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COVID-19: A global and continental overview of the second wave and its (relatively) attenuated case fatality ratio

1. Introduction

The world continues to struggle in the grip of the COVID-19 pandemic that was initially identified in Wuhan, China, in December 2019 [1]. This resulted in international travel bans in March 2020 in an attempt to dampen viral spread, a measure that affected over 90% of the world’s population [2]. This, accompanied by social distancing measures, resulted in an overnight global crisis for both tourism and hospitality sectors, crucial pillars of national economies [3]. The measures were effective in dampening the pandemic, may have delayed many millions of infections and averted the deaths of millions more [4,5].

COVID-19 is a beta coronavirus not an influenza virus but its transmission epidemiology is similar to influenza and it is therefore constructive to review the progression of historical influenza pandemics. These have followed wave patterns, with a peak usually succeeded by a second wave a few months later [6].

Virtually all countries commenced easing restrictions on the spread of the virus. This was followed by a new wave of cases shortly followed by deaths in a similar pattern. The monthly ratio of detected cases to deaths (case fatality ratio) initially rose to 0.08, then fell to 0.02. This resulted in international travel bans in March 2020 in an attempt to dampen viral spread, a measure that affected over 90% of the world’s population [2]. This, accompanied by social distancing measures, resulted in an overnight global crisis for both tourism and hospitality sectors, crucial pillars of national economies [3]. The measures were effective in dampening the pandemic, may have delayed many millions of infections and averted the deaths of millions more [4,5].

COVID-19 is pandemic. International travel bans in March 2020 dampened viral spread and resulted in an overnight global economic crisis. As countries ease travel and social distancing restrictions, viral resurgences are expected. This study was carried out in order to delineate the development of a second wave of COVID-19 cases and deaths due to lockdown easements in June–July 2020.

2. Methods

Publically available data for daily new cases and deaths from December 2019 to September 2020 was obtained from “Our World In Data” website and analysed with Pearson correlation. Results: At global level, both datasets exhibited three distinct time periods. Cases rose to mid-April, plateaued till mid-May then rose again. Almost all of the slopes in these three time periods were statistically significant. Deaths followed a similar three-part pattern, albeit more pronounced, with values lagging circa one week after new cases and a middle time period when numbers (of deaths) actually decreased, with all periods exhibiting significant slopes. At continent level, for new cases, Asia rose steadily, Europe is increasing again, the Americas and Africa are declining. Deaths follow a similar pattern. Oceania shows a bimodal pattern, with a first and second wave of cases shortly followed by deaths in a similar pattern. The monthly ratio of detected cases to deaths (case fatality ratio) initially rose to 0.08, then fell to 0.02.

Conclusion: The world is in its second wave of COVID-19, with fortunately reduced case fatality ratios.
average of the initial set of datapoints (here 14 days) of the series. The subset is modified by shifting forward; excluding the first number of the series and including the next value. This calculation is used in time series data to smooth out short-term fluctuations and highlight longer-term trends/cycles. A p-value ≤ 0.05 was considered to be a statistically significant result.

3. Results

At global level, both datasets exhibited three distinct time periods. Daily new COVID-19 cases rose to mid-April, plateaued till mid-May then rose again (Fig. 1). Almost all of the slopes in these three time periods were statistically significant (Table 1). Deaths followed a similar three-part pattern, albeit more pronounced, with values lagging circa one week after new cases and a middle time period when numbers (of deaths) actually decreased, with all periods exhibiting significant slopes (Fig. 2 and Table 1).

At continent level, for new cases, Asia rose steadily, Europe plateaued and is increasing again, the Americas and Africa are declining (Fig. 3). Deaths are stabilising or falling everywhere except in Asia (Fig. 4).

Due to smaller numbers, Oceania is plotted separately, and this shows a bimodal pattern, with a first and second wave of cases shortly followed by deaths in a similar pattern (Fig. 5).

The ratio of detected cases to deaths (case fatality ratio) initially rose to 0.08, then fell to 0.02 (Table 2).

