A spatial analysis of elderly mortality, morbidities and mental health status in Hong Kong

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Abstract

Background: Rapid increase of aging populations is seen in many parts of the world, including Hong Kong. Different stakeholders are becoming increasingly interested in the determinants of elderly health outcomes. This study aims to provide a description of the mortality on major diseases and mental health status (as measured by MMSE) in the Hong Kong elderly population based on the Elderly Health Centres (EHC) data.

Methods: A prospective cohort study of following Elderly Health Centers members from the date of recruitment to their date of death or the censored date (December 31, 2011). We estimate the spatial pattern of standardized incidence ratios for mortality on some major diseases and mental status in small tertiary planning unit groups (STPUGs) in Hong Kong, for old adults (aged 65+) during 2004-2011.

Results: Elderly mortality is higher in New Territories such as Tai Po, Yuen Long, Tsuen Wan and North district. There are also high SIR in some small areas such as Kwun Tong, Sha Tin, Sham Shui Po, Kowloon City and Southern district. Proportionally more women are diagnosed with severe cognitive impairment (lower score in MMSE) than men. As age increases, the difference between males and females also increases.

Conclusion: The geographic distribution of elderly mortality and mental health status in Hong Kong highlights the area-level determinants of health outcomes amongst elderly in Hong Kong.

Introduction

Rapid growth of aging populations in many parts of the world, including Hong Kong, makes policy makers, healthcare service providers, and researchers increasingly interested in the determinants of elderly health outcomes. Hong Kong has undergone a major demographic transition in the past few decades and is now aging rapidly, resulting in a persistent low fertility rate and rising life expectancy. The number of older adults greatly increased during the last half-century. In 2014, the estimated number of older adults was 1.07 million, accounting for 14.7% of the Hong Kong population. The number is projected to further increase in the next two decades, up to 2.16 million in 2031 and 2.56 million in 2041, approximately one in every three persons will be an older adult at that point (30.2%; Population Policy, 2015).

Elderly health is influenced by multiple factors at both individual and area level. Recent social epidemiological studies showing the relationships between geographical areas and health outcomes has become a widely discussed topic. Geographical variations can be attributed to, for instance, socioeconomic levels, lifestyle of the residents, and the quality of living conditions. These factors are related to one's morbidity and mortality (Chang et al., 2010; Cheung et al., 2012; Gunnell et al., 2012; Weden, Carpiano, & Robert, 2008; Wight et al., 2008). However, empirical studies among elderly populations are still limited in Hong Kong to date.

Traditionally, local studies mainly focused on identifying individual's circumstances as the greatest attribution on health but that of geographical characteristics seems to be less focused (Woo, Ho & Sham, 2001; Lam, et al., 2007). Moreover, most of the previous studies used only cross-sectional survey for their analysis. There is an emerging need for a better understanding of the individual- and area-level determinants of health outcomes amongst the elderly in Hong Kong (Hsu et al., 2015). The area-level variables will provide rich information on the local community characteristics and will enable us to study their potential impact on the health status of the elderlies living in the community.

In this report, we provide a description of the mortality on major diseases and mental health status (MMSE) in the Hong Kong elderly population based on the Elderly Health Centres (EHC) data. To examine the spatial distribution of the elderly, we use the Geographic Information System (GIS) to perform the pattern.

Data and Methods

Data

The study is based on a dataset from the 18 Elderly Health Centres (EHCs), Department of Health (DH) in the period of 1998-2011. Each participant was interviewed by trained nurses using standardized questionnaires and underwent clinical examination by the EHC doctors.

The record for each participant includes demographics, socioeconomic variables, lifestyle, medical history, functioning, cognitive function, depression, the cause of death following the 10th International Classification of Diseases (ICD-10, WHO 2012) if the participant died within the study period, and residential addresses. We used part of the residential addresses to geocode down to a building level, and assigned each participant to one of the geographic unit based on the geocoded coordinates. The geographic unit, Small Tertiary Planning Unit Group (STPUG, n=204 in the 2006 census) defined by the Hong Kong Planning Department, is used in this report.

Health data on elderly between the year of 1998 and 2003 included both self-reported and newly diagnosed diseases and those since 2004 are doctor diagnosed/verified diseases. Mortality data are cross-matched the EHC database and registered death database.

Method

The data is related to the status of EHC members at the censored date, namely survival or death with the date of death. This prospective cohort study followed all EHC members from the date of recruitment to death or the censored date (December 31, 2011). Moreover, the model has the flexibility to introduce time-dependent explanatory variables and handle censoring of survival times due to the use of partial likelihood function. Time of entry is the date of recruitment; time of the end of observation is either at December 31, 2011, or the date of death if earlier.

Mapping of standardized mortality ratios (SMR) and standardized incidence ratios (SIR) (i.e. the ratio of the observed to the expected number) for mortality on some major diseases and mental status in STPUGs (excluded those with less than 30 samples) in Hong Kong, for old adults (aged 65+) during 2004-2011 was conducted. The SMR and SIR are calculated by comparing the district to the overall and older adults only. The expected number was calculated by multiplying the whole Hong Kong age-specific rate and the corresponding age-specific sample in each area.

In the maps, the red-shaded areas indicate that the area has a higher SMR/SIR, implying that the area has a relatively higher risk of mortality / morbidity amongst elderly than the overall of Hong Kong. On the contrary, the blue-shaded areas indicate the opposite. For a more detailed colour scale, please refer to the legend in the figures.

Results

Section 1: Spatial distribution of different major diseases

Distribution of elderly by standardized mortality ratios (SMR)

For all-cause mortality, we present the result in Figure 1. As seen in Figure 1, spatial distribution by sex, higher SMR in elderly male were found in North, Shum Shui Po, and Kwai Tsing districts along with more scattered areas in Tai Po, Kwun Tong, and Central & Western and Eastern districts. On the other hand, higher SMR in elderly female were found in North, Tai Po, and Sai Kung districts along with more scattered areas in Yuen Long, Wong Tai Sin, Kwun Tong, Kowloon City, and Southern districts.

Distribution of elderly with cancer by standardized incidence ratios (SIR)

Figure 2 shows the maps of elderly with cancer-related major diseases. We included major cancer types provided by the EHC database, including breast cancer, cervical cancer, colorectal cancer, lung cancer and other cancers. For males, areas having high risk of cancer were primarily found in Eastern, Kwun Tong, Kowloon City, Kwai Tsing, and some areas of Sha Tin and North districts. For female, areas having high risk of cancer were primarily found in Sha Tin, Kowloon City, Kwun Tong, Yau Tsim Mong, and some areas of Eastern and Islands districts.

Distribution of elderly with cardiovascular disease by standardized incidence ratios (SIR)

As seen in Figure 3, the distribution of males who had cardiovascular diseases appears to be scattered around areas of Sha Tin, Kwun Tong, Wong Tai Sin, Eastern and Islands districts. Females who had cardiovascular diseases appear to be centralized in Sha Tin and Tai Po districts, along with some scattered areas of Kwun Tong, Kwai Tsing and North districts.

Distribution of elderly with Parkinson's by standardized incidence ratios (SIR)

Figure 4 shows the distribution of males who had Parkinson's appears to be concentrated in Tai Po, Kowloon City and Eastern districts with others scattered around North, Yuen Long, Kwai Tsing, and Tsuen Wan districts. Females who had Parkinson's appears to be concentrated in Yuen Long and Yau Tsim Mong districts, and some scattered areas in Eastern, North, Shum Shui Po, and Central & Western districts.

Distribution of elderly with dementia by standardized incidence ratios (SIR)

Figure 5 shows the distribution of both genders who had dementia. Males and females have different spatial patterns with dementia. Males who had dementia appears to be centered in Sha Tin and Kowloon Tong districts; and parts of Central & Western, Eastern,

Southern and Sham Shui Po districts. On the other hand, female who had dementia appears to be concentrated in New Territories such as North, Tai Po, Sai Kung, Yuen Long districts and areas at Hong Kong Island such as Eastern district.

Distribution of elderly with Diabetes Mellitus by standardized incidence ratios (SIR)

Figure 6 shows the distribution of both genders who had Diabetes Mellitus. Male and female have different spatial patterns with Diabetes Mellitus. Males who had Diabetes Mellitus appeared to be concentrated in North, Sha Tin and Kowloon City districts; and some areas at Tai Po district. Female who had Diabetes Mellitus appeared to be concentrated in North, Tai Po, Kowloon City, Kwun Tong, Yau Tim Mong, Wong Tai Sin, Eastern and Southern districts.

Distribution of elderly with Hypercholesterolemia by standardized incidence ratios (SIR)

Figure 7 shows the distribution of both genders who had Hypercholesterolemia. Male and female have similar spatial pattern, both appearing to be concentrated in Eastern district only.

Figure 1. Spatial distribution of elderly by standardized mortality ratios (SMR) in 2004-2011

