Blue Zones in Hong Kong? Searching for Areas of Exceptional Longevity in the Longest-Living Territory in the World

Roland Rau* Stuart Gietel-Basten†

13th September 2024

Abstract

Since overtaking Japan in 2016, Hong Kong has maintained the highest life expectancy globally. This study investigates potential "blue zones" within Hong Kong—districts exhibiting exceptional longevity. Utilizing microdata from the Census and Statistics Department, we analyzed mortality data for all deaths across 18 districts in 2011, 2016, and 2021. Our preliminary findings reveal significant disparities in life expectancy, with the highest values observed in districts like Wan Chai and the Islands, contrasting sharply with Yau Tsim Mong. Notably, socio-economic factors, particularly median household income, correlate strongly with life expectancy, suggesting systemic causes behind these differences. Despite the absence of a clear geographical pattern, the consistency in rankings for both genders indicates that factors influencing longevity may transcend typical male mortality risks. Future analyses will explore the robustness of these findings across years, assess non-socio-economic influences such as air quality, and examine disease-specific mortality rates to further elucidate the unique longevity landscape of Hong Kong. This research aims to contribute valuable insights into the remarkable longevity of this densely populated, high-income region, offering lessons for global health initiatives.

*University of Rostock & Max Planck Institute for Demographic Research
†Hong Kong University of Science and Technology

1 Introduction: Background & Research Question

Background: Hong Kong has emerged as a leader in global life expectancy, consistently surpassing renowned nations like Japan and Singapore. This trend persists alongside other demographic factors such as an aging population and low fertility rates (Basten et al., 2013; HKCSD, 2023; United Nations, Department of Economic and Social Affairs, Population Division, 2022). As of 2023, Hong Kong's Average Life Expectancy at birth is projected to continue rising, with local healthcare initiatives effectively addressing chronic diseases and enhancing overall health outcomes (Ni et al., 2021; Woo, 2013).

Environmental factors have a profound effect on public health. Research indicates that air quality significantly impacts respiratory and cardiovascular health, leading to increased mortality rates (Shah et al., 2013; Wong et al., 2002). The introduction of policies such as the Air Quality Health Index (AQHI) has resulted in lower hospitalization rates for cardiovascular diseases, demonstrating the positive outcomes of environmental governance (Mason et al., 2019).

Hong Kong's healthcare system is characterized by a dual structure comprising public and private sectors, with a focus on accessibility and affordability. The public healthcare system, managed by the Department of Health and the Hospital Authority, has implemented comprehensive strategies, including the integration of electronic medical records and diabetes management programs (Lee, 2018; Chan et al., 2019). These advancements have facilitated timely care and effective management of chronic diseases, further enhancing life expectancy (Yam et al., 2019).

Lifestyle factors, including diet and physical activity, significantly contribute to health outcomes in Hong Kong. The traditional diet, rich in seafood and diverse culinary options, supports lower rates of chronic diseases (Wang et al., 2011). Moreover, while a significant portion of the population engages in sedentary behavior, the availability of recreational facilities promotes physical activity, which is crucial for maintaining health (Sallis et al., 2009; HKDH, 2022).

Hong Kong's response to public health emergencies has also influenced its life expectancy. The healthcare system's preparedness for epidemics, highlighted by the management of COVID-19, reflects the effectiveness of emergency protocols and the commitment of healthcare professionals (Kwok et al., 2020; Yeung et al., 2020). Efficient communication and rapid response strategies have mitigated potential health crises, further supporting the population's longevity.

Research Question: We are asking whether we can detect "blue zones" within Hong Kong, i.e. areas of even more exceptional longevity, by estimating mortality in its 18

districts. The emerging spatial pattern might allow us to gain further insights, which causes are key for Hong Kong's exceptional life expectancy.

2 Data & Methods

We obtained microdata for all deaths in 2011, 2016, and 2021 from Hong Kong's "Census And Statistics Department". The corresponding population data are 5% census samples from the given years. Since each census was taken roughly in the middle of the year we used them as the mid-year population to approximate person-years lived at each age after multiplying each record's weight by 20. Both data sources, death counts and census data, contain information on district of residence which allows us to estimate mortality on a more detailed geographical level. In Figure 1 (p. 7) we show that this approach generates reliable mortality results until age 95. While ages above that threshold will not affect life expectancy estimates in a substantial way, we used the number of life-years lived between ages 0 and 95, i.e. "temporary life expectancy", as our outcome measure. Confidence intervals were bootstrapped under the canonical assumption that death counts are poisson-distributed (e.g., Brillinger, 1986).

3 (Preliminary) Results

Fig. 2 (p. 8) depicts e_{0-95}, for simplicity from now on referred to as life expectancy, in Hong Kong's 18 districts in 2016, separately for women and men, as a "caterpillar" plot. Our point estimates for each district and sex are denoted by dark lines whereas the surrounding horizontal bars show the 95% confidence intervals. The differences in male life expectancy across the districts is a bit more than 4.6 years, ranging from 79.43 years in Yau Tsim Mong to 84.08 in Wan Chai. Lowest female life expectancy is only half a year higher, again in Yau Tsim Mong. Highest life expectancy overall in 2016 was observed for women in the Islands district with almost 88.3 years. Thus, with about 3.69 years differences in female life expectancy are about one year smaller than for males.

While we are certain that life expectancy is higher in Wan Chai or the Islands district than in Yau Tsim Mong, the rankings should be taken with a grain of salt: The confidence intervals of the caterpillar plots illustrate clearly that the exact rank of a district can not necessarily be ascertained.

Maps of life expectancy in Hong Kong's 18 districts are shown in Fig. 3 (p. 9) for women (top) and men (bottom). Two features become obvious: 1) There is no clear

spatial pattern: The "blue zones" are not concentrated in a single area. 2) Areas of high and of life expectancy for women on the one hand and for men on the other hand are situated in similar regions. For instance, the top 3 districts for women are also in the top 3 for men; the two districts at the bottom are the same for women and men.This let's us conclude: a) Since life expectancy is not randomly distributed it is very likely that there are systematic causes for the differences in life expectancy. b) While being male remains one of the largest risk factors for mortality, causes for the life expectancy differences between the districts are very unlikely to be due to typical reasons for male excess mortality (smoking, dangerous driving, ...). Rau and Schmertmann (2020) have shown for Germany that differences across districts are often a mirror image of socio-economic conditions. We also find (preliminary) support for it in Hong Kong. Fig. 4 depicts for women (left) and men (right) the relationship between median household income and life expectancy in each district in 2016. The trend lines illustrate that life expectancy is higher in districts of higher median household income. The impact is higher for men: An increase by 1000 HK$, about 130 US$, in annual household income corresponds to a life expectancy increase of 0.17 years.

4 Summary / Next Steps

Hong Kong has exceeded Japan's life expectancy in 2016 and has held the world record ever since. We have discovered some blue zones, i.e. areas of high life expectancy, in some districts: Mortality is lower in Wai Chai, Sai Kung and the Islands district than in any other area in Hong Kong. In the next steps we will analyse:

1. Whether those results are robust? For that purpose we will replicate the analysis for the years 2011 and 2021; especially the latter—due to the "zero-COVID" strategy—could be interesting.

2. Can we track down other factors apart from household income? Unemployment was the strongest predictor for Germany, for instance (Rau and Schmertmann, 2020). But maybe non-socio-economic factors such as air quality could play a more prominent role in Hong Kong?

3. Ni et al. (2021) showed that low cardiovascular mortality, cancer mortality and smoking-attributable mortality set Hong Kong apart from other high-income countries. Do we find similar effects within Hong Kong, i.e. is mortality from those diseases also substantially lower in the three "vanguard districts" than in the rest of Hong Kong.

4. Chung and Marmot (2021) formulated an alternative hypothesis: population composition. They argue that people who emigrated from mainland China after having endured many hardships might have exceptionally low mortality. With the given data, providing country of birth, country of previous residence, ...) we will be able to test this hypothesis.

It is our aim to contribute some pieces to the solution of this "important puzzle":

> *"[T]here could not be a more important puzzle to solve for the rest of the world—how did a former British colony of largely ethnic Chinese people with a semi-autonomous political status situated at the edge of southeast China achieve such a great life expectancy, despite spending so little on health and social care and having among the worst income inequality in the world?"*
>
> Chung and Marmot (2021)

Acknowledgements

This research project has been financially supported by the Department "Aging of Individuals and Society" of the "Interdisciplinary Faculty" at the University of Rostock, Germany.

References

Basten, S., P. Yip, and E. Chui (2013). Remeasuring ageing in Hong Kong SAR. *Journal of Population Research 30*, 249–264.

Brillinger, D. R. (1986). The Natural Variability of Vital Rates and Associated Statistics. *Biometrics 42*, 693–734.

Chung, R. Y.-N. and M. Marmot (2021). People in Hong Kong Have the Longest Life Expectancy in the World: Some Possible Explanations. US National Academy of Medicine. NAM Perspectives. Commentary.

HKCSD (2023). Hong Kong Life Tables 2016–2025. Available online at the website of the HKCSD: Hong Kong Census and Statistics Department.

Kwok, K. O., K. K. Li, H. H. H. Chan, Y. Y. Yi, A. Tang, W. I. Wei, and S. Y. S. Wong (2020). Community responses during early phase of COVID-19 epidemic, Hong Kong. *Emerging infectious diseases 26*(7), 1575.

Mason, T. G., C. M. Schooling, K. P. Chan, and L. Tian (2019). An evaluation of the air quality health index program on respiratory diseases in hong kong: an interrupted time series analysis. *Atmospheric Environment 211*, 151–158.

Ni, M. Y., V. Canudas-Romo, J. Shi, F. P. Flores, M. S. Chow, X. I. Yao, S. Y. Ho, T. H. Lam, C. M. Schooling, A. D. Lopez, et al. (2021). Understanding longevity in Hong Kong: a comparative study with long-living, high-income countries. *The Lancet Public Health 6*(12), e919–e931.

Rau, R. and C. P. Schmertmann (2020). District-level life expectancy in Germany. *Deutsches Ärzteblatt International 117*(29-30), 493–499.

Sallis, J. F., H. R. Bowles, A. Bauman, B. E. Ainsworth, F. C. Bull, C. L. Craig, M. Sjöström, I. De Bourdeaudhuij, J. Lefevre, V. Matsudo, et al. (2009). Neighborhood environments and physical activity among adults in 11 countries. *American Journal of Preventive Medicine 36*(6), 484–490.

Shah, A. S., J. P. Langrish, H. Nair, D. A. McAllister, A. L. Hunter, K. Donaldson, D. E. Newby, and N. L. Mills (2013). Global association of air pollution and heart failure: a systematic review and meta-analysis. *The Lancet 382*(9897), 1039–1048.

United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022. Summary of Results.

Wang, M. P., G. N. Thomas, S. Y. Ho, H. K. Lai, K. H. Mak, and T. H. Lam (2011). Fish consumption and mortality in Hong Kong Chinese—the LIMOR study. *Annals of Epidemiology 21*(3), 164–169.

Wong, T. W., W. Tam, T. Yu, and A. Wong (2002). Associations between daily mortalities from respiratory and cardiovascular diseases and air pollution in Hong Kong, China. *Occupational and environmental medicine 59*(1), 30–35.

Woo, J. (2013). Aging and health in Hong Kong. *Health & Social Care in the Community 21*(3), 217–226.

Yeung, T. A., F. Chan, J. Luk, and W. Mok (2020). Covid-19 and older adults: experience in hong kong. *Asian J Gerontol Geriatr 15*, 1–6.

