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COVID-19 risk management in dental practice Part 1: Seven Pandemics and 100 years later – What lessons have we learnt?

Johan Hartshorne[1] and Andre van Zyl[2]

Keywords: COVID-19, consequences, coronavirus, epidemiology, influenza, mitigation, pandemic, SARS, MERS, Spanish flu, Asian Flu, Hong Kong flu, Swine flu, seasonal flu, risk management

Executive Summary

Rationale

- COVID-19 is a global public health emergency of international concern and declared a pandemic on March 11, 2020 by the World Health Organization.
- No country, government, institution, health care system or individual saw, anticipated or was prepared for what was coming at them.
- The rapid advance of COVID-19 around the world has laid bare the unpreparedness of health care systems, availability of resources, and the limits of our knowledge.
- The purpose of this Part 1 of this review is to provide a historical overview of pandemics over the past 100 years, an epidemiological snapshot of COVID-19 globally, South Africa and other geographic regions, and South Africa, and a brief understanding of risk mitigation and its socio-economic consequences within the wider context of communities and populations.

Key points

- COVID-19 is the most contagious of all the respiratory viral pandemics
- COVID-19 is spreading fast in more than 215 countries with 42,548,025 confirmed cases, 1,150,140 deaths, and 31,454,342 recoveries globally to date.(24 October, 2020)
- Mitigation strategies are all based on hand hygiene, wearing masks, screening, isolation and quarantine, social distancing and avoiding crowded places and gatherings.
- Non-pharmaceutical interventions alone are unlikely to prevent or contain a pandemic – it only delays or flattens the pandemic peak to allow health authorities to prepare for the pandemic and reduce the strain on health care systems.
- History has every time repeated itself in showing global unpreparedness of public health care systems and inadequate availability of resources.
- It is impossible to predict why, how and when cycles and waves will occur in different countries.
- COVID-19 infection outbreaks are fuelled by superspreading events (high risk individuals, facilities and opportunistic situations.

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- To reach herd immunity for COVID-19, 70% or more of the population would need to be immune. • Studies suggest that at this point in time no more that 2-4% of any countries population has been infected with SARS-CoV-2.
- The primary focus of the initial mitigation and lockdown efforts has been on limiting the spread of SARS-CoV-2 s infection and COVID-19 disease (so called 'flattening the curve') to relieve potential strain on health care systems because of unavailability or inadequacy of resources (personal protection equipment), facilities (hospital beds and intensive care units) and to prepare health care professionals to be able to manage the impact of COVID-19.
- COVID-19 around the world has laid bare the un-preparedness of health care systems, availability of resources, and the limits of our knowledge
- Fundamental questions about how SARS-CoV-2 spreads in a population and who is at risk of both infection and severe complications is still unanswered.
- Co-morbidities and immunocompromised conditions tend to increase severity of illness and fatalities.

Practical implications

- The unintended consequences of 'lockdown', mitigation policies and restriction has resulted in a devastating impact on social, economic and health care systems.
- Governments world-wide are now faced with the complicated challenge on how to deal with all the unintended consequences created by the 'lockdown' intervention and restore the devastating effects of COVID-19.
- SARS-CoV-2 is a novel respiratory virus, there is no vaccine, no antiviral drugs and no scientific evidence-based data to underpin / back any mitigation or infection control protocol.
- A novel virus is always going to be a problem because the population has no immunity and there is no vaccine.
- Each pandemic is different and no one can predict when and how it will end .

Introduction

A highly contagious pneumonia outbreak caused by a novel coronavirus emerged in Wuhan, China in December of 2019. Subsequently, the World Health Organization (WHO) declared a public health emergency of international concern over this global pneumonia outbreak on January 30, 2020. On February 11, 2020, WHO named the novel viral pneumonia officially as Corona virus disease or COVID-19. The International Committee on Taxonomy of viruses (ICTV) named the virus: severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)[1] The World Health Organization (WHO) officially declared COVID-19 as a pandemic on March 11, 2020.[2]

Covid-19 is spreading fast with an increasing number of infected patients world-wide.[3] The Johns Hopkins University of Medicine dataset on July 27, 2020 showed there were 16,526,414 confirmed cases of COVID-19 globally, 649,662 deaths whilst 10,115,994 individuals infected with SARS-CoV-2 globally have recovered. Cases of COVID-19 at this stage have been reported in more than 188 countries.[4,5] The rapidly increasing number of cases and evidence of human-to-human transmission suggested that the virus was more contagious than SARS-CoV and MERS-CoV.[6,7,8] In addition, thousands of health care workers have been infected, and outbreaks have occurred in hospitals, aged care facilities and prisons.[9] Thus COVID-19 has not only become a global public health emergency, but mitigation policies such as 'lockdowns' implemented world-wide has also placed a tremendous amount of strain on health care systems (including dental practices) and global economies.

No country, government, institution, health care system or individual saw, anticipated or was prepared for what was coming at them. In addition to the loss of lives, COVID-19 has placed unprecedented physical, financial and emotional strain on health care systems, businesses, food security, individuals and global economies at large. Dentistry world-wide was, and are still in many countries, under severe strain since the outbreak of COVID-19. As a result dentists and their staff have to endure work-, health-, social- and economic-related implications and anxieties resulting from the COVID-19 pandemic.

SARS-CoV-2 is a novel respiratory virus and at the time of this writing there is no vaccine and no anti-viral drugs against SARS-CoV-2. Furthermore, there is at this moment in time no scientific evidence-based data to back any mitigation or infection control protocol specifically against COVID-19 and SARS-CoV-2.

Literature search methodology

Emerging literature on COVID-19 is scattered over various sources, characterized by lack of, or incomplete or uncontested evidence-based data and by a plurality of voices within the health care, academic, and environmental research community. The pandemic and its implications is rapidly evolving making it difficult to clearly and rapidly

synthesize and articulate scientific evidence.[10] There is need for timely evidence to inform and update dentists on their infection prevention and control practices on emerging infectious respiratory diseases. Because there are no specific evidence-based data for COVID-19, the only source of data we have is retrospective data on previous respiratory viral pandemics. A retrospective review of available evidence will allow extrapolation of results from indirect evidence and rapid dissemination of results widely to assist dentists to adjust their infection control and prevention protocols.

A comprehensive literature search of multiple bibliographic databases was conducted, including Medline, Embase and the Cochrane Collaboration. COVID-19 repositories with lists of grey literature sources (e.g., LitCOVID, COVID-END and WHO-COVID-19) and pre-print servers or repositories for biological and medical sciences (e.g., medRxiv, bioRxiv) were also included in the search strategy. Preprints are preliminary reports of research word that have not been certified by peer review. Information derived from preprints thus have to be interpreted with caution. Studies and reviews in all languages were considered for inclusion. Search keywords used in this review include, COVID-19, consequences, coronavirus, epidemiology, influenza, mitigation, pandemic, SARS, MERS, Spanish flu, Asian Flu, Hong Kong flu, Swine flu, seasonal flu, risk management. Electronic databases were searched to July 31, 2020.

Purpose

The purpose of this 4-part series is to enhance dental practitioners understanding of the what, why, and how underpinning the risk-management of the virus (SARS-CoV-2) and the disease (COVID-19) within both the broader community and the dental practice setting.

Part 1 provides a historical overview of pandemics over the past 100 years, an epidemiological snapshot of COVID-19 (October,24, 2020), and a brief understanding of risk mitigation and its socio-economic consequences in the wider context of communities and populations.

Part 2 will focus on the key parameters of the infection chain that impact directly on risk management in the dental practice setting namely: (i) the pathogen SARS-CoV-2, (ii) reservoir or source of infection, (iii) portal of exit, (iv) mode of transmission, (v) portal of entry and virus replication, and (vi) a susceptible host and the corona virus disease (COVID-19) In addition, Part 2 will also summarize the current state of knowledge regarding the aerobiology and flow physics implicated in the generation, expulsion, evolution and transmission of virus-laden droplets and aerosols generated from the respiratory tract during expiratory activities such as breathing, talking, coughing and sneezing and during aerosol generating procedures.

Part 3 of this review investigates the current available in formation on: (i) the global burden of COVID-19 on health care workers and in particular dental health care workers, (ii) why the dental practice setting is regarded as a 'high occupational risk' setting, and (iii) are dental health care workers and their families at increased risk of COVID-19 compared to the general population?

Part 4 of this review provides an update and summarizes the current knowledge on infection control and prevention measures in the dental practice setting.

These reviews will enhance dental practitioners knowledge, awareness and appreciation of pandemics, respiratory viruses and their consequences, current epidemiology data, and what precautionary and preventive measures to take that will minimize, mitigate or eliminate the risk of exposure and transmission of coronavirus in the dental practice workplace, to protect the health and safety of dental health care workers (DHCW) and patients and public visiting their premises during the COVID-19 pandemic.

Placing Covid-19 in perspective – 7 pandemics and 100 years later

Between 1918 and 2020 the world has experienced three major wars, massive growth in population and human associated microbiomes, antibiotic resistance, trade and international travel, all contributing in their own unique way to the emergence and spread of pandemic diseases. During this period the world has experienced seven respiratory virus pandemics, four related to influenza virus, (Spanish Flu 1918, Asian Flu 1957-1958, Hongkong Flu 1968-1970, Swine Flu 2009-2010, and three to coronavirus (SARS 2002, MERS 2012, and COVID-19). (Table 1) [11-28]

These pandemics have several common features, namely: (i) they are caused by a novel virus, originating from a primary animal host (i.e, Influenza – birds and swine, and coronavirus – bats and camels), (ii) transmission is by respiratory droplets, contact with contaminated surfaces and airborne transmission, (iii) symptoms are similar to flu, (iv) there is no immunity and no vaccination is available, (v) secondary bacterial pneumonia is a common feature, and (vi) they tend to occur in waves.

Co-morbidities and immunocompromised conditions tend to increase severity of illness and fatalities. Mitigation strategies are all based on hand hygiene, wearing masks, screening, isolation and quarantine, social distancing and avoiding crowded places and gatherings. Non-pharmaceutical

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Table 1 : A comparison of epidemiological characteristics of respiratory virus pandemics and seasonal flu over the past century (1918 -2020)

	Spanish Flu 1918	Asian Flu 1957-1958	Hongkong Flu 1968-1970	Swine Flu 2009-2010	Seasonal Flu (Annually)	SARS * 2002	MERS** 2012	COVID-19*** 2019
Detected: Date	March 1918	February: 1957	July 1968	April: 2009	Seasonal	November: 2002	June: 2012	December: 2019
Origin	China	Yunan, China	Hongkong, China	Mexico	South-East Asia	Guangdong, China	Jeddah, Saudi Arabia	Wuhan, China
Pathogen	Influenza A/ H1N1	Influenza A/ H2N2	Influenza A/ H3/N2	Novel A/H1N1 H1N1 pdm09	A/H3N2 or A/H1N1p-dm09	SARS-CoV βcoronavirus	MERS-CoV βcoronavirus	SARS-CoV-2 βcoronavirus
Receptor	Sialic acid	Sialic acid	Sialic acid	Sialic acid	Sialic acid	ACE2	DPP4 (CD26)	ACE 2
Incubation period	1-2 days	1-2 days	1-2 days	1 – 4 days	2-4 days	2-14 days (mean: 5 days)	2-14 days	2-14 days (mean: 6 days)
Ro: (Contagiousness)	≈1.8	≈1.7	≈1.8	≈1.5	≈1.3	≈ 1.7-1.9	≈ 0.4-0.7	≈ 3.54 (highly diffusible)
Spread (countries)	Unknown	39	74	122	Unknown (not notifiable)	26 countries	27 countries	213 countries
Number cases	500 million (50% of global population)	9 million in UK	Unknown	60.8 (43.3 -89.3) million	1 Billion annually	8096 (21% health-care workers)	2521	41 million
Number deaths	≈ 50 million (over 4 month period)	1-2 million	1-4million	≈ 284,000 151,700-575,400	≈ 400,000 290,000 – 646,000 annually	774	866	600,532
Mortality rate	1-3%	0.67%	0.03	0.02%	0.1%	≈ 9.2% (9.5%)	≈34.4% (34.4%)	≈ 1,38-3.4% (2.3%)
At risk group	13-34 years of age	Younger age groups 5-39 yrs old	Younger populations	Younger people pregnant women	Children 5-19 yrs Elderly & immune compromised,	Elderly & individuals with Co-morbidities	Medical co-morbidities, Men >60 yrs	Individuals with co-morbidities, >65Yrs,
Vaccine	None	Available when pandemic hit USA	November 1968	Effective vaccine available after epidemic	Effective vaccine	No vaccine available	No vaccine available	No vaccine available - 3 in development stage
Disease profile	Highly contagious Deadliest Most died of pneumonia	Mild pandemic Pneumonia 50% Low death rate	Highly transmissable Low disease severity	Mild but costly Predictors of death: lung disease, other co-morbidities	Mild and self-restricting Many people have residual immunity 3-5 million cases of severe illness	Acute and often fatal illness	Acute and often fatal illness. Most patients who die are immunocompromised or have medical co-morbidities	Very contagious and high mortality. More people have mild-to- moderate symptoms/ less severe clinical picture, asymptomatic spread
Duration	6 months (abated quickly	1 -2 years	2-3 yrs	1 year	Seasonal (annually)	SARS has reappeared four times	Still active	Ongoing
Waves	3	2	2	1	Annually	4	Still active	Still active
End of Pandemic	April 1919	1 March 1958	1970 still in circulation as part of seasonal flu	August 2010	Seasonally	July 2003	Still active	Still active
References	11,12,13,15	12, 13, 14, 15, 16	12,13,15	13, 15, 17, 18	15, 24	13, 15, 19, 20, 22, 23, 28	13, 15, 19, 20, 21, 22, 23, 25,26	13, 15, 19, 20, 21, 22, 23,27, 28

*SARS : Severe acute respiratory syndrome / **MERS: The Middle East Respiratory Syndrome
***COVID-19 epidemiological data as on 12 June 2020

Table 2: Comparative epidemiological perspective of COVID-19 data stratified by geographical regions (Up to 24 October 2020)

Geographical area	South Africa	Africa	Europe	North America	Asia	South America	Oceana	Global
Countries		57	48	39	49	14	8	215
Population	59,540,916	1,360,378, 201	747,207,105	590,547,609	4,620,145,977	4,318,674,627	41,762,627	11,668,715,952
Tests	4,657,116 (7.72%) †	16,000,528 (1.18%) †	203,297,225 (27.2%) †	146,704,230 (24.8%) †	355,921,749 (7.7%) †	41,345,749 (0.95%) †	9,646,979 (23,1%) †	772,916,460 (6.62%) †
Cases	712,412 (1.20%) †	1,708,640 (0.12%) †	8,050,726 (1.08%) †	10,483,822 (1.77%) †	12,994,159 (0.28%) †	9,274,079 (0.21%) †	35,878 (0,08%) †	42,548,025 (0.36%) †
Cases/Million	7110	2100	11945	7815	7309	14703	2794	5459
Deaths	18891 (0.03%) †	41020 (0.003%) †	248,240 (0.03%) †	341,954 (0.06%) †	231,881 (0.005%) †	286,071 (0.007) †	959 (0.002%) †	1,150,140 (0.01%) †
Deaths/Million	317	33	276	202	79	459	22	147,6
Recovered cases	643,523 (90.3%) ‡	1,398,172 (81.8%) ‡	3,407,407 (42.3%) ‡	6,985,006 (66.6%) ‡	11,401,113 (87.7%) ‡	8,221,740 (88.6%) ‡	31,245 (87.1%) ‡	31,454,342 (73.9%) ‡
Active cases	49,998 (7.02%) ‡	269,448 (15.8%) ‡	4,395,079 (54.6%) ‡	3,156,862 (30.1%) ‡	1,352,165 (10.4%) ‡	766,268 (8.26%) ‡	3674 (10.24%) ‡	9,943,543 (23.3%) ‡
Serious/critical cases	546 (0.08%) ‡	2069 (0.12%) ‡	15,578 (0.19%) ‡	20,006 (0.19%) ‡	21,087 (0.16%) ‡	17,856 (0.19%) ‡	17 (0.05%) ‡	76,617 (0.18%) ‡

(† = % of Population) / (‡ = % of Cases)
Adapted from Worldometer, 2020 30 and Coronatracker, 202031

interventions alone are unlikely to prevent or contain a pandemic – it only delays or flattens the pandemic peak to allow health authorities to prepare for the pandemic and reduce the strain on health care systems.

Differences between pandemics mostly occurred in the level of contagiousness, mortality rate, age groups most likely to be affected and the number of people affected and died.

Common variables that are most likely associated with the occurrence and cyclic nature of pandemics are emergence of novel viruses due to genetic mutations, antibiotic resistance, increasing population growth, increased crowding and gathering in public spaces, shopping, public transport and sporting events, and increased international travel. Global connectedness and international travel has brought about greater and faster spread of infectious disease, larger disease impacts, and improved international cooperation and surveillance to mitigate spread of infectious disease. However, history has every time repeated itself in showing global unpreparedness of public health care systems and inadequate availability of resources.

History has also shown that pandemics occur in unpredictable cycles and occur in waves, however it is impossible to predict why, how and when cycles and waves will occur in different countries. In addition pandemics are inherently uncertain, nobody knows how it will end and when it will end.

Furthermore, pandemics are always associated with societal disruption, economic burden and strain on public health systems, hospitals and human resources during pandemic peaks. Pandemics, distinguished on the basis of their geographical spread, have caused significant disease burden, social and economic disruption for centuries. In recent decades, however, globalization and increased travel mobility have altered the emergence and accelerated global disease spread.

The experience in countries, especially poorer countries, with differences in demographic and social structures, poor quality and unavailability of health care, have emphasized

the intense pressure that COVID-19 pandemic places on national health systems, with demand for testing kits, PPE, intensive care beds and ventilators, rapidly outstripping their availability. This has potentially profound consequences on the impact and outcome of measures that can help reduce the spread of the virus, and associated morbidity and mortality.[29]

Epidemiology: Prevalence, morbidity and mortality statistics

Initial studies indicate a high prevalence of COVID-19 with a rapid spread from a single city (Wuhan) to the entire country in just 30 days.[3] The COVID-19 outbreak, which originated in Wuhan, China, has now spread to 215 countries infecting more than 42 million individuals of all ages as of 24 October, 2020. (Table 2) [30,31]

By mid-February 2020, a large number of infections in medical staff had already been reported.32 Survey data show that resident physicians in anaesthesiology, frontline emergency medicine, and ophthalmology were at greatest risk of contracting COVID-19. Another review suggested that dental practitioners are at a particular risk to infection due to close contact with patients and potential exposure to contaminated droplets and aerosols generated during dental procedures and saliva contaminated surfaces that could lead to potential cross-infection.[33]

Although most dental practices are only providing emergency services, the dental practice setting is considered a high risk environment for both dental health care workers as well as patients and staff due to airborne, aerosol, contact and contaminated surface transmission routes of SARS-CoV-2.[34]

A comparative demographic and epidemiological analysis of current COVID-19 data (up to 23 October, 2020) is summarized in Table 2.[30,31]

The global COVID-19 testing rate to date was 6.62%. More testing was done in Europe (27.2%), North America (24.8%) compared to Africa (1.18%). The testing rate in South Africa was 7.72%. The global prevalence rate for COVID-19 to date is 0.36%. The highest prevalence rate was in North America (1.77%) followed by South Africa (1.20%). Europe and South America showed the number of COVID-19 cases per million people. (Table 2). The global COVID-19 related mortality rate per population to date was 0.01%. South Africa and Europe had the highest mortality rate to date (0.03%). To date, the average global recovery rate is 73.9%

South Africa showed the highest recovery rate (90.3%) while the lowest recovery rate to date is in Europe (42.3%). The percentage of cases that are serious/critical are more or less the same over geographical regions with a global average of 0,18%. (Table 2) The lowest average percentage of individuals presenting serious/critical was found in Oceana (0.05%) and South Africa (0.08%).

Variations amongst regions have not been analysed but can be possibly be ascribed to testing trend (high or low testing protocols), accuracy of testing, asymptomatic cases and geographic heterogeneity (summer and winter during COVID-19 outbreak).

What is our current understanding of contagiousness?

Spreading of a virus contagiousness is measured in general by the basic reproductive number (R0)

This is a measure of the average number of secondary infections from an index case. With R0=2 for instance, each index case transmits to two new cases, which then each transmits to two new cases, and so on, increasing the number of new cases exponentially. For an outbreak to persist the R0 must be greater than 1; If R0 is less than 1, the number of new infections over time will decrease.

The reproduction number, or R0, is a mathematical term that defines contagiousness, namely the number of people that one sick host can infect. Estimates of the R0 of SARS-CoV-2 have ranged from 2.24 to as high as 3.58[35] although the WHO estimates it is between 1.4 and 2.5.[36] Current evidence suggests that it takes 3-7 days for the epidemic to double in size. The estimated median range reproduction number (R0) is between 2.0 and 3.0.

What is the current understanding of population heterogeneity, super-spreading events and transmission dynamics of SARS-CoV-2?

There are many heterogeneities in human societies, including different age cohorts, society activity levels and health status, that will influence virus transmission in a population.[37] However, it is suggested that viruses have significant transmission heterogeneity resulting in a small proportion of viruses infecting the vast majority of secondary cases.[38] Factors most likely contributing to superspreading are not completely understood but include (i) biological factors (e.g., individuals with higher viral load), (ii) behavioural and social factors (e.g., individuals with high contact rates), (iii) high risk facilities and places (e.g., closed spaces with poor ventilation such as prisons, long-term care and facilities, health care facilities), and (iv) opportunistic situations (e.g., where large number of individuals temporarily cluster such as in fish and meat factories, cruise ships, crowded public

transportation, family gatherings, parties and night clubs). In these situations, the probability of transmission per contact temporarily increases in an unusual way, such as singing or frequent loud speaking.38 While super-spreading events fuel outbreaks, they allow an opportunity to risk-stratify populations and locations for public health interventions and to interrupt super-spreading events.

What do we know about COVID-19 treatments, vaccines, herd immunity and mitigation measures?

Currently, there are no tested and approved antiviral drugs against COVID-19. Drug treatments currently used for COVID-19 mainly comprise four ways i.e., antiviral Western medicine, Chinese medicine, immunoenhancement therapy, and viral specific plasma globulin.3 There is also no vaccine available at this in time, although three different vaccines are in their development stage.

To reach herd immunity for COVID-19, likely 70% or more of the population would need to be immune.[39] Infectious disease epidemiologists state clearly that herd immunity against COVID-19 will not be achieved at a population level in 2020. Although more than 16 million confirmed cases of COVID-19 have been reported worldwide, studies suggest that no more that 2-4% of any countries population has been infected with SARS-CoV-2.

To date the primary focus of the initial mitigation and lockdown efforts has been on limiting the spread of SARS-CoV-2 s infection and COVID-19 disease (so called 'flattening the curve') to relieve potential strain on health care systems because of unavailability or inadequacy of resources (personal protection equipment), facilities (hospital beds and intensive care units) and to prepare health care professionals to be able to manage the impact of COVID-19. The objective of limiting spread of infection and stalling COVID-19 was to assist government and health care authorities to buy the necessary time to allow them to prepare for COVID-19. The primary intervention to this end was 'lock down' with accompanying restrictive regulations to minimize the spread of infection.

A key issue for epidemiologists is helping policy makers decided on the main objectives of mitigation (lock down) - e.g. minimizing morbidity and associated mortality, avoiding an epidemic peak that overwhelms the health care services, keeping the effects of the economy within manageable levels, and flattening the epidemic curve to wait for vaccine development and manufacture on scale and antiviral drug therapies.[40] Such mitigation objectives are difficult to achieve by the same interventions, so choices must be made about priorities.[41] For COVID-19, the potential social and economic impact of voluntary self-isