Appraisal in Meta-journal Hour 20

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The Paper: Estimating excess mortalities due to the COVID-19 pandemic in Malaysia between January 2020 and September 2021

Why was this study done?

COVID-19 was declared a pandemic by the World Health Organization in March 2020, with over 286 million confirmed cases and 5.43 million deaths worldwide. These figures are likely to underestimate the true burden of a pandemic. Malaysia, an upper-middle-income country, implemented public health measures like the Movement Control Order (MCO) to contain the spread of COVID-19.

The country experienced outbreaks driven by clusters in factories, prisons, and immigration detention centres. The emergence of more transmissible variants, particularly the Delta variant, led to a damaging wave in mid-2021. Malaysia recorded 2.75 million cases and 31,462 deaths by December 2021.

The tax-funded public health system in Malaysia played a major role in vaccinating, screening, and treating the population.

Historically, All-cause mortality has been used for the surveillance of infectious diseases such as influenza. The algorithm for detecting aberrant events can be used in detecting excess mortalities as well.

Excess mortalities can capture unreported COVID-19 deaths and collateral damage from overwhelmed health systems. Excess mortalities refer to the number of deaths that exceed the expected number of deaths in a given period. They are used as an indicator of the true burden of a disease, such as COVID-19. Excess mortalities are calculated by comparing the observed number of deaths to the expected number of deaths based on historical trends and other factors.

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What is the objective of conducting this study?

This study aims to investigate the possibility of excess all-cause mortalities in Malaysia due to the COVID-19 pandemic and its age, location, and cause-specific distributions across Malaysia

Excess mortalities refer to the number of deaths that exceed the expected number of deaths in a given period. The difference between the observed and expected number of deaths is reported as excess mortalities.

How was it done?

In Malaysia all death in the country need to be reported within 7 days(Peninsular and Sarawak) and 10 days for Sabah.

The mortality data will be compiled into Nasional mortality database maintained by DOSM.

DOSM will liaise with MOH and Police department to counter-check on the completeness of death registration

How the data obtained?

- From DOSM for death occurring between epidemiological week one in January 2016 to epidemiological week 39 in September 2021, amounting to 69 months of data.
- Additional data were retrieved from the official MOH COVID-19 data repository between 1 January 2020- 30 Sept 2021

What is the data extracted?

- Age of death, Sex, Nationality, Ethnicity, Place of residence by state, Cause of death (COD)

Codes of COD

- Using ICD-10 for death that had been medically certified or
- Less formal codes for deaths that had been certified by police personnel
- ICD-10 codes were unavailable for 2019 and 2021 during data extraction
- Death from traffic road accident were identified using ICD-10 codes. Deaths due to RTA for the year 2019-2021 were identified through mining free text description of COD keywords such as motor, traffic, road, crash as well as the Malay equivalent term.
- COVID-19 mortality in Malaysia are adjudicated as either death due to COVID-19 or death with COVID-19 using pre-defined set of criteria by MOH.
- Only deaths due to COVID-1 are counted as COVID-19 mortalities

Statistical analysis

Missing Data Management	Random imputation was done for missing data with no day of death but with month and year. Account for 2% of data in 2017-2019 The data then being used to categorize mortality into epidemiologic week
Explore temporal structure of the data	LOESS(STL) was carried out on the time series LOESS(STL) is a seasonal-trend decomposition using LOESS..
Surveillance of potential aberrations within all-cause mortality count	Carried out using flexible Farrington algorithm The algorithm is formulated to predict an observed number of counts using a set of reference values from window of size w weeks up to b years back,
Fitted the reference value into statistical model	The reference value then fitted into overdispersion Poisson generalized model with **one sided confident interval.** A w of 3 and b of were utilized. Data were further divided into 10 periods and fit into the model. Data from 2016-2019 were utilized for model training
Stratification	Age group (i) under one, (ii) under five, (iii) 5–14, (iv) 15–40, (v) 41–59, and (vi) 60 years and above Sex male or female Cause of death road traffic accidents (RTA) or non-RTA Ethnicity (i) Malay, (ii) Other Indigenous, (iii) Chinese, (iv) Indian, and (v) Other ethnicities Nationality (i) Malaysian and (ii) Non-Malaysian.
Sensitivity analysis	Varying w(2-8) and b(2-5) Compared with Bayesian hierarchical approach modelling trends, temperature, spatiotemporal patterns and a greater geographical resolution developed by Konstantinoudis et al.
Reporting excess mortality	Excess mortalities were reported as the difference and percentage change between observed mortalities, the predicted point estimate and its 95% CI (upper limit) Excess mortalities attributable to COVID-19 mortalities were calculated by taking the proportion of COVID-19 mortalities from the excess mortalies.
Software and package	R version 3.6.0 using tidyverse and surveillance package

What was the finding?

a) Overall mortality

In Malaysia from January 2016 to September 2021, there were 1,000,562 all-cause mortalities, predominantly affecting those aged 60 and above (66.8%). COVID-19 cases and deaths followed four waves, with the lowest observed after the March-April 2020 movement control order. Predicted all-cause mortality had bimodal peaks in December 2020-February 2021 and May-July 2021. Mortality trends declined in 2020 but sharply increased in 2021, surpassing predictions by 13.0–24.0%.

In 2020, there was a reduction of 5.5–23.7% in observed mortalities compared to predictions. However, in 2021, there was an excess of 13.0–24.0%, with 86.2–100% of excess mortalities attributed to COVID-19. The peak of excess mortalities occurred between July and September 2021, with a 46.4–58.1% increase compared to predicted mortalities. Trends in COVID-19 cases and deaths aligned with observed all-cause mortality trends in 2021.

b) By state mortality

The states in Malaysia exhibited varied trends in predicted all-cause mortalities. Johor, Kedah, Perak, Perlis, Pulau Pinang, Sabah, and Sarawak showed a bimodal pattern, reflecting the national trend. Kelantan, Melaka, Negeri Sembilan, Pahang, and Terengganu reported unimodal predicted mortality trends. Selangor, Putrajaya, Kuala Lumpur, and Labuan displayed a static trend. All states recorded higher all-cause mortalities than the upper interval of predicted values between July and September 2021.

Notably, excess counts were most significant in Terengganu (2.2–19.5%), Pahang (10.2–22.4%), Perak (14.1–25.5%), Kelantan (17.6–28.8%), Melaka (23.4–37.4%), Negeri Sembilan (25.8–38.0%), Johor (28.0–36.6%), Pulau Pinang (29.3–39.4%), Kedah (35.5–43.3%), Selangor (47.6–53.6%), and Kuala Lumpur (53.3–61.3%) during July-September 2021. The proportion of excess mortalities attributed to COVID-19 in these states ranged from 51.6% to 100%.

c) Mortality by age group

Predicted mortalities for individuals aged 40 and above followed a bimodal pattern, while younger age groups did not show a specific trend. Beyond July 2021, observed all-cause mortalities exceeded predictions across all age groups above 14 (Fig. 3). The largest excess counts were in individuals aged ≥60 (27.8–33.7%), between 41 and 59 (41.7–45.9%), and between 15 and 40 (32.0–41.5%) during July-September 2021.

The proportion of excess mortalities attributed to COVID-19 in these age groups ranged from 74.8% to more than 100%, as indicated in Supplementary Appendix 3. In essence, the impact of COVID-19 was particularly pronounced in older age groups, with observed mortalities surpassing predictions and a significant proportion of excess mortalities linked to the virus.

d) Mortality by gender

Male and female predicted all-cause mortality patterns are in line with national bimodal trends. The highest months for observed all-cause mortality were reported to be July and September of 2021. It is reported that beyond July 2021, observed all-cause mortality will surpass projected mortalities. Males exhibited the highest excess numbers between July and September 2021, with an excess of 30.5–35.0% for men and 33.3–39.1% for women. The ratio of extra deaths in these age groups linked to COVID-19 varied from 82.5% to over 100%.

e) Mortality by non-RTA and RTA

The bimodal national all-cause death trends and the predicted non-RTA mortality trends lined up. It was found that predicted RTA trends weakened over time. The observed non-RTA mortalities peaked between July and September 2021, which is in line with national trends in all-cause mortality.

Over the course of the investigation, observed RTA fatalities were shown to be consistently lower than predicted by 36.6–80.5%. The drop from 86.7 to 135.7 per cent between April and June 2020 was the biggest difference between the observed and anticipated mortalities. The overall estimates and the stratification by nationality and ethnicity did not show any appreciable trends that differed significantly.

f) Sensitivity analysis

Like the Farrington approach, the Bayesian hierarchical estimates had higher excess thresholds and more uncertainties. According to both forecasts, there will be excess in 2021 and none in 2020. For July–September 2021, an excess of 33.6–38.1% (Farrington) and 22.1–31.9% (Bayesian Hierarchical) is estimated.

Discussions

Initial Period (Early 2020)

- There were minimal changes in overall mortality rates.
- This suggests that local transmission of COVID-19 was likely low during that period.
- Strict lockdown measures lead to a significant reduction in observed deaths.
- Other causes of mortality such as influenza, pneumonia and accidents also reduce in trend.

Reversal in 2021

- There were significant increase in all cause of mortality especially in Julu to September.
- This is particularly corresponded due to surge in COVID-19 case and widespread of Delta variant.

Impact in specific age group

- Mortality among individuals under 15 years of age showed a decreasing trend, possibly due to reduced non-covid-19 pneumonia mortality.
- Reduced human interaction, mask usage, hand hygiene, and physical distancing measures likely contributed to this decrease.
- Road and transport-related accident (rta) mortalities, a leading cause of death among those aged 15 to 40, significantly declined during movement restrictions.