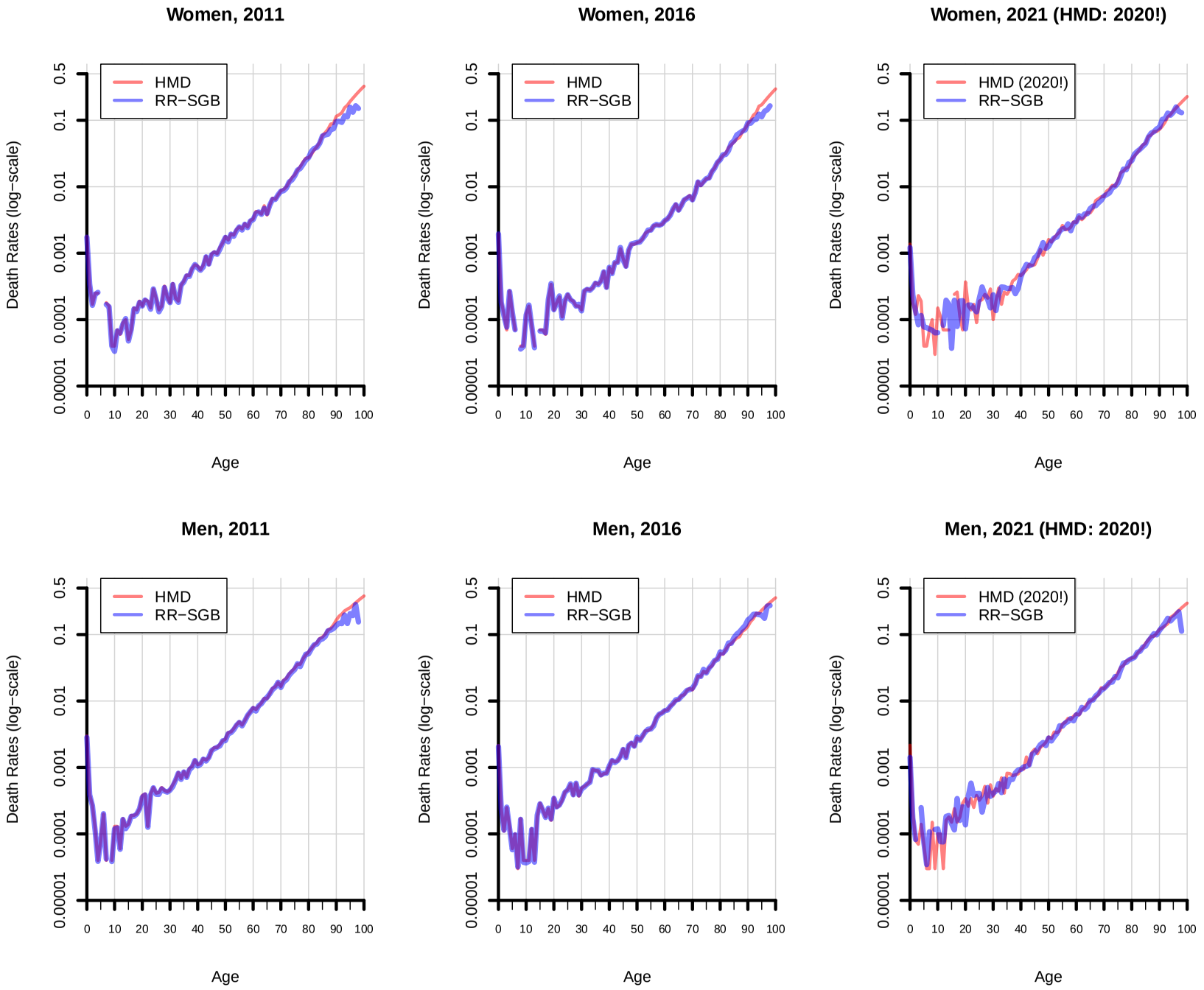

Figure 1: Checking the trustworthiness of our estimated death rates (blue) by comparing them to those from the Human Mortality Database (red) for the years 2011, 2016 and 2021 (2020 for HMD data) for women (top row) and men (bottom row).