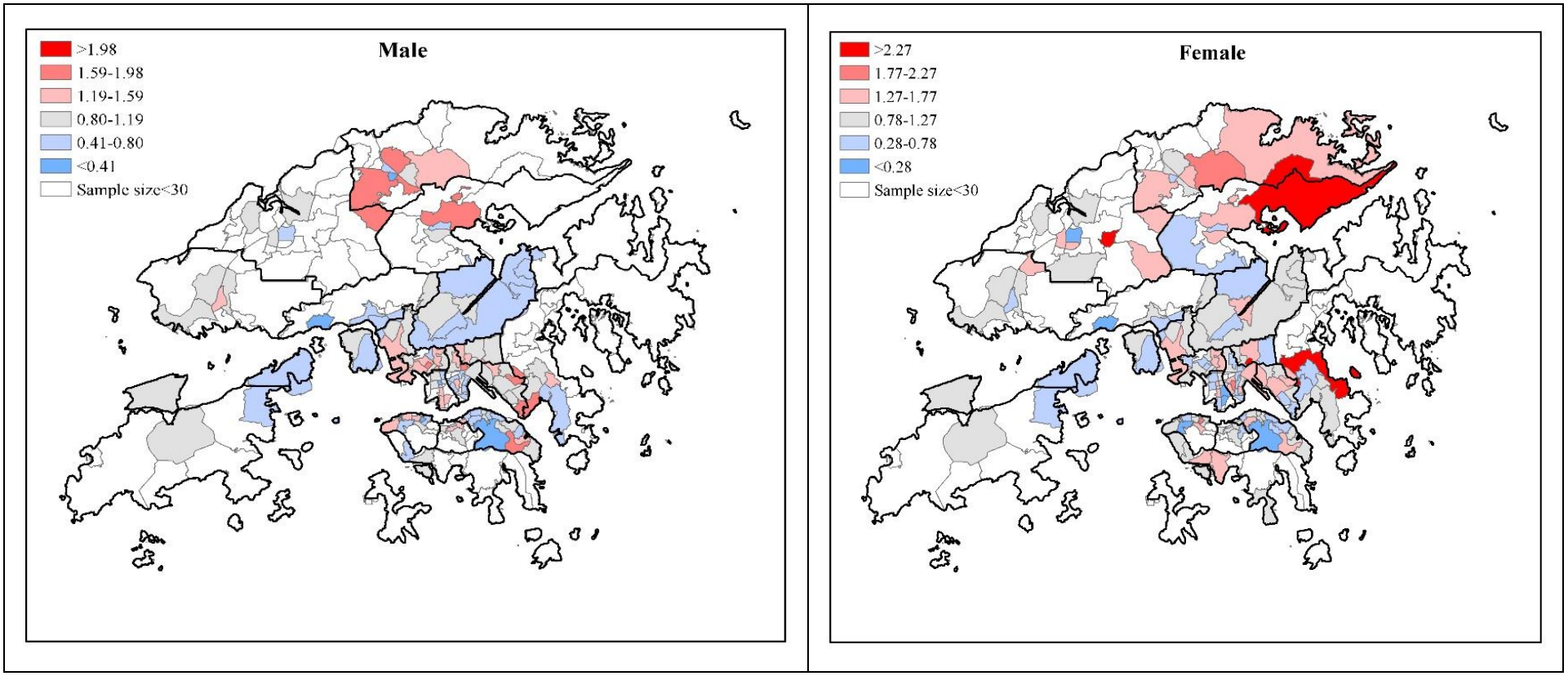


Figure 2. Spatial distribution of elderly with cancer ***by standardized incidence ratios (SIR)*** in 2004-2011

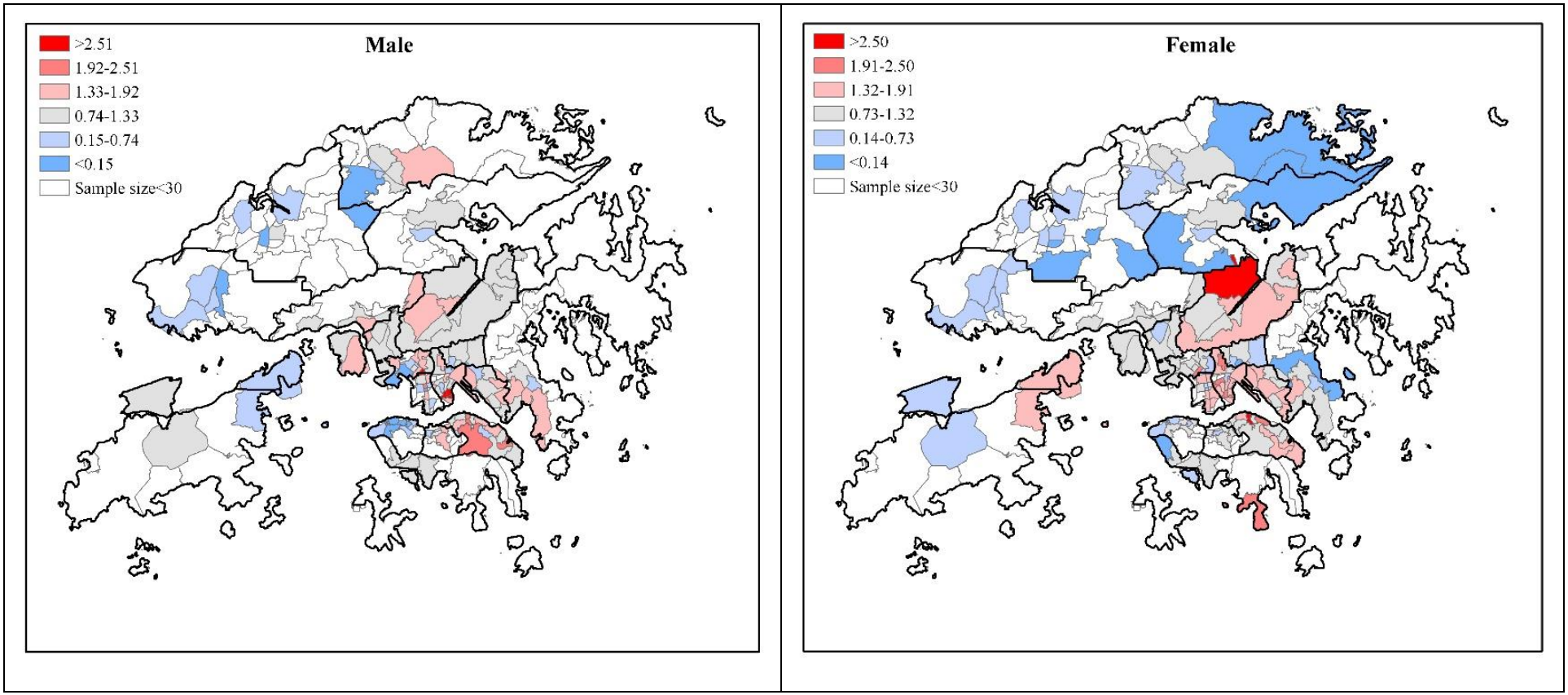


Figure 3. Spatial distribution of elderly with cardiovascular diseases ***by standardized incidence ratios (SIR)*** in 2004-2011

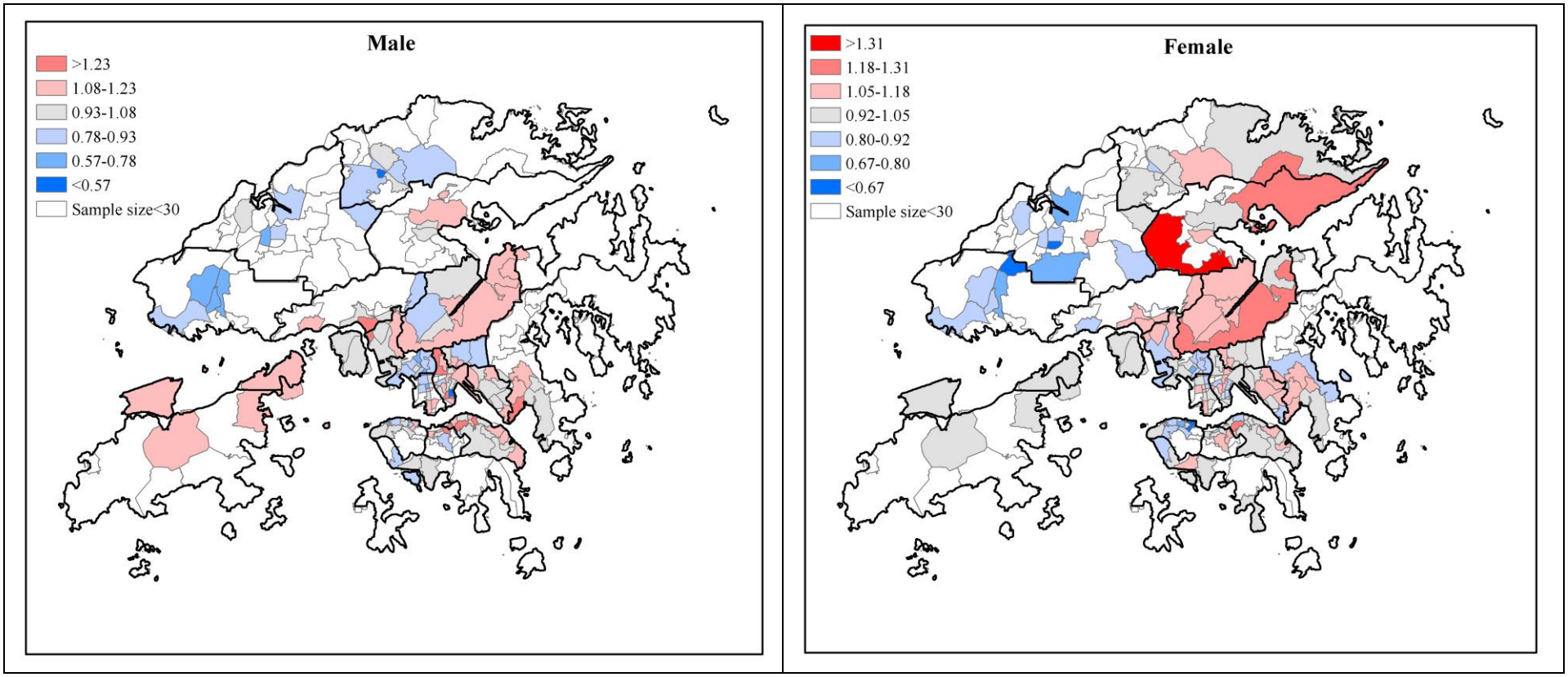


Figure 4. Spatial distribution of elderly with Parkinson's ***by standardized incidence ratios (SIR)*** in 2004-2011

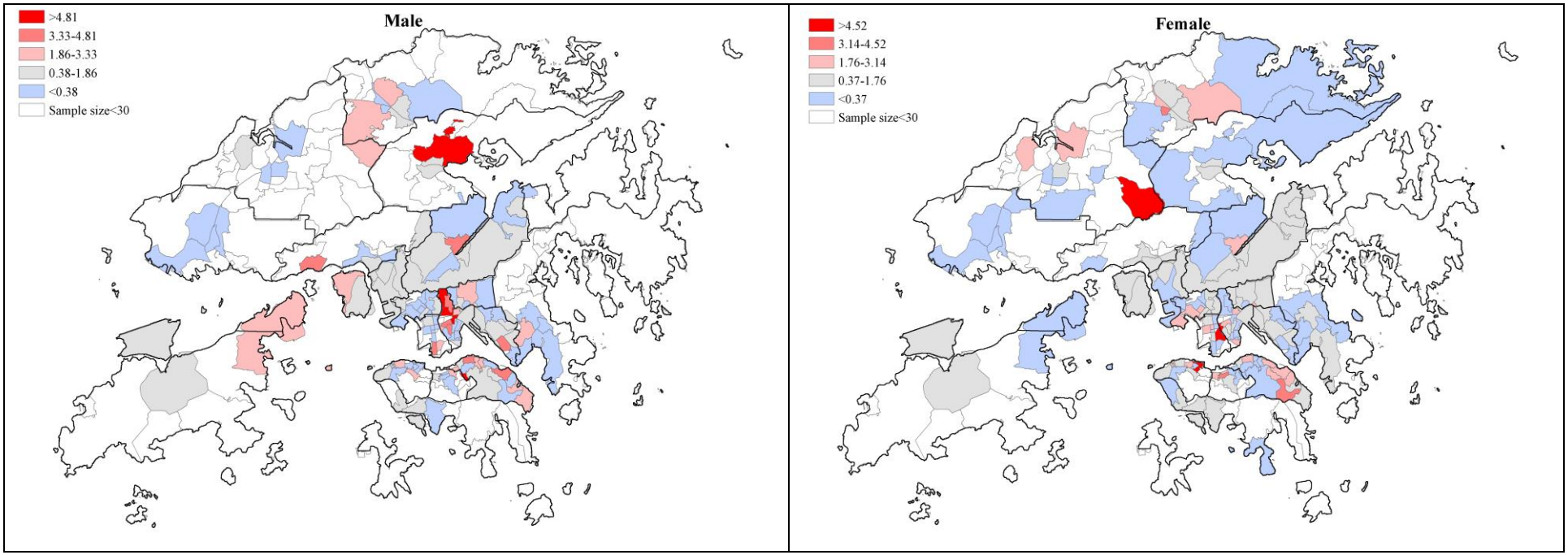


Figure 5. Spatial distribution of elderly with dementia ***by standardized incidence ratios (SIR)*** in 2004-2011

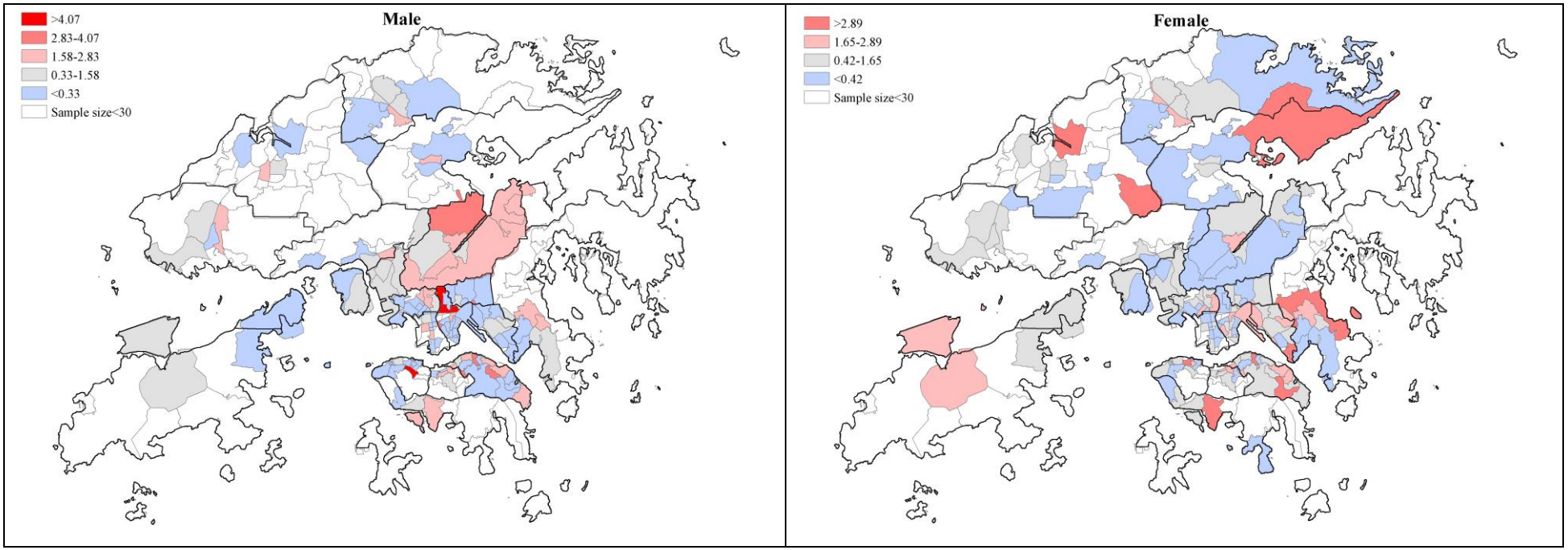


Figure 6. Spatial distribution of elderly with Diabetes Mellitus ***by standardized incidence ratios (SIR)*** in 2004-2011

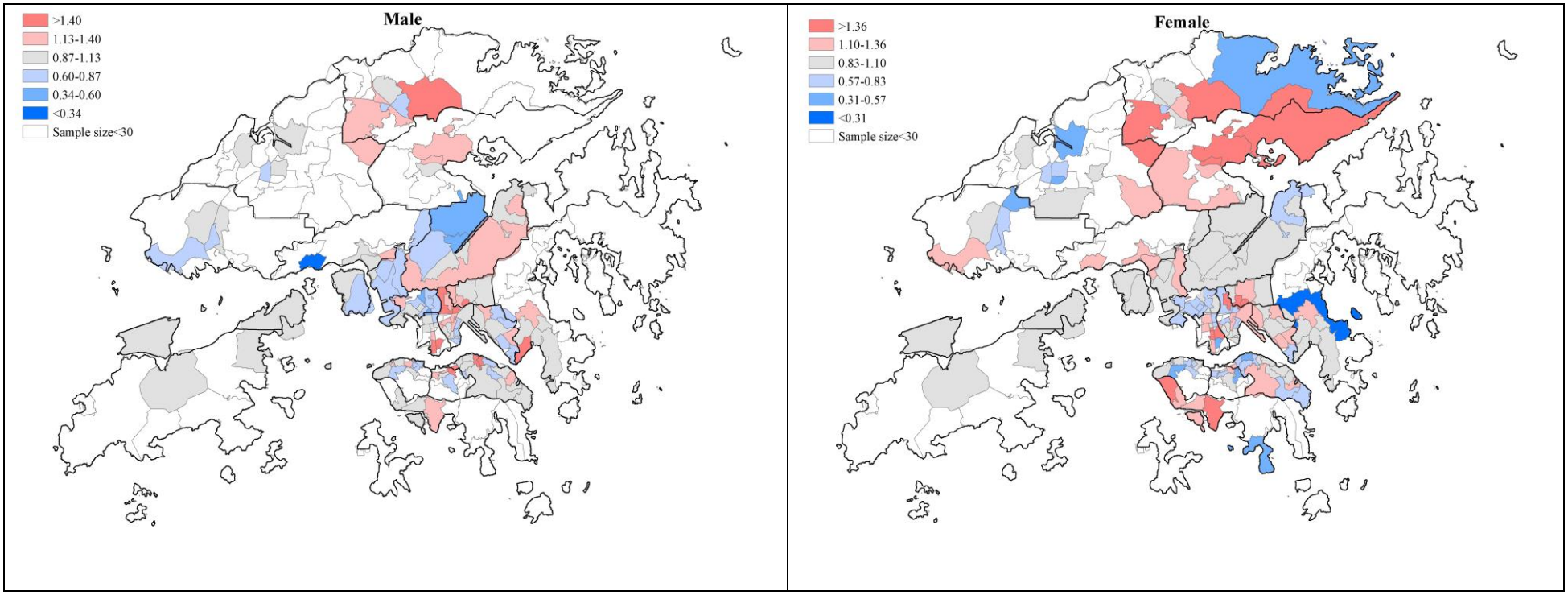
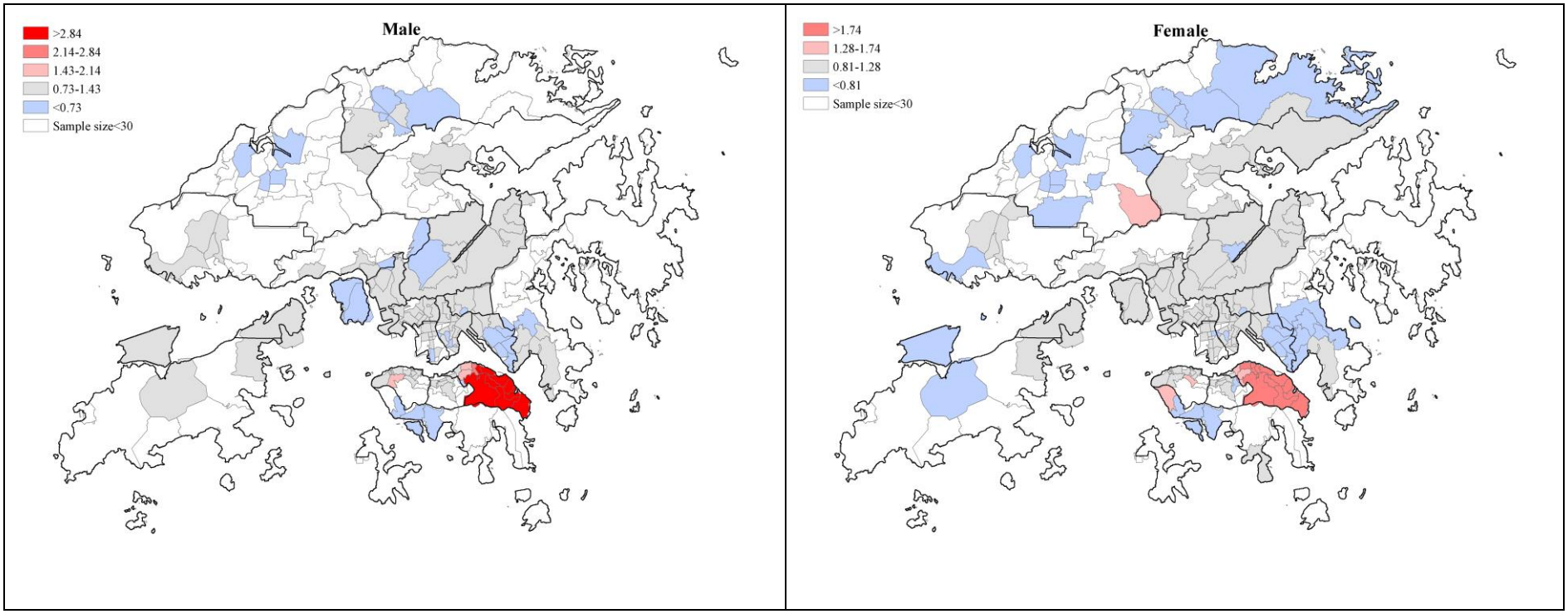


Figure 7. Spatial distribution of elderly with Hypercholesterolemia ***by standardized incidence ratios (SIR)*** in 2004-2011



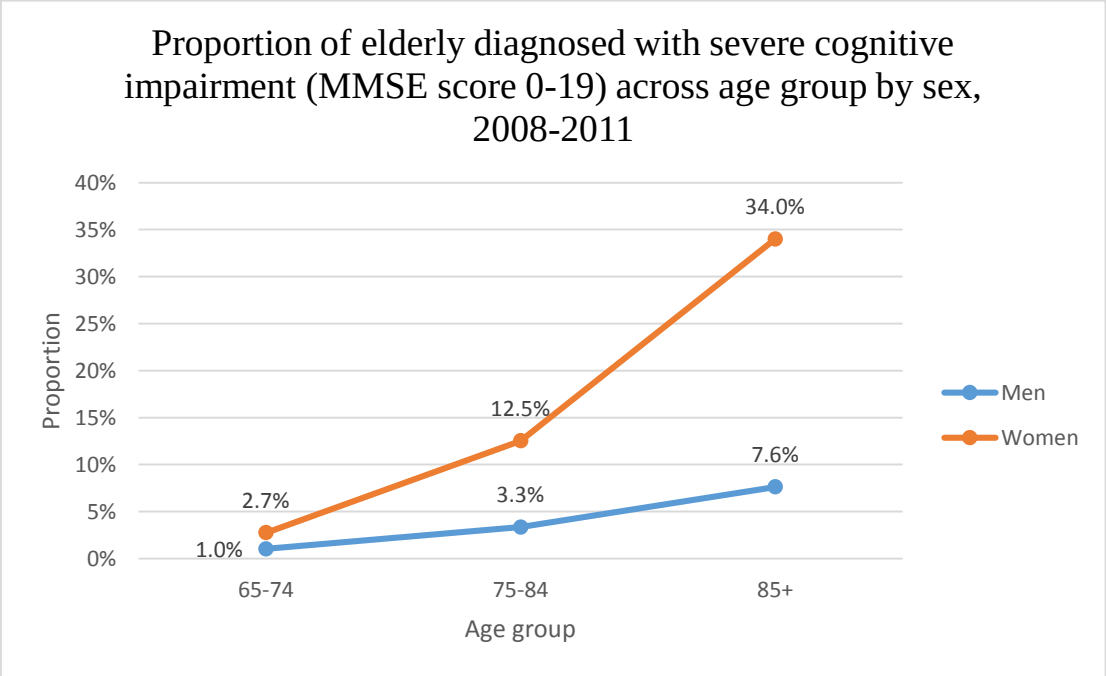
Section 2: Spatial distribution of patients with Mini-Mental State Examination (MMSE)

Mini-Mental State Examination (MMSE), developed by Folstein, Folstein, and McHugh (1975), is a widely used tool in measuring an individual's cognitive functioning. It requires both physical and verbal abilities to respond to commands such as folding a piece of paper and copying a polygon. It also consists of tasks examining an individual's functioning in terms of memory and attention. The cut-off scores of 0-19, 20-24, >=25 were adopted in this study, indicating severe cognitive impairment, mild impairment, and no cognitive impairment respectively.

Severe cognitive impairment across age group by sex

Figure 7 shows the proportion of elderly diagnosed with severe cognitive impatient (i.e. MMSE score 0-19) across age groups by sex in 2008-2011. It could be seen that the proportion of elderly diagnosed with severe cognitive impairment generally surges with age. Comparing between the two sexes, proportionally more women were diagnosed with severe cognitive impairment than men. Furthermore, the difference between women and men widens substantially when age increases.

Figure 7. Proportion of elderlies diagnosed with severe cognitive impairment (MMSE scored 0-19) across age groups by sex in 2008-2011.

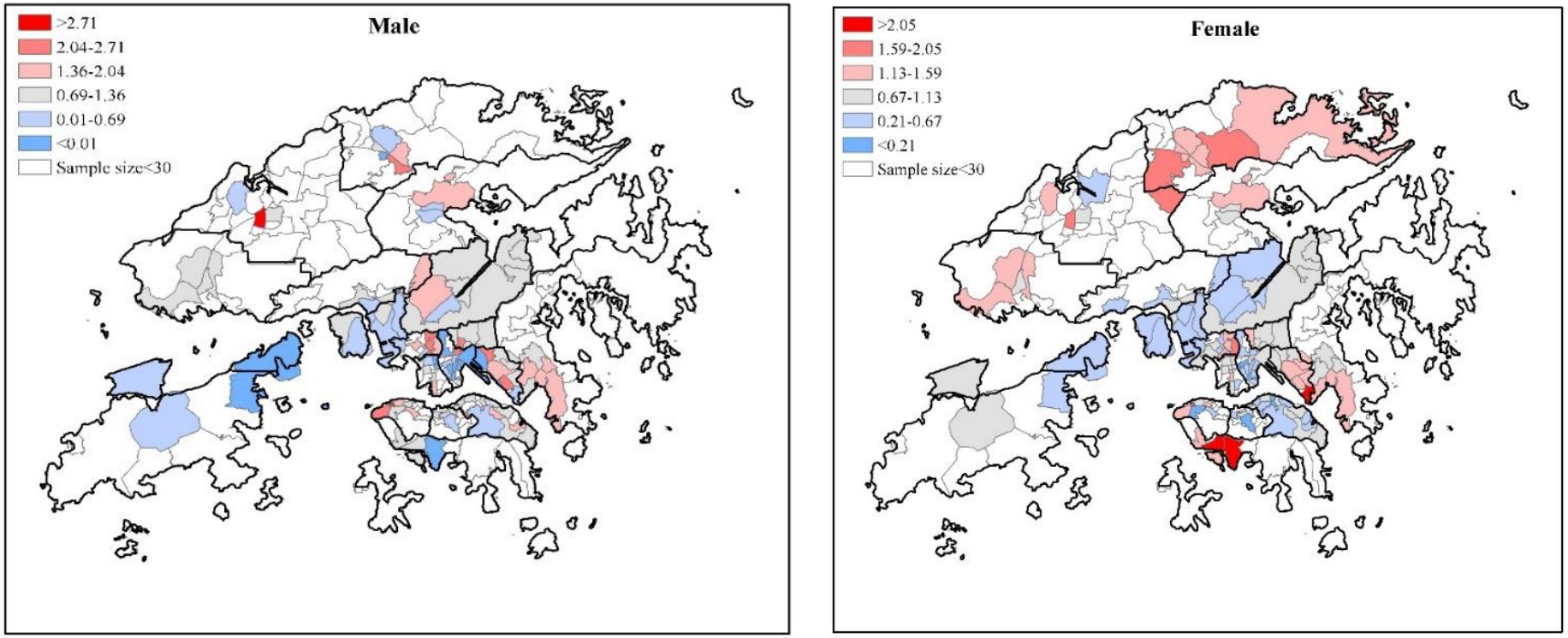


Age has long been recognized as a risk factor for cognitive impairment (Kawas, Gray, Brookmeyer, Fozard, & Zonderman, 2000; Launer, Dinkgreve, Jonker, Hooijer, & Lindeboom, 1993). Thus, it is expected that the proportion of elderly for both sexes diagnosed with cognitive impairment increases with age. The gender differences found in our results are consistent with previous studies conducted in the United States (Kawas et al., 2000), China (Zhang et al., 1990), Japan (Yoshitake et al., 1995) and Korea (Han et al., 2008). All studies found the incidence rates for cognitive problems are higher among women than men. However, inconsistent results were found in the Rotterdam study conducted by Ruitenberg, Ott, van Swieten, Hofman, and Breteler (2001) which suggested no difference between women and men. On the other hand, the increasing gap between women and men found in our results are consistent in various European countries (Andersen et al., 1999; Berr, Wancata, & Ritchie, 2005) and in China (Dong et al., 2007).

Distribution of elderly by MMSE

Figure 8 showed the distribution of elderly who had a lower score on MMSE (below 20). For males who had a lower score on MMSE, they appear to be scattered in Sha Tin, North, Yuen Long, Kwun Tong and Shum Shui Po districts. For females who had lower score on MMSE, they appear to be concentrated in North district, and in some areas in Southern, Yuen Long, Kwun Tong, Shum Shui Po and Tuen Mun districts.

Figure 8. Spatial distribution of elderly on MMSE in 2004-2011



Conclusions

The number of elderly is expected to increase rapidly in the next twenty years and will contribute to major disease burden in Hong Kong. This drives the need for appropriate and timely service planning to prepare for the rapidly aging population. Our results showed that elderly mortality are higher at New Territories such as Tai Po, Yuen Long, Tsuen Wan and North districts. There are also relatively high SIRs in some small areas such as Kwun Tong, Sha Tin, Sham Shui Po, Kowloon City and Southern districts.

Comparing between sexes, proportionally more women are diagnosed with severe cognitive impairment (lower score in MMSE) than men. When age increases, the difference between males and females becomes wider.

With a higher life expectancy, women seem to have a higher survival probability than men comparing within the same age group.

Regarding the association with morbidity, the domains barriers to services, demographic, housing and living environment are correlated with risk of disease among elderlies. The living arrangement and supportive resources are different in different districts. Further analysis to analyze the association between social determinants and standardized incidence ratio among elderlies may provide particular service planning implications for stakeholders.

The availability of the data allowed us to perform a detailed investigation of the spatial distribution of elderly mortality and mental health status. However, one limitation worth noticing is that EHC members enrolled voluntarily at EHCs and therefore the sample can be biased as compared to Hong Kong general population.

The aging population is the greatest challenge for Hong Kong and the globe. With adequate available data and sound research, together with the support from various stakeholders and policymakers, we can improve the life and health for the elderly in the next few decades. Spatial analysis can be used for monitoring and surveillance of the elderly, and also serve as an evaluation tool to assess the effectiveness of programs. Follow-up data will help to provide a better evaluation of elderly mobility and its association with geographic locations.

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