4. Discussion

As anticipated, once lockdowns and restrictions were eased, cases of COVID-19 rose rapidly worldwide. The world is clearly in the grip of a second wave of COVID-19, with no imminent vaccine in sight. However, the case fatality ratio has fallen, a puzzling but fortunate finding [12,13]. Some pharmacological treatments may be modifying the natural history of the disease and these include remdesivir, dexamethasone and convalescent plasma, with improved outcomes [14]. Furthermore, healthcare workers have gained and shared their now voluminous experiences in treating affected patients [15]. However, while these advances seemed to have stemmed the tide of deaths in Europe and North America, with a stable mortality despite more cases, this is not the case in much of the rest of the world.

The true toll of this pandemic may never quite be established as cases in developing countries may not be recorded [16]. Even in developed countries, for various reasons, the true toll may only be estimated by calculating excess deaths when compared to similar time periods in recent years [17].

Countries are desperate to restart economies and have opened up to travel and are also competing with a variety of incentives in order to lure visitors. However, public health measures must be maintained: social distancing, hygiene and the rigorous use of face masks in public areas: ‘my mask protects you, your mask protects me’ [18]. Countries may also be able to avoid viral resurgence or dampen it by releasing restrictions slowly, as per WHO criteria [19]:

1. Evidence shows COVID-19 transmission is controlled;
2. Public health and health system capacities are in place to identify, isolate, test, trace contacts and quarantine them;
3. Outbreak risks are minimized in high-vulnerability settings, particularly in homes for older people, mental health facilities and crowded places of residence;
4. Workplace preventive measures are established, including physical distancing, handwashing facilities and respiratory etiquette;
5. Importation risks can be managed; and
6. Communities have a voice and are aware, engaged and participating in the transition.

**Table 1**

| Date     | New deaths | Days | New cases | New deaths |
|----------|-------------|------|-----------|------------|
| 12/11/05 | 31/05       | 103  | 12/11/05  | 31          |
| 04/12/05 | 13/05       | 130  | 05/20/09  | 97          |
| 05/20/09 | 11/01/16/4  | 97   | 04/28/05  | 42          |
| 05/05    | 29/05       | 130  | 05/20/09  | 42          |

**Fig. 1.** Daily new COVID-19 cases and 14 day moving average.

**Fig. 2.** Daily new COVID-19 deaths and 14 day moving average.

**Fig. 3.** 14 moving average for new cases by continent.
It is vital for all countries to remain vigilant and act swiftly so as to instantly arrest/dampen COVID-19 case spikes. Health issues are particularly relevant as in the developed countries, it has been estimated that if Gross Domestic Product (GDP) were to drop by 6% or more, more years of life would be lost due to recession than would be gained through lives saved, as affluent countries would be able to spend less on healthcare, safety and the environment [20]. The resuscitation of economies must therefore literally constitute a risk balancing act - tourism competition using health leverage in the COVID-19 era [11].

This is proving to be very difficult with countries (such as the UK and Malta and indeed all countries without draconian measures) experiencing high infection rates as restrictions are eased [21,22]. The only solution will be an effective vaccine when one becomes available, [23] and even then, if vaccine uptake is poor [24], or the vaccine only partially effective (as is for example the influenza vaccine) [25], restrictions of sorts may still need to be imposed for years to come until a measure of herd immunity from vaccination or natural infection is attained.

Declaration of competing interest

The authors have no conflict of interest to declare.

References

[1] C. Huang, Y. Wang, X. Li, L. Ren, J. Zhao, Y. Hu, L. Zhang, G. Fan, J. Xu, X. Gu, Z. Cheng, T. Yu, J. Xia, Y. Wei, W. Xu, X. Xie, Y. Yin, H. Li, M. Liu, Y. Xiao, H. Gao, L. Lu, J. Xie, G. Wang, R. Jiang, Z. Gao, Q. Jin, W. Wang, B. Gao. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet (London, England). 395 (2020) 497–506, https://doi.org/10.1016/S0140-6736(20)30183-5.

[2] V. Grech, P. Grech, S. Fabri, A risk balancing act - tourism competition using health leverage in the COVID-19 era. Int. J. Risk Saf. Med. (2020), https://doi.org/10.3233/JRS-200042.

[3] M. Buheji, K. da C. Cunha, G. Bekas, B. Mavrić, Y.L. do C. de Souza, S.S. da C. Silva, M. Hanafi, T.C. Yein. The extent of COVID-19 pandemic socio-economic impact on global poverty. a global integrative multidisciplinary review, Am. J. Econ. 10 (2020) 213–224, https://doi.org/10.5923/j.economics.20201004.02.

[4] S. Hiang, D. Allen, S. Amano-Phan, K. Bell, I. Bolliger, T. Chong, H. Druckenmiller, L.Y. Huang, A. Huthgen, E. Kratovich, P. Laiu, J. Lee, E. Rolf, J. Tseng, T. Wu. The effect of large-scale anti-contagion policies on the COVID-19 pandemic, Nature. (2020) 1–9, https://doi.org/10.1038/s41586-020-2404-8.

[5] S. Flaxman, S. Mishra, A. Gandy, H.J.T. Unwin, T.A. Melief, H. Coupland, C. Whittaker, H. Zhu, T. Berah, J.W. Eaton, M. H. Q. Chan, C.A. Ghani, C.A. Donnelly, S. Riley, M.A.C. Vollmer, N.M. Ferguson, L.C. Okell, S. Bharti, Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. Nature. (2020) 1–5, https://doi.org/10.1038/s41586-020-2405-7.

[6] P.C. Weyer, L. van Bergen. Death from 1918 pandemic influenza during the First World War: a perspective from personal and anecdotal evidence, Influenza Other Respir. Viruses 8 (2014) 538–546, https://doi.org/10.1111/irv.12267.

[7] J. Wise. Covid-19: risk of second wave is very real, say researchers, BMJ. 369 (2020) m2294, https://doi.org/10.1136/bmj.m2294.

[8] N.M. Ferguson, D. Laydon, G. Nedjati-Gilani, N. Imai, K. Ainslie, M. Baguelin, S. Bhatia, A. Boonyasairi, Z. Cucunubá, G. Cuomo-Dannenburg, A. Dighe, I. Dorigatti, H. Fu, K. Gaythorpe, W. Green, A. Hamlet, W. Hinsley, L.C. Okell, S. van Elshoven, H. Thompson, R. Verity, E. Volz, H. Wang, Y. Wang, P. Gt Walker, C. Walters, P. Winskill, C. Whittaker, C.A. Donnelly, S. Riley, A.C. Ghani. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand (n.d.). doi: 10.25561/77482.

[9] Times of Malta. Record economic slumps hit Europe in face of resurgent virus, Times of Malta, 2020. https://timesofmalta.com/articles/view/record-economic-slumps-hit-europe-in-face-of-resurgent-virus.808635. (Accessed 4 August 2020).

[10] H. Ritchie, Coronavirus source data - our world in data, Our World Data, 2020. http://ourworldindata.org/coronavirus-source-data. (Accessed 7 August 2020).

[11] V. Grech, WASP (Write a Scientific Paper) using Excel-13: correlation and regression, Early Hum. Dev. 122 (2018) 60–63, https://doi.org/10.1016/j.earhumdev.2018.04.005.

[12] C. Kenyon, Flattening-the-curve associated with reduced COVID-19 case fatality rates - an ecological analysis of 65 countries, J. Inf. Secur. 81 (2020) e98–e99, https://doi.org/10.1177/0022158620939107.

[13] D.D. Raigord, M.H. Lee, S. Archuleta, N. Bagdasarian, S.C. Quek, The many estimates of the COVID-19 case fatality rate, Lancet Infect. Dis. 20 (2020) 776–777, https://doi.org/10.1016/S1473-3099(20)30244-5.

[14] R.A. Siemieniuk, J.J. Bartoszko, L. Ge, D. Zeraatkar, A. Izcovich, H. Pardo-Heru, T. Liang, Handbook of COVID-19 Prevention and Treatment, Mexico, https://cov-19-app.nappброекм.vid-19.conacyt.mx/jspui/handle/1000/25, 2020. (Accessed 7 August 2020).