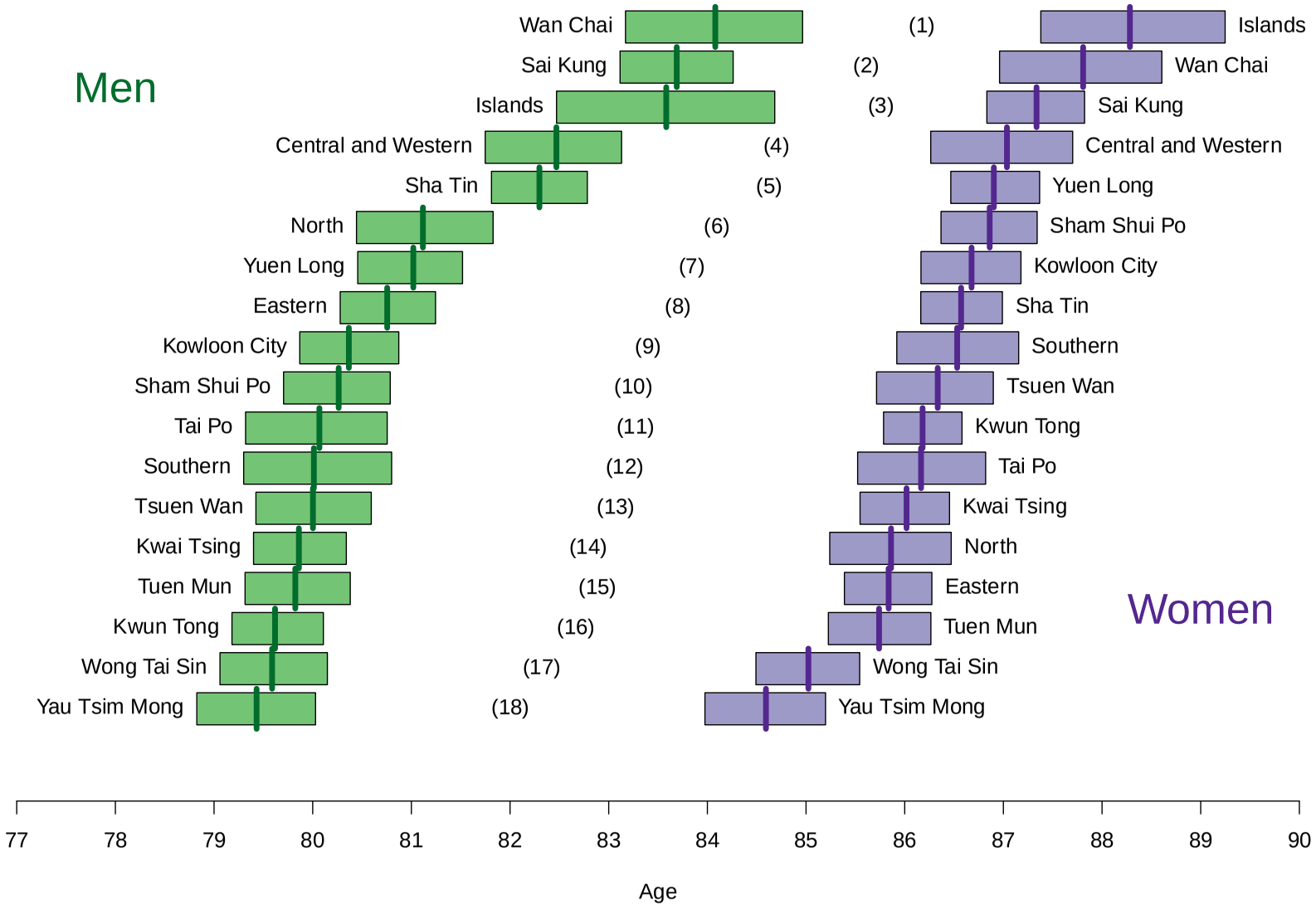

Figure 2: "Caterpillar" Plots for Temporary Life Expectancy e_{0-95} and 95% Confidence Intervals in Hong Kong's 18 Districts in 2016 for Men (left) and Women (right)

