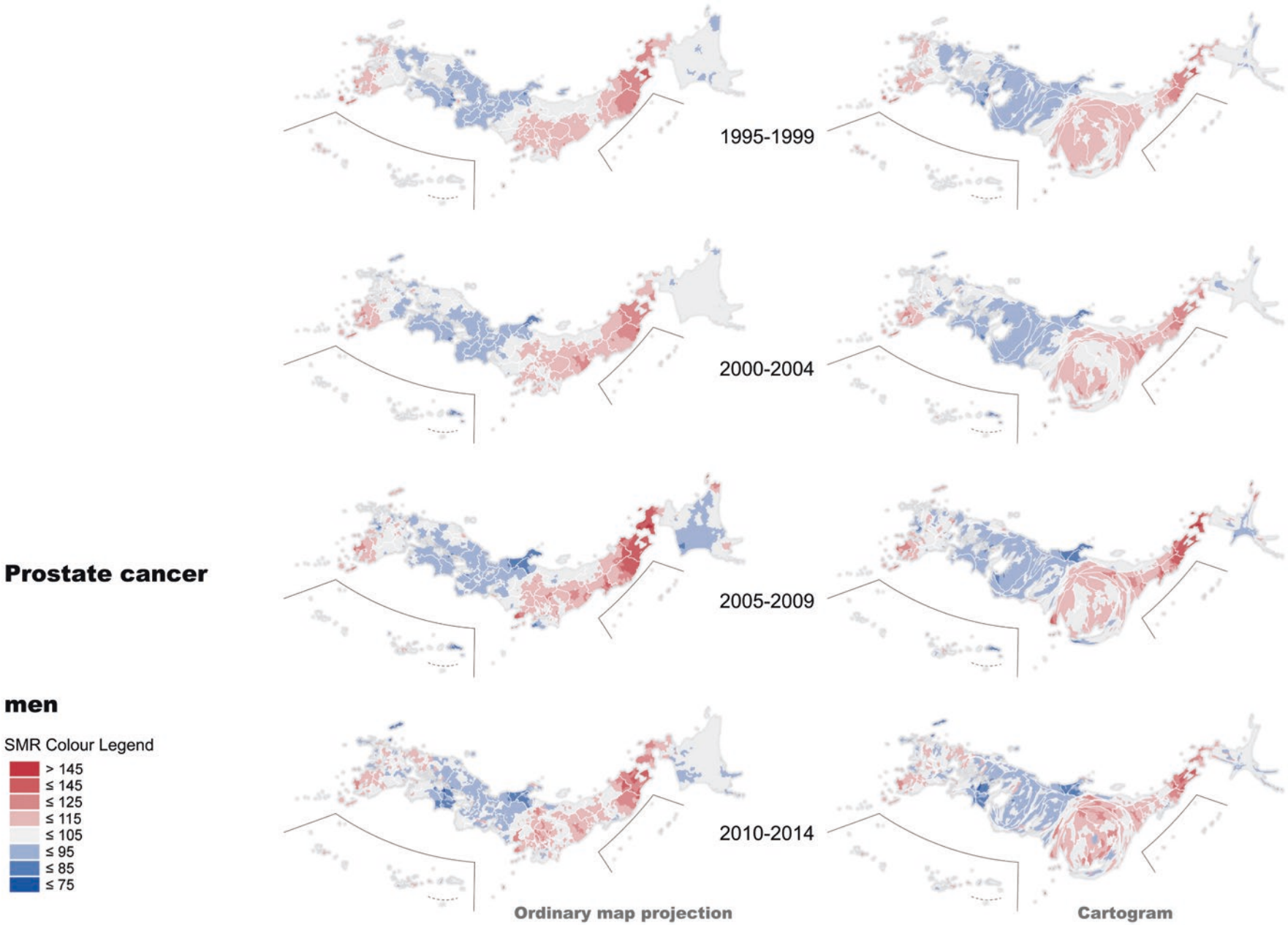


Fig. 4.67 Transition of SMR distribution of prostate cancer, men, from 1995 to 2014 by 5-year period

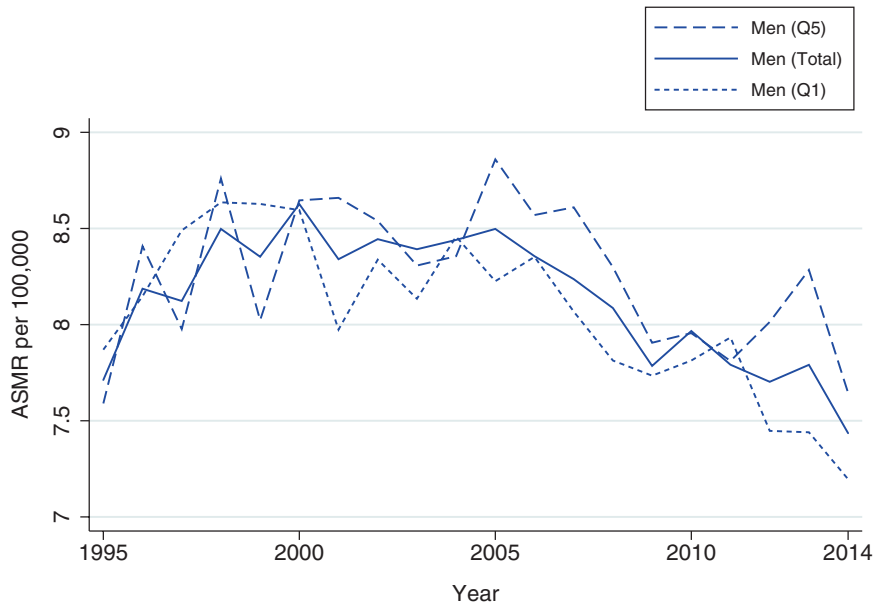


Fig. 4.68 Annual transition in the ASMR of prostate cancer from 1995 to 2014

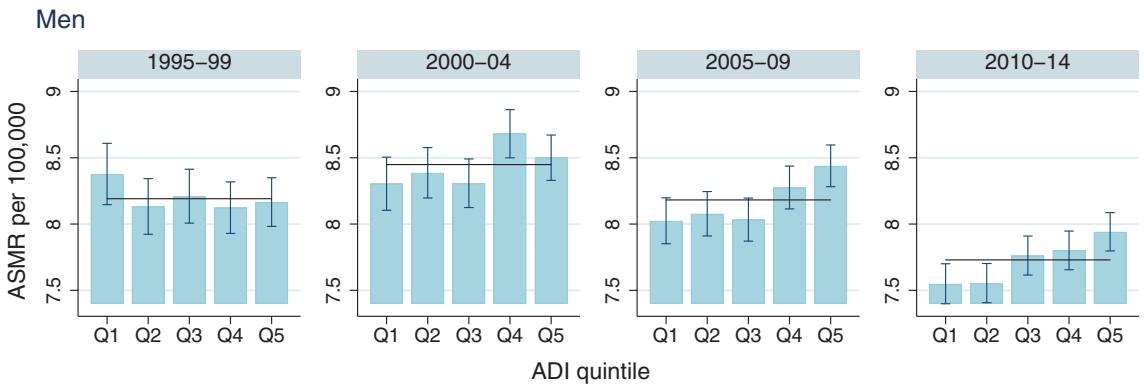


Fig. 4.69 The transition in the ASMR distribution of prostate cancer by ADI quintile (top: men, bottom: women)

