The Estimation of Disease Burden of COVID-19 in Hong Kong from 2020 to 2022

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Background

- The COVID-19 pandemic has been a significant public health concern
- Monitoring excess mortality in real time is important
- Estimating the long-term mortality impacts is difficult with mortality displacement (“harvesting”), a phenomenon in which a part of COVID-19 mortality is displaced from the future

Objectives

We aim to investigate the following in 2020-22:

❖ Changes in life expectancy (LE)
❖ Excess mortality
❖ The distribution of mortality displacement

Methods

- The Arriaga decomposition method was used to decompose changes in LE by age and cause of death, for example respiratory, circulatory, and neoplasms [1,2]
- The total contribution C_x of age group x to the change in life expectancy in 2022 relative to 2021 can be found by [3]:

$$C_{x=}\left[\frac{l_x^{2021}}{l_0}\left(\frac{L_x^{2022}}{l_x^{2022}}-\frac{L_x^{2021}}{l_x^{2021}}\right)\right]+\left[\frac{T_{x+1}^{2022}}{l_0}\left(\frac{l_x^{2021}}{l_x^{2022}}-\frac{l_{x+1}^{2021}}{l_{x+1}^{2022}}\right)\right]$$

L_x is the number of person-years lived between exact age x and age x+1
T_x is the total person-years lived after the exact age x
l_x is the number of survivors at the exact age x

- We can decompose the change in life expectancy by cause with the following formula [3]:

$$C_x^i = C_x\left[\frac{R_x^{i,2022}m_x^{2022}-R_x^{i,2021}m_x^{2021}}{m_x^{2022}-m_x^{2021}}\right]$$

R_x^i is the all-cause mortality rate in age group x
m_x is the proportion of mortality in age group x with death cause i

Results

- 13825 COVID-19 deaths from 2020 to 2022
- Survival probabilities of both male and female at older ages were significantly lower than that of 2020 and 2021

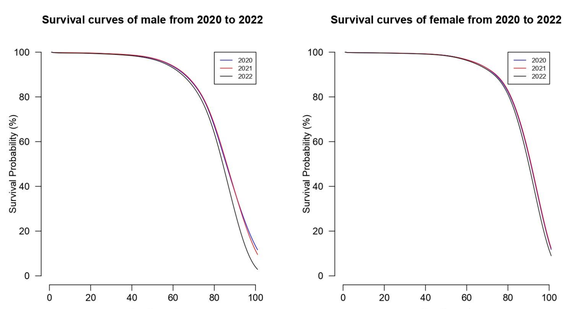

Figure 1: Survival curves of the male (left) and female (right) from 2020 to 2022

- Distribution of mortality displacement
❖ SARS-COV-2 activity peaks from December 2020 to February 2021 increases the risk of death of individuals whose PYLL is 1 month
❖ The fifth wave of the pandemic increases the risk of death of frail individuals whose PYLL is less than one month

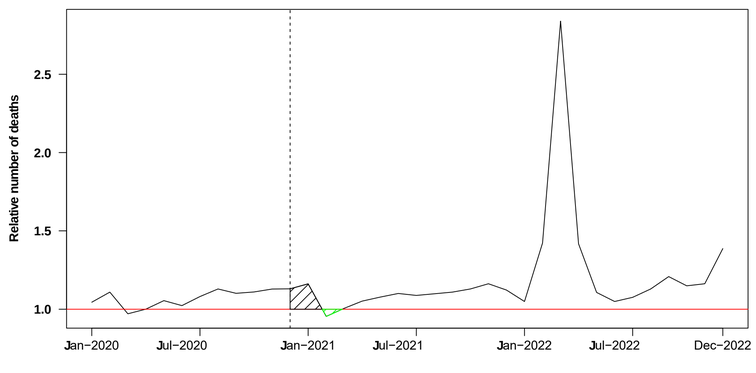

Figure 2: Monthly number of deaths in 2020-2022 relative to the monthly average for 2015-2019

- Change in life expectancy
❖ Loss in LE was mainly attributed to deaths aged 70 years or above
❖ There is a larger loss in LE in males compared to that of females
❖ Respiratory causes attributed a large extent to the LE gap in 2022, compared to that of 2021
❖ Respiratory causes shortened the LE of males and females by 2.4 and 1.02 years respectively in 2022

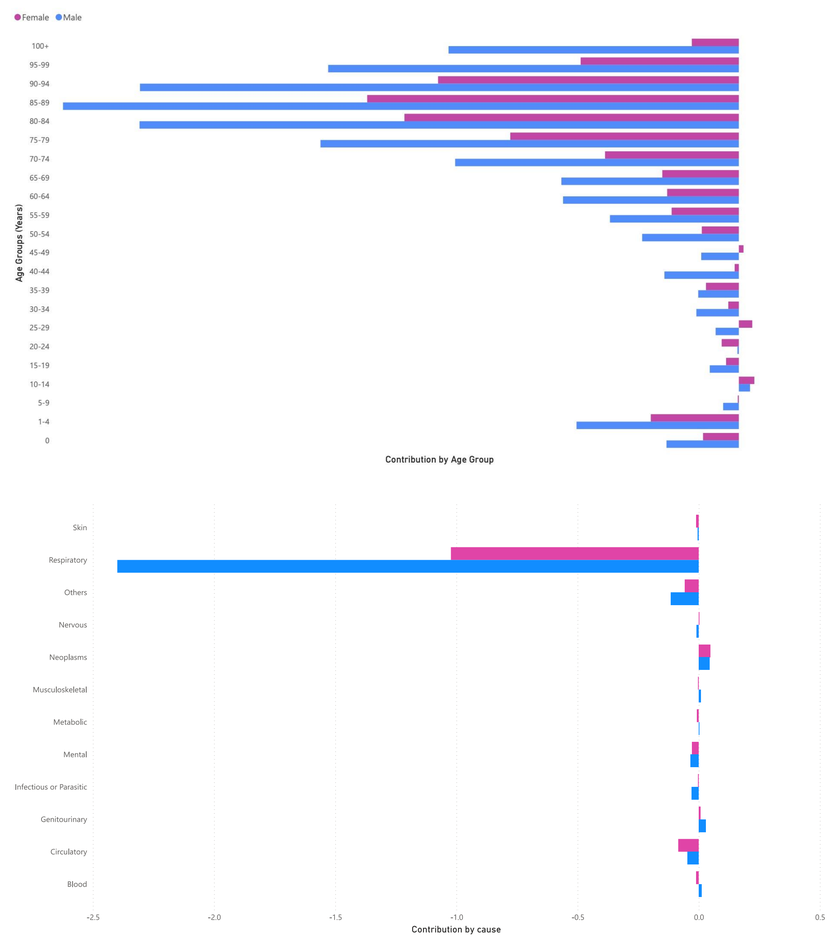

Figure 3: Decomposition of change in life expectancy by age group (top) and cause of death (bottom) from 2021-2022

Conclusions

- Understanding mortality displacement could fill in the gap in COVID-19 epidemiology in disease burden and effectiveness of interventions for high-risk groups (e.g. toddlers, old people and healthcare workers)
- This research can be applied to studies on other infectious diseases and help understand how disease burden can be reduced with public health social measures

Discussion

- COVID-19 has a significant public health impact on the local community
❖ COVID-19 infection and mortality rates vary by variants of and the clinical conditions of individuals
- Evaluation of PYLL and excess mortality attributed to COVID-19 allows health authorities to calibrate public health responses accordingly

References

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Acknowledgements

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