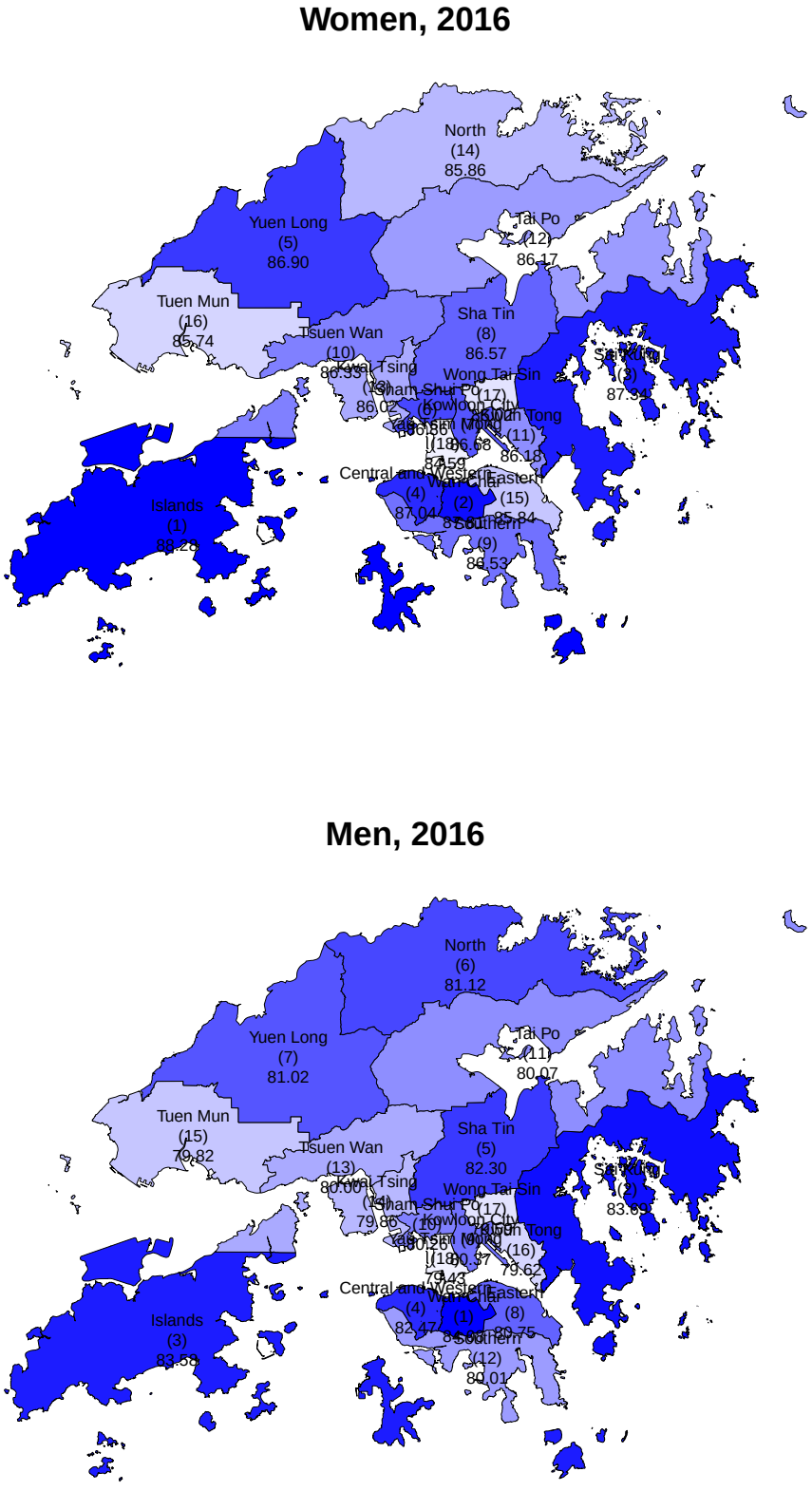

Figure 3: Maps for Temporary Life Expectancy e_{0-95} in Hong Kong's 18 Districts in 2016 for Women (top) and Men (bottom)

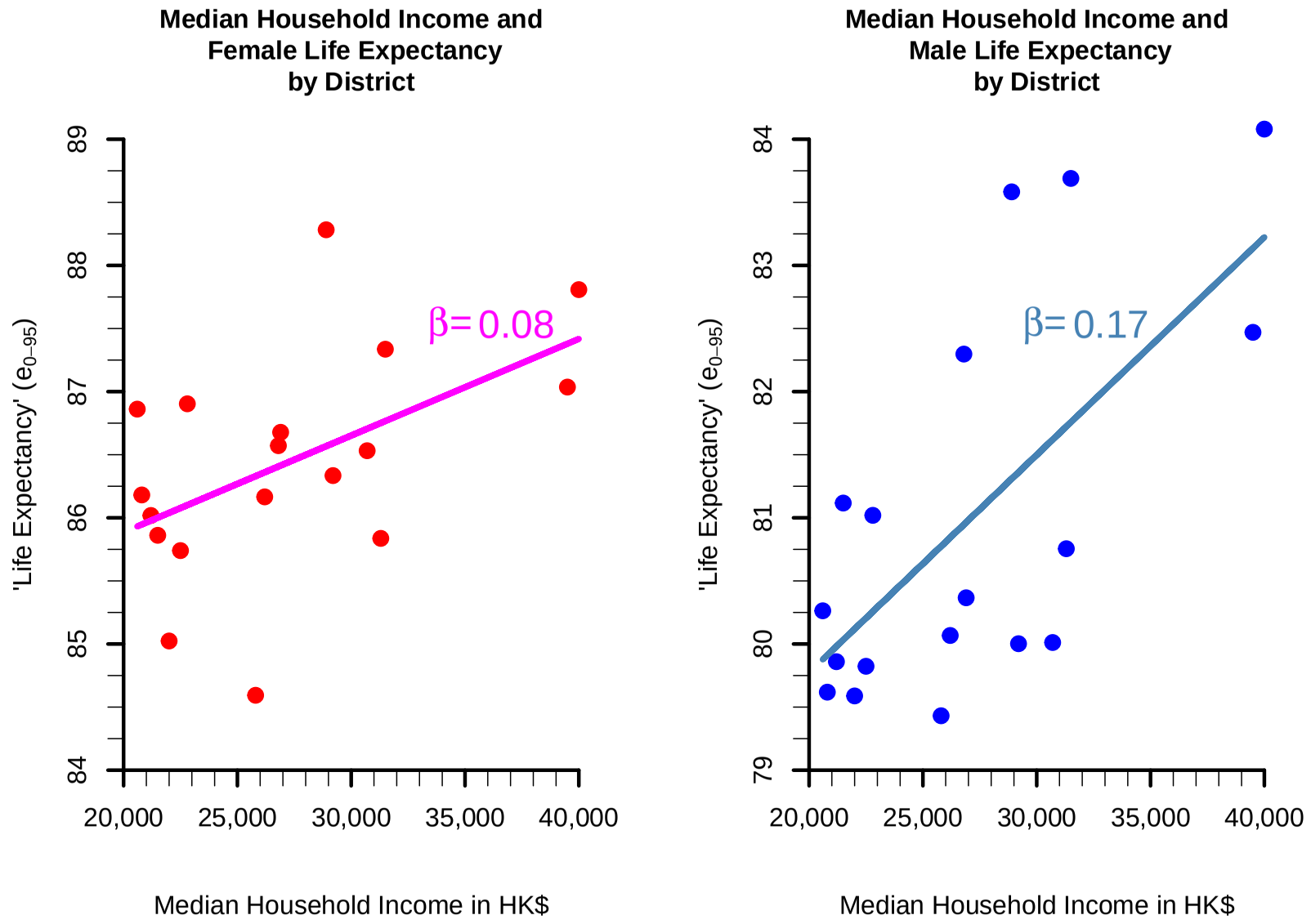

Figure 4: Scatterplots of Median Household Income in HK$ and Temporary Life Expectancy e_{0-95} in Hong Kong's 18 Districts in 2016 for Women (left) and Men (right)