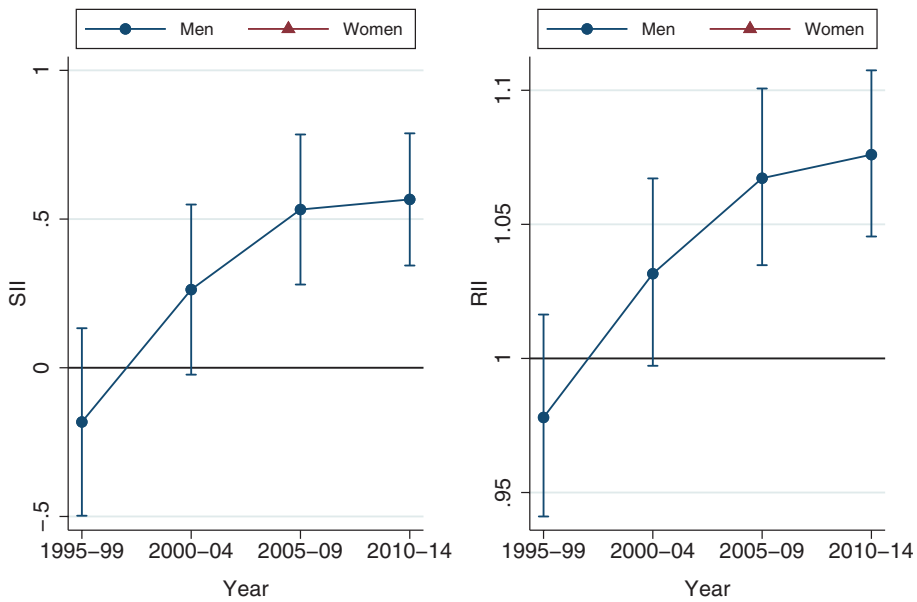


Fig. 4.70 Transition in SII and RII of prostate cancer from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.15 Malignant Lymphoma (ICD10: C81–C85, C96): An East-West Dividing Cancer

Yoshikazu Nishino

Overview

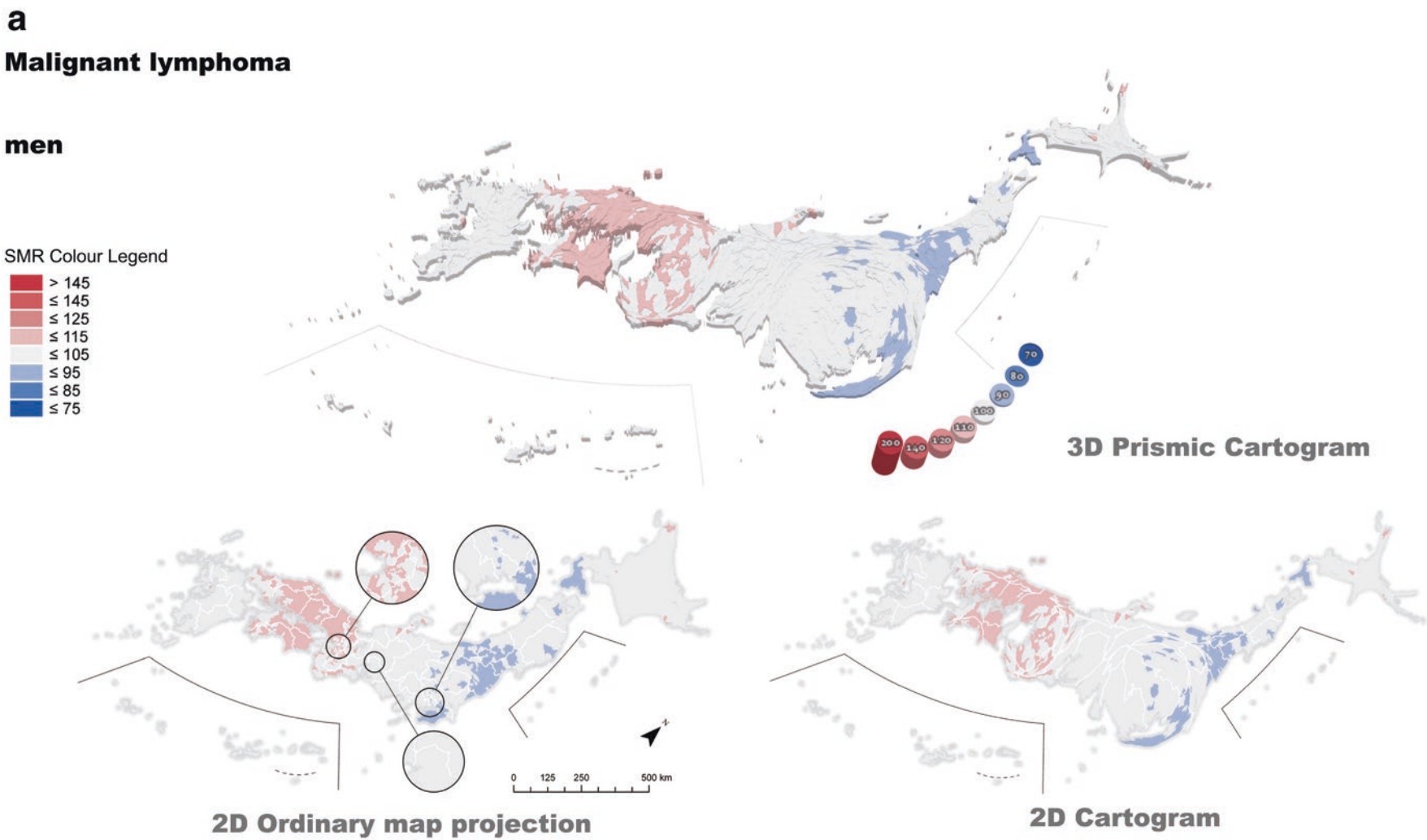
Malignant lymphoma is the ninth most common cause of all cancer deaths in both sexes, equating to 3% of all cancer deaths. Although the regional variation in the SMRs of this disease is small, there is a clear east-west pattern in the SMR map (Fig. 4.71). The observed SMRs of malignant lymphoma were high in the west of Japan, but low in the east. Among men, SMRs were high in the Chugoku and Shikoku regions, low in South Hokkaido, Fukushima Prefecture and the surrounding areas in the Tohoku region and Chiba Prefecture in the Kanto region. Among women, SMRs were high in the Kinki region and low in the Tohoku region and Chiba Prefecture.

HCV infection increases the risk of non-Hodgkin lymphoma incidence (Pozzato et al. 2017). In Japan, the prevalence of HCV is high in western Japan, which might explain the high incidence of malignant lymphoma in the area.

Transitions and Socioeconomic Disparities

The distributional pattern of high SMRs in the west and low SMRs in the east remained fundamentally unchanged during the 20 years from 1995 to 2014 (Fig. 4.72). Among men, low SMR areas were more widely spread before 2010 than the most recent period, 2010–2014. Among the metropolitan areas emphasised by the cartogram, the Keihanshin/Osaka metropolitan area generally showed high SMRs in the 1995–1999 period, but the number of areas with high (over 100) SMRs has decreased since then.

The ASMR of malignant lymphoma has decreased slightly during the 20 years (Fig. 4.73). The socioeconomic gradient of the ASMR was not clear in 1995–2004 but has become apparent since 2005 (Figs. 4.74 and 4.75).


a
Malignant lymphoma
men
SMR Colour Legend
> 145
≤ 145
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3D Prismic Cartogram
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2D Ordinary map projection
2D Cartogram

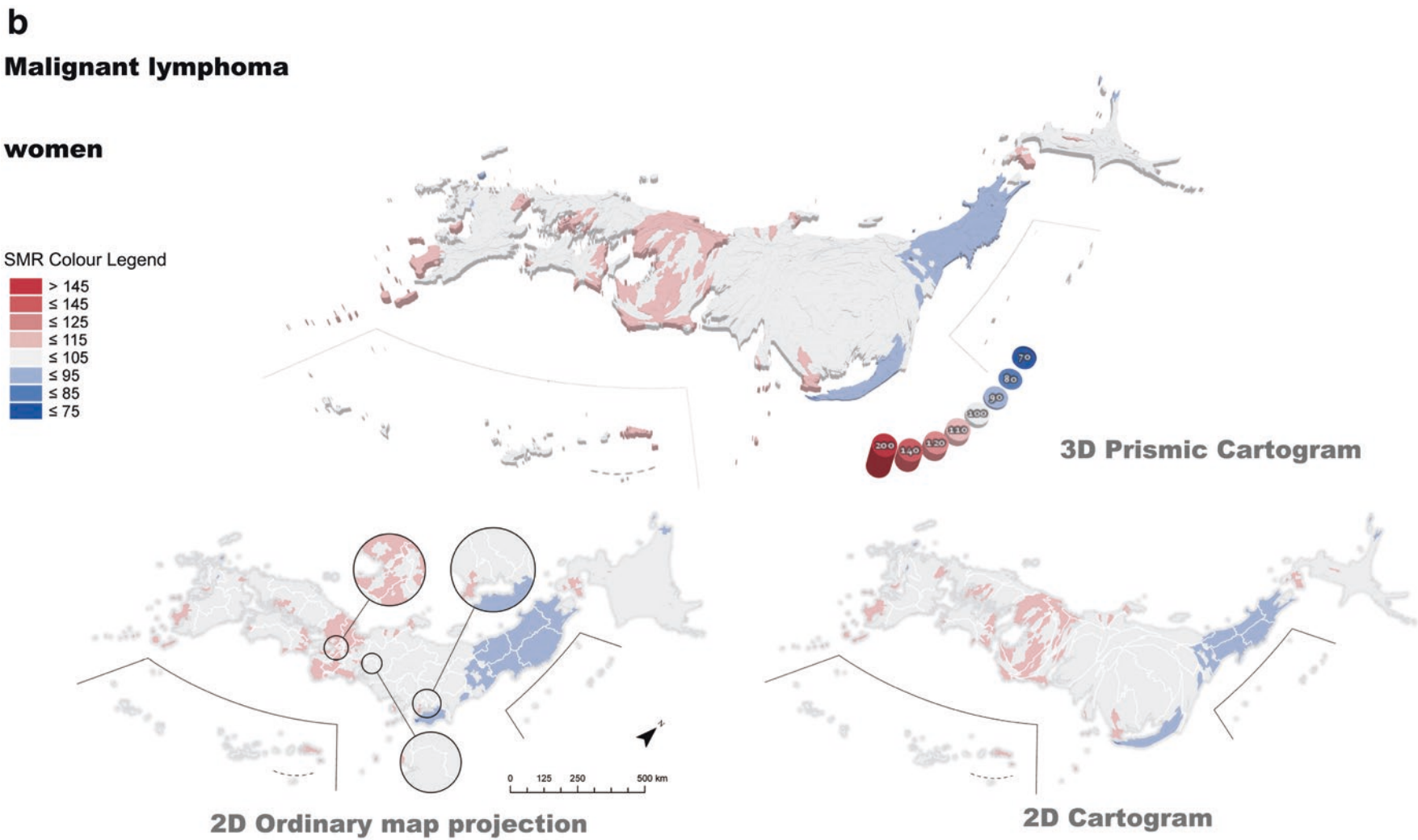
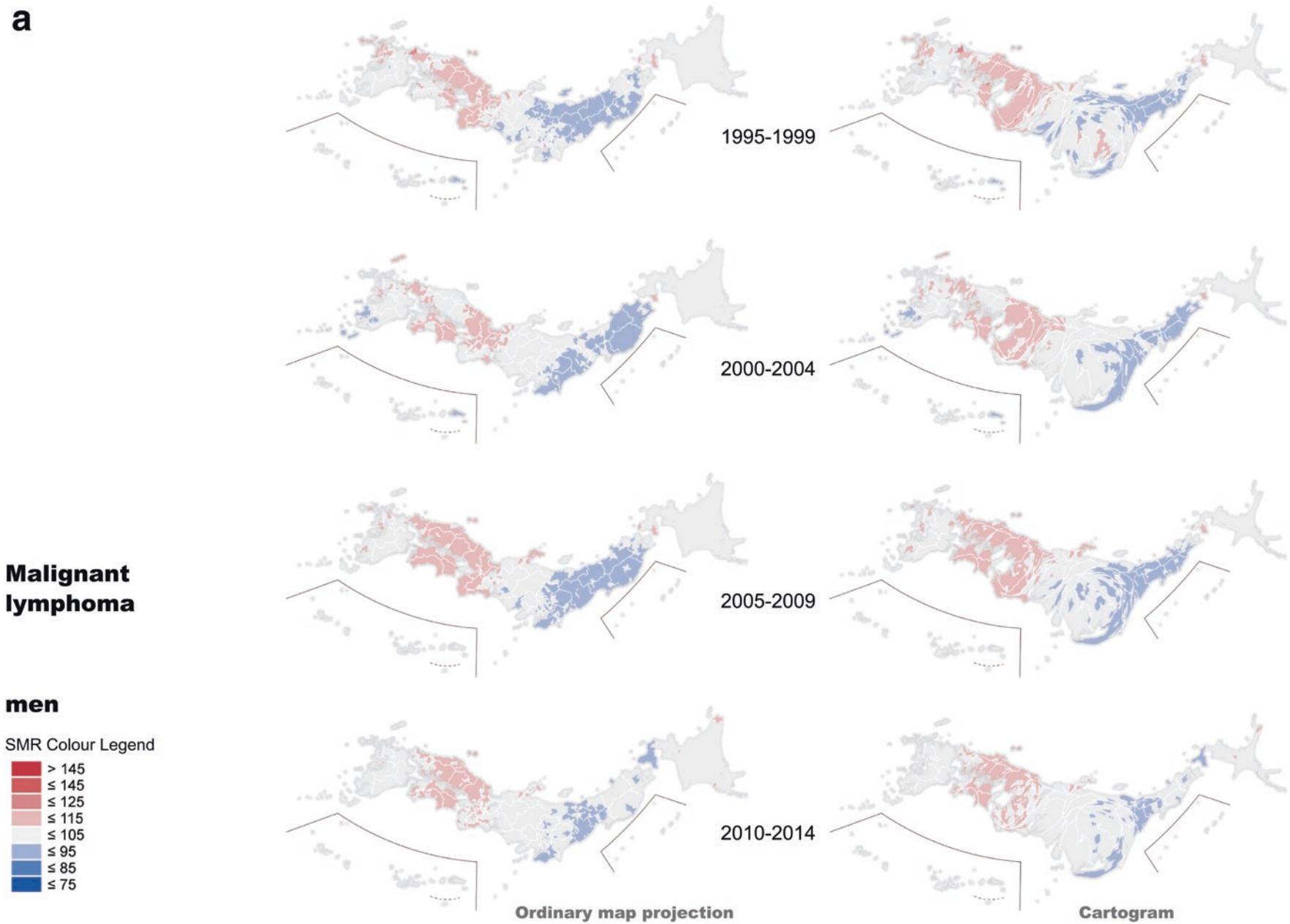


Fig. 4.71 SMR distribution of malignant lymphoma, 2010–2014. (**a**) Men. (**b**) Women


a
Malignant lymphoma
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
≤ 85
≤ 75
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

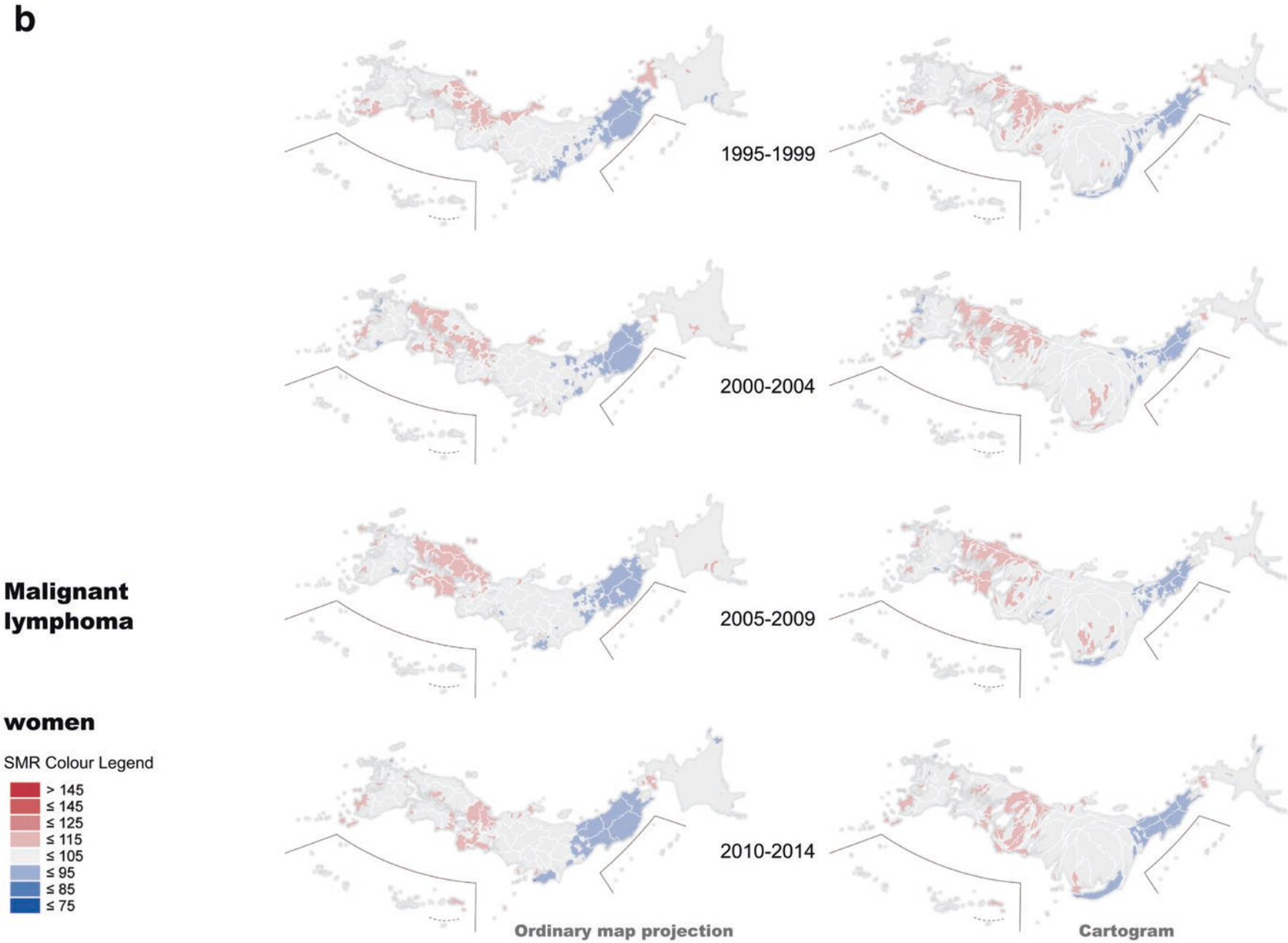


Fig. 4.72 Transition of SMR distribution of malignant lymphoma from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

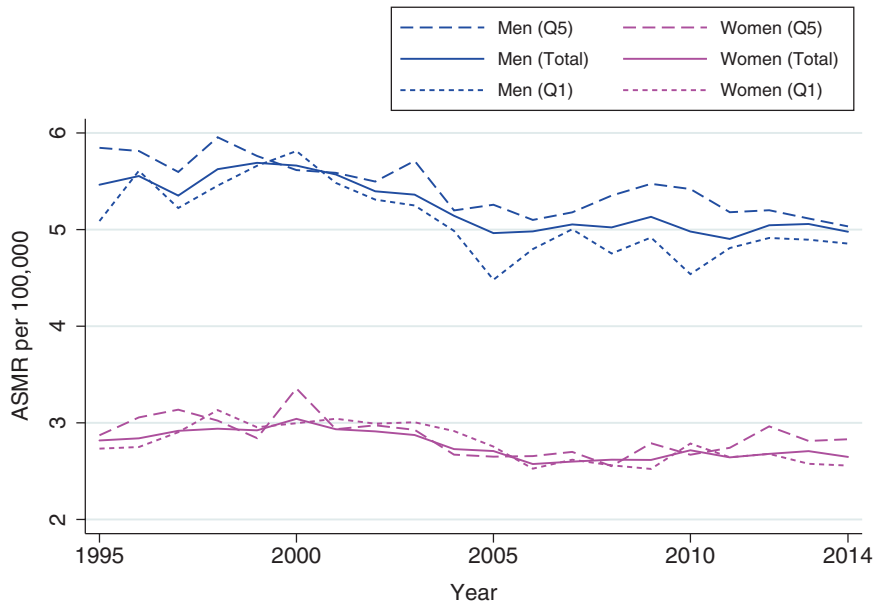


Fig. 4.73 Annual transition in the ASMR of malignant lymphoma from 1995 to 2014

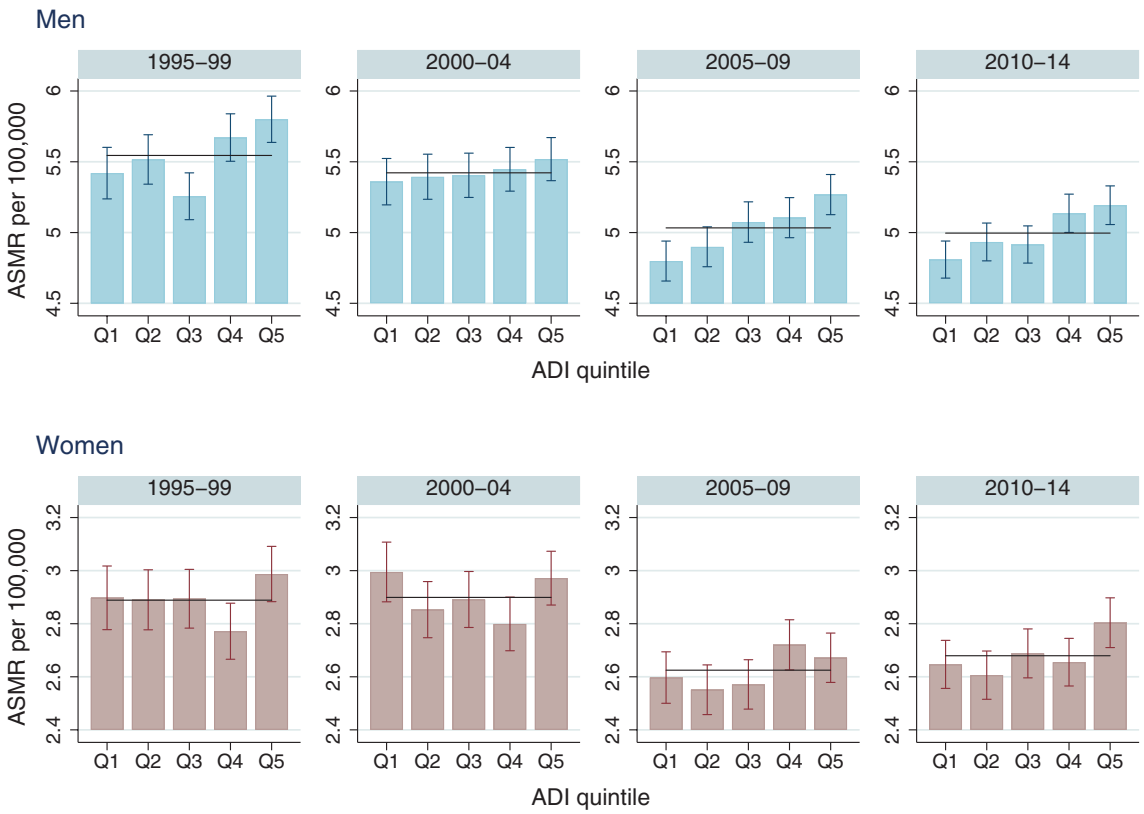


Fig. 4.74 The transition in the ASMR distribution of malignant lymphoma by ADI quintile (top: men, bottom: women)

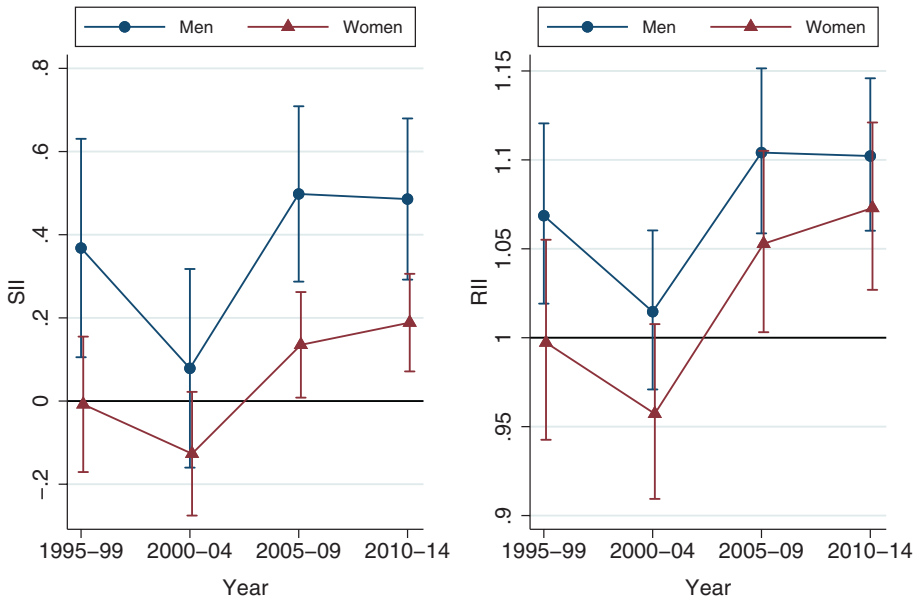


Fig. 4.75 Transition in SII and RII of malignant lymphoma from 1995 to 2014 by 5-year period (left: SII, right: RII)

4.16 Leukaemia (ICD10: C91–C95): Historical Footprints of Past Coastal Migration

Yoshikazu Nishino

Overview

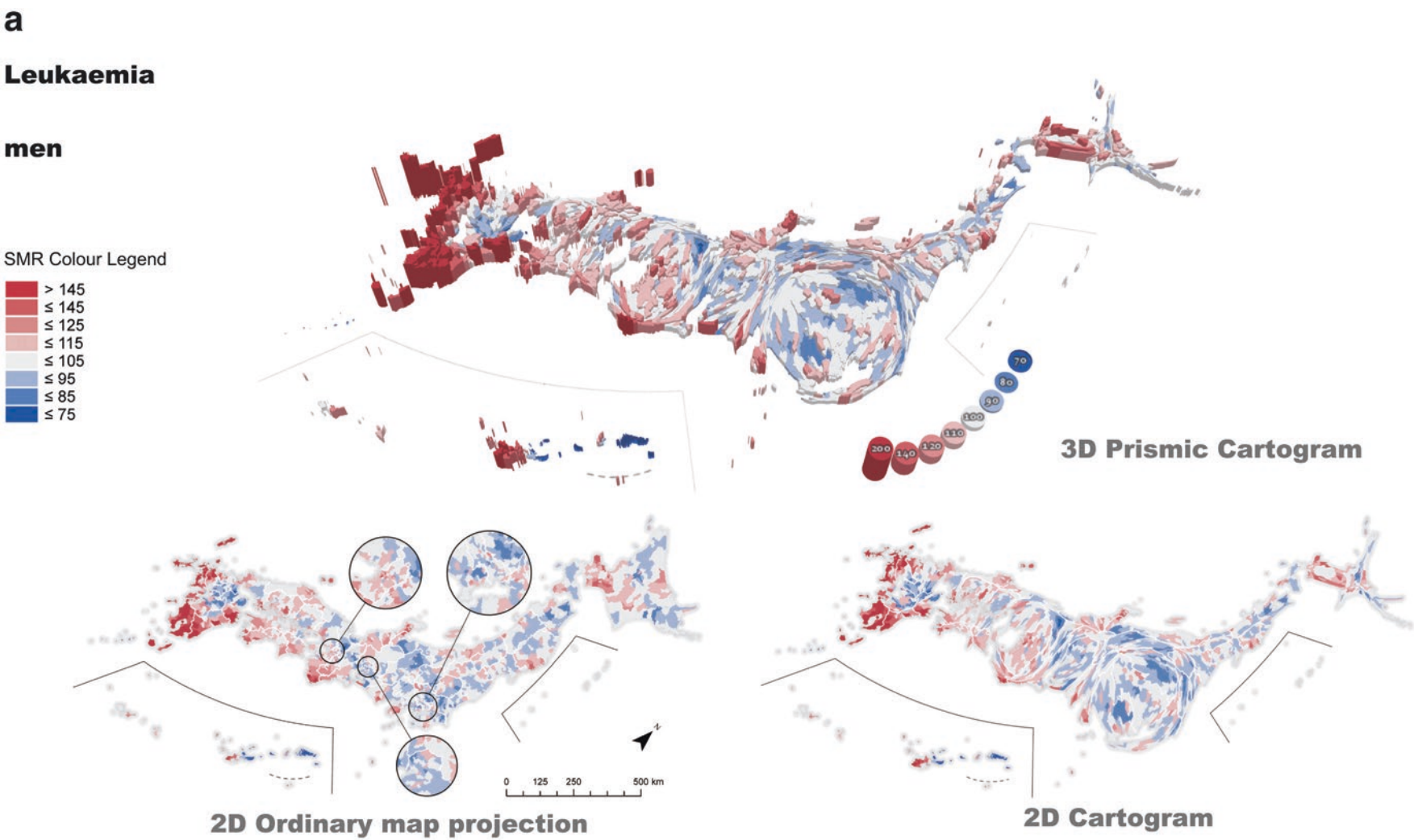
Approximately 2% of all cancer deaths are due to leukaemia. The ASMR of leukaemia in Japan is lower than that in Western countries.

SMRs of leukaemia were very high in the Kyushu region, but some high SMR areas were scattered across the maritime areas covering Hokkaido, Honsyu (the main island of Japan), Shikoku and the Okinawan islands (Fig. 4.76).

The distribution of Adult T-cell leukaemia (ATL) incidence is strongly related to the regional differences in leukaemia incidence in Japan. ATL incidence in the middle-aged and the older adults was attributed to vertical infection of human T-lymphotropic virus type I (HTLV-1) through breastfeeding. Although high prevalence of HTLV-1 and high incidence of ATL have been reported in the Kyushu and Okinawa regions, birth areas of ATL patients are widely distributed throughout Hokkaido, Honsyu—the main island of Japan—and Shikoku. Local hotspots of ATL incidence were reported on the Pacific Ocean side of the Tohoku region, Kii Peninsula in Wakayama and Mie Prefectures, and the southern coastal part of Shikoku region (Tajima 1990). Some transmission could be attributable to past migration of HTLV-1 carriers along sea routes from the Kyusyu region to other parts of Japan.

Transitions and Socioeconomic Disparities

While there was no fundamental change of SMR distribution during the 20 years from 1995 to 2014 (Fig. 4.77), the ASMR of leukaemia decreased (Fig. 4.78). The distributions of ASMR by ADI quintile show that in Q5, the most deprived quintile group of areas, the ASMR has been consistently highest (Fig. 4.79). In addition, the RII was large, especially among women (Fig. 4.80). These indicate that the coastal regions which have high leukaemia mortality tend to have high areal deprivation. Trends in the RII were stable during the 20 years.


a
Leukaemia
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
≤ 85
≤ 75
70
80
90
100
110
120
140
200
3D Prismic Cartogram
0 125 250 500 km
2D Ordinary map projection
2D Cartogram

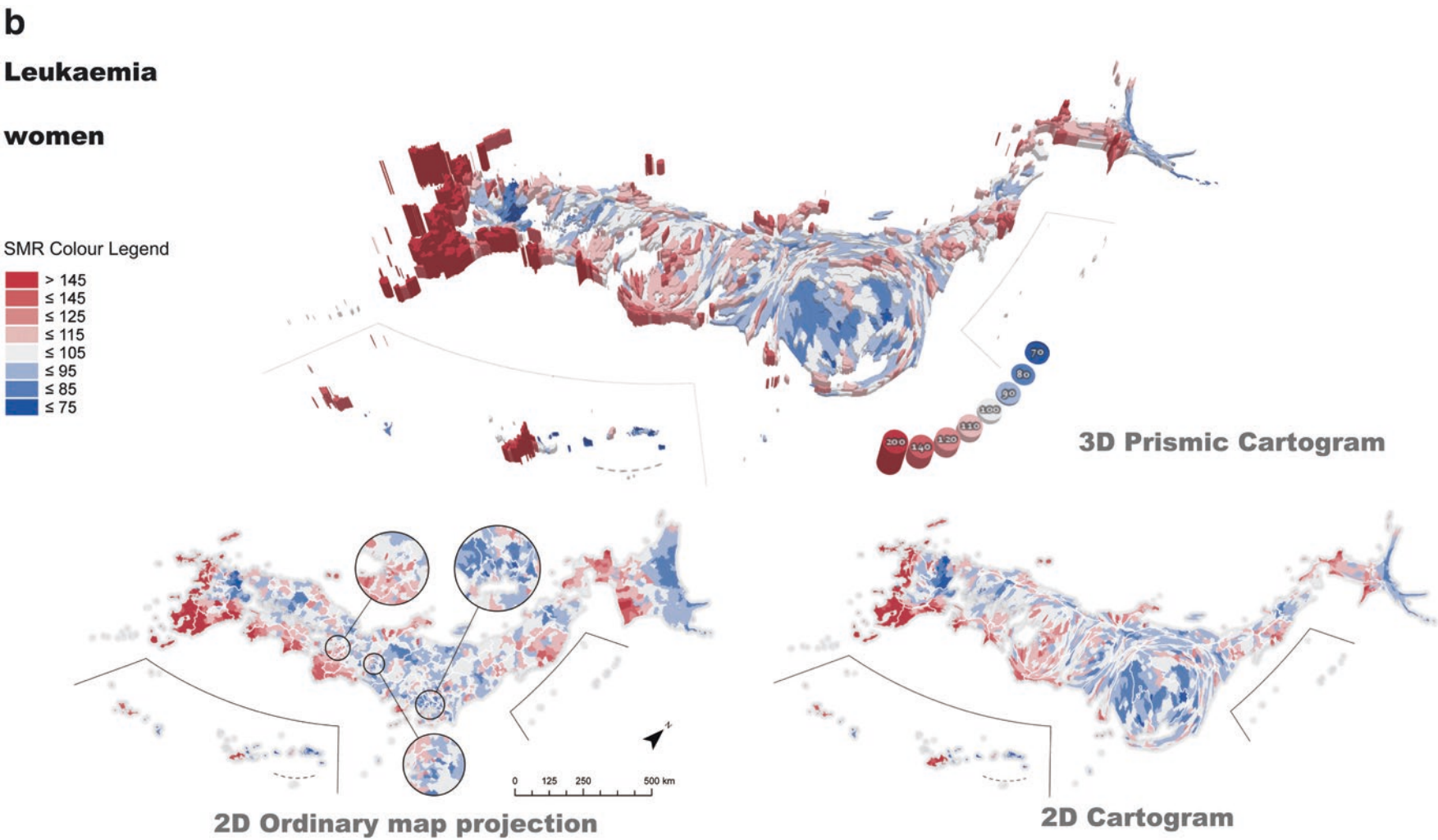
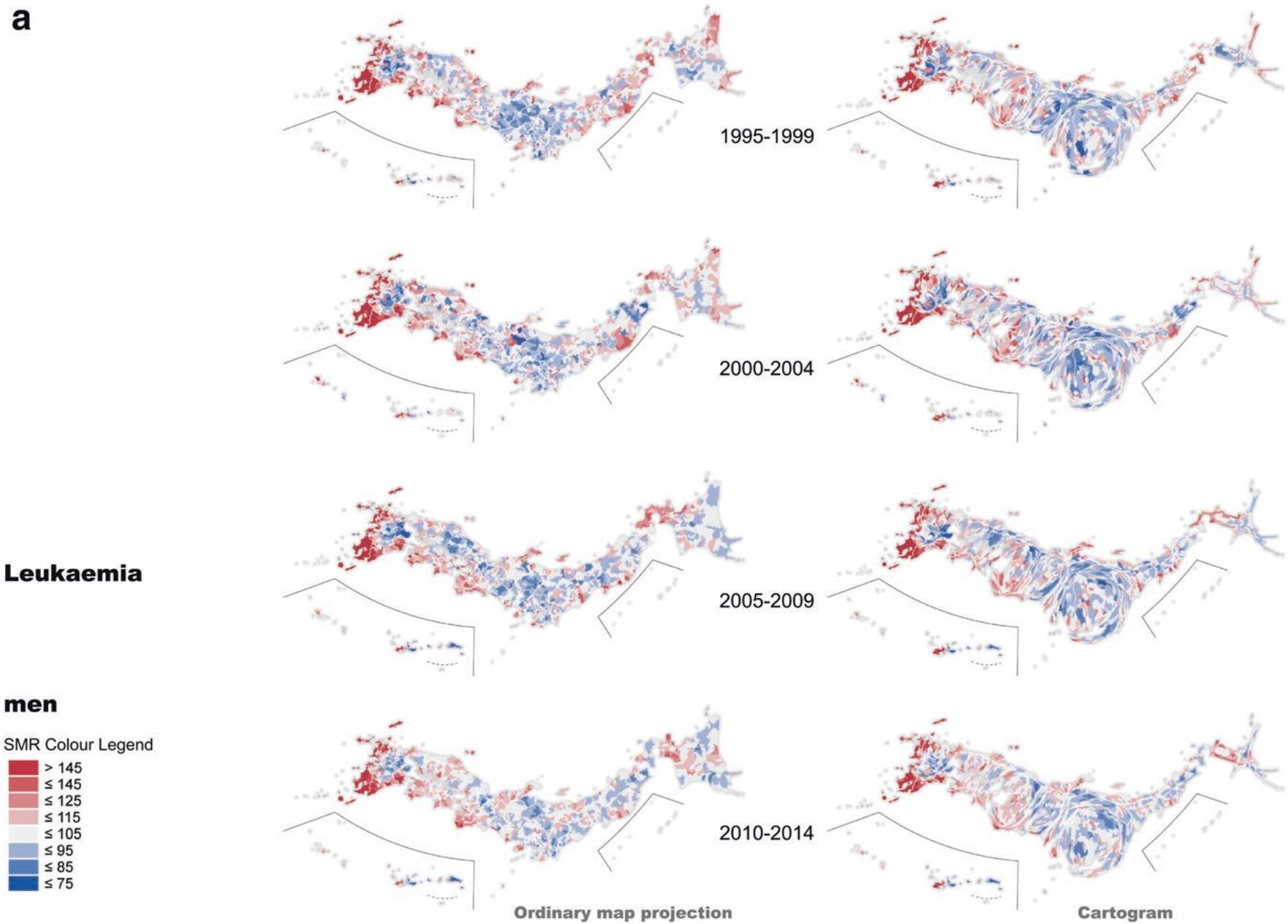


Fig. 4.76 SMR distribution of leukaemia, 2010–2014. (**a**) Men. (**b**) Women


a
Leukaemia
men
SMR Colour Legend
> 145
≤ 145
≤ 125
≤ 115
≤ 105
≤ 95
≤ 85
≤ 75
1995-1999
2000-2004
2005-2009
2010-2014
Ordinary map projection
Cartogram

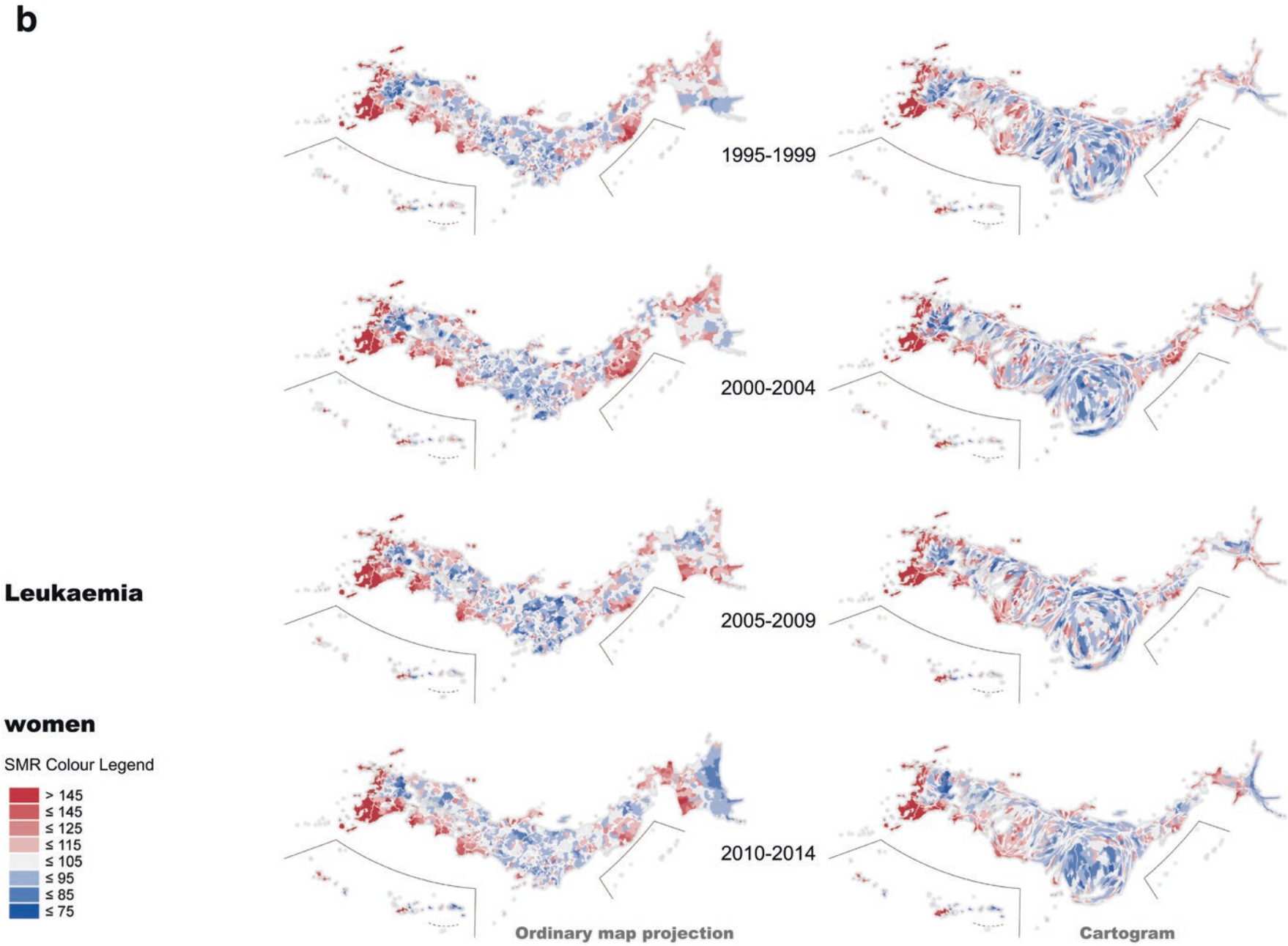


Fig. 4.77 Transition of SMR distribution of leukaemia from 1995 to 2014 by 5-year period. (**a**) Men. (**b**) Women

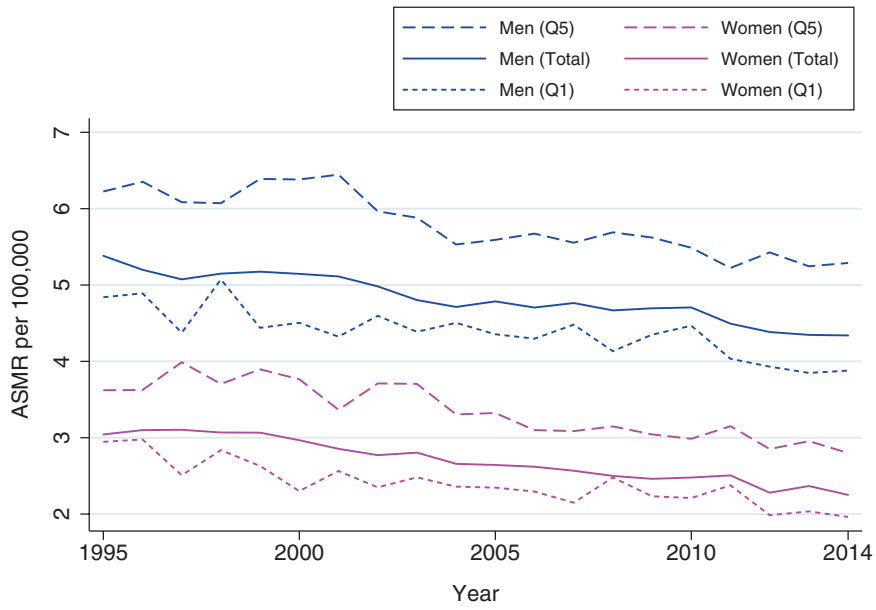


Fig. 4.78 Annual transition in the ASMR of leukaemia from 1995 to 2014

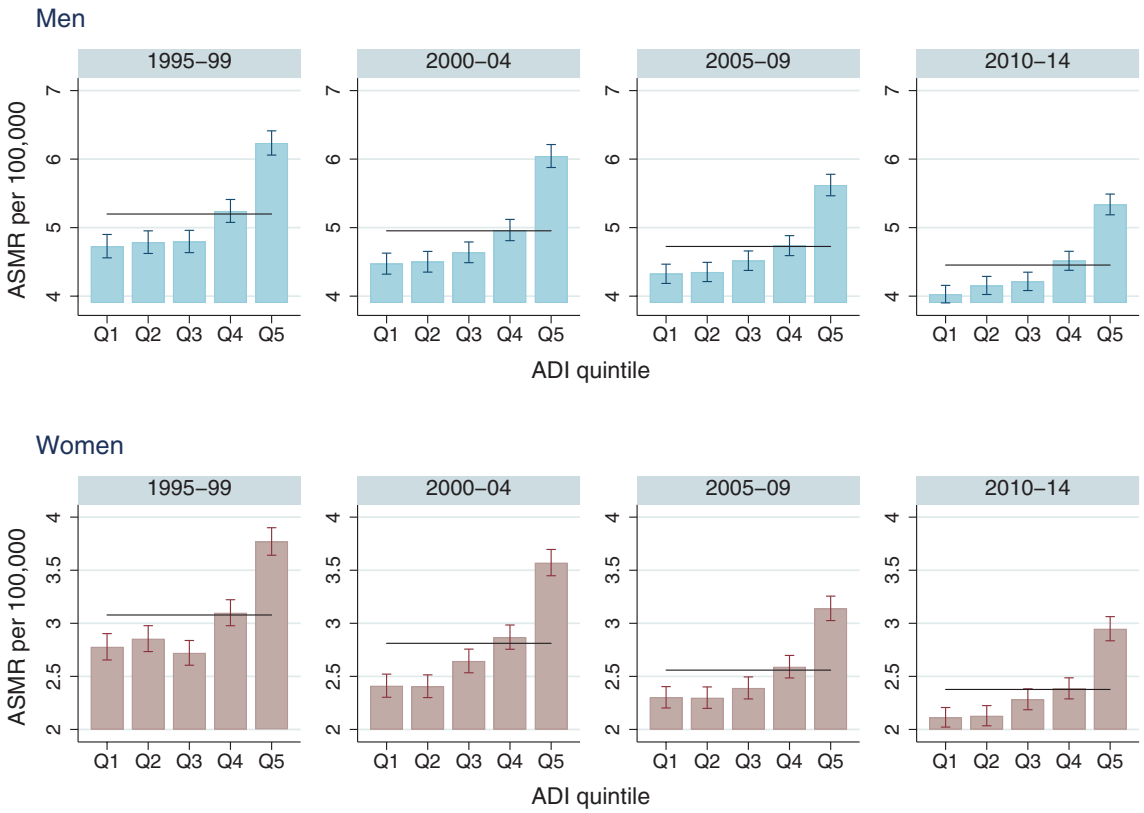


Fig. 4.79 The transition in the ASMR distribution of leukaemia by ADI quintile (top: men, bottom: women)

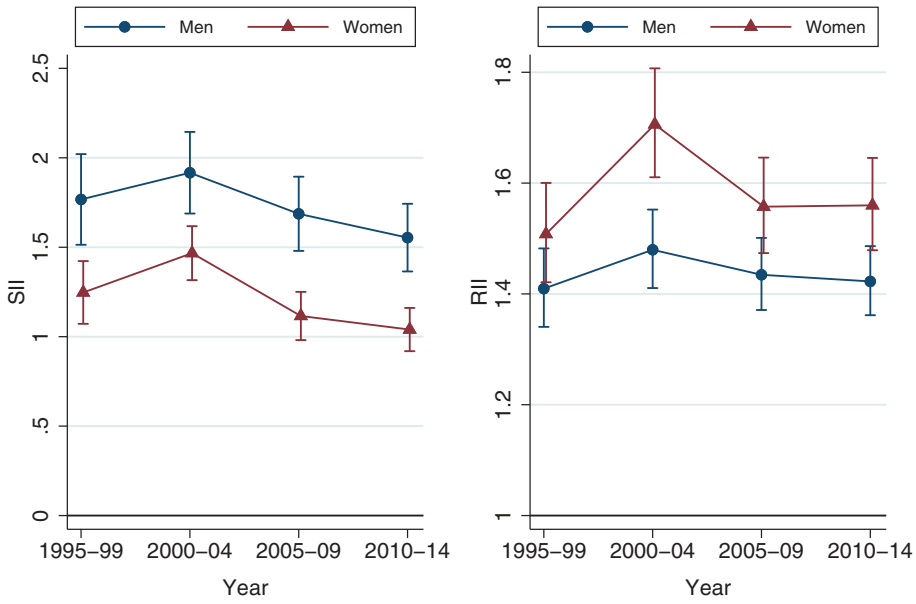


Fig. 4.80 Transition in SII and RII of leukaemia from 1995 to 2014 by 5-year period (left: SII, right: RII)

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