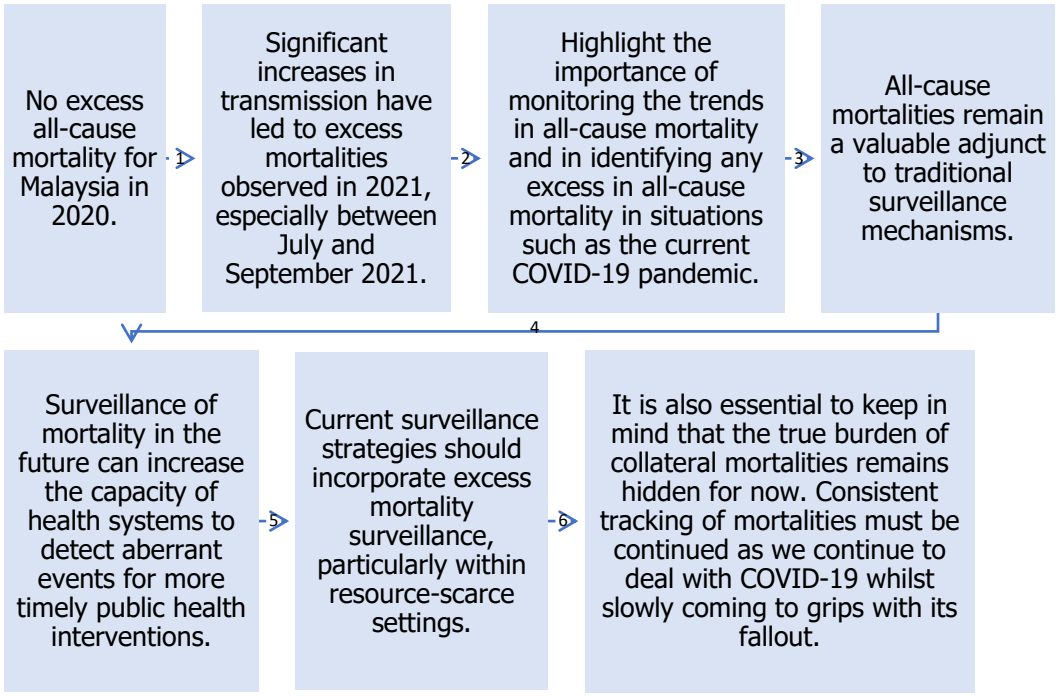
Scarcity of published data at Southeast Asia

- Despite the lengthy pandemic, there is a scarcity of published data on excess mortality in southeast Asia, highlighting the need for improved vital statistics surveillance in the region.
- The study emphasizes the importance of establishing a regional surveillance system to monitor future pandemics and public health threats

Methodology & Limitation

- The study used robust aberration detection mechanisms to analyse a large dataset over 21 months.
- Limitations included potential reporting delays and underreporting, particularly in East Malaysia.
- The analysis focused on all-cause mortality, making it challenging to attribute specific causes to excess deaths amid the COVID-19 pandemic

Conclusion



How much can we take out from this paper?

The study aimed to investigate levels of excess all-cause mortality and their geographic, age, and sex distributions in Malaysia between January 2020 and September 2021. The findings revealed an overall reduction in observed mortalities from predicted mortalities in 2020, indicating low local transmission in the early days of the pandemic. However, there was a significant increase in excess all-cause mortalities in 2021, particularly between July and September, corresponding to the spread of the Delta variant.

Movement restriction measures, such as the Movement Control Order (MCO), led to a substantial reduction in road and transport-related accident mortalities, especially in individuals aged between 15 and 40. Lockdowns have been shown to reduce accidental mortalities.

The study emphasizes the importance of monitoring all-cause mortality trends and incorporating excess mortality surveillance in current surveillance strategies. This can aid in timely public health interventions and enhance the capacity of health systems to detect and respond to public health emergencies.

A seasonal and trend decomposition using LOESS (STL) was employed to delineate the effect of noise prior to putting it into predictive modelling. This paper uses an over-dispersed Poisson generalized linear model to predict excess mortalities due to the COVID-19 pandemic in Malaysia. This model is more complex than the standard Poisson model but can provide more accurate estimates of the true underlying distribution of the data. The model incorporates regression parameters of time-trend and seasonal factors to estimate the expected number of mortalities with a one-sided confidence interval. It is particularly relevant in studies assessing the impact of COVID-19 as an external factor on mortality rates.

Sensitivity analysis was performed by varying the parameters w and b, and linear trends were tested over time for inclusion within the model. On top of that, the researchers use hierarchical Bayesian analysis which has the advantage of handling complex data.

Despite having discrepancies in some of the results when using both robust statistical analyses, bear in mind that Bayesian modelling incorporates prior information in their posterior to form inference. On top of that, they add more parameters to be estimated by Bayesian modelling such as population trends, temperature, spatiotemporal patterns and a greater geographical resolution compared when using an over-dispersed Poisson generalised linear model

In conclusion, this study provides valuable insights into the estimation of excess mortalities during the COVID-19 pandemic in Malaysia. It highlights the impact of the Delta variant, the effectiveness of movement restrictions in reducing accidental mortalities, and the need for improved surveillance systems to better respond to future pandemics and public health threats.