[15] H. Guyatt, R. Brignardello-Petersen, Drug treatments for covid-19: living system review and network meta-analysis, BMJ 370 (2020), m2980, https://doi.org/10.1136/bmj.m2980.

[16] N. Sekercioglu, L. Sheng, C. Switzer, B. Tendal, L. Thabane, G. Tomlinson, E. Pitzer, N.G. Reich, M. Russi, L. Simonsen, A. Watkins, C. Viboud, Estimation of the effect of large-scale anti-contagion policies on the COVID-19 pandemic, Nature. (2020) 1–5, https://doi.org/10.1038/s41586-020-2405-7.

[17] D.M. Weinberger, J. Chen, T. Cohen, F.W. Crawford, F. Mostashari, D. Olson, V. E. Pitzer, N.G. Reich, M. Russi, L. Simonsen, A. Watkins, C. Viboud, Estimation of excess deaths associated with the COVID-19 pandemic in the United States, March to May 2020, JAMA Intern. Med. (2020). https://doi.org/10.1001/jama internmed.2020.3931.

[18] R.O.J.H. Stutt, R. Retkute, M. Bradley, C.A. Gilligan, J. Colvin, A modelling framework to assess the likely effectiveness of face masks in combination with ‘lock-down’ in managing the COVID-19 pandemic, Proc. R. Soc. A Math. Phys. Eng. Sci. 476 (2020) 20200076, https://doi.org/10.1098/rspa.2020.0376.

Table 2

Global case fatality ratio.

| Month | New cases | Deaths | Ratio |
|-------|-----------|--------|-------|
| Jan   | 9797      | 213    | 0.022 |
| Feb   | 74,707    | 2702   | 0.036 |
| Mar   | 722,387   | 35,797 | 0.050 |
| Apr   | 2,330,512 | 189,176| 0.081 |
| May   | 2,874,101 | 140,149| 0.049 |
| Jun   | 4,232,988 | 134,078| 0.032 |
| Jul   | 7,053,152 | 166,208| 0.024 |
| Aug   | 7,977,432 | 110,833| 0.022 |
| Sep   | 5,560,123 | 110,833| 0.020 |
[19] World Health Organization, Strengthening and adjusting public health measures throughout the COVID-19 transition phases. Policy considerations for the WHO European Region, 24 April 2020, World Health Organization, 2020. http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/technical-guidance/2020/strengthening-and-adjusting-public-health-measures-throughout-the-covid-19-transition-phases-policy-considerations-for-the-who-european-region-24-ap. (Accessed 9 June 2020).

[20] P.J. Thomas, Nanotechnology perceptions, Nanotechnol. Perceptions 16 (2020) 16–40. https://research-information.bris.ac.uk/en/publications/j-value-assessment-of-how-best-to-combat-covid-19. (Accessed 3 August 2020).

[21] J. Wise, Covid-19: experts divide into two camps of action-shielding versus blanket policies, BMJ. 370 (2020) m3702, https://doi.org/10.1136/bmj.m3702.

[22] S. Cuschieri, M. Balzan, C. Gauci, S. Aguis, V. Grech, Mass events trigger Malta’s second peak after initial successful pandemic suppression, J. Community Health (2020) 1–8, https://doi.org/10.1007/s10900-020-00925-6.

[23] S. Caddy, Developing a vaccine for covid-19, BMJ. 369 (2020) m1790, https://doi.org/10.1136/bmj.m1790.

[24] P. Verger, E. Dubé, Restoring confidence in vaccines in the COVID-19 era, Expert Rev. Vaccines (2020), https://doi.org/10.1080/14760584.2020.1825945.

[25] M.L. Jackson, J.R. Chung, L.A. Jackson, C.H. Phillips, J. Benoit, A.S. Monto, E.T. Martin, E.A. Belongia, H.Q. McLean, M. Gaglani, K. Murthy, R. Zimmerman, M.P. Nowalk, A.M. Fry, B. Flannery, Influenza vaccine effectiveness in the United States during the 2015–2016 season, N. Engl. J. Med. 377 (2017) 534–543, https://doi.org/10.1056/NEJMoa1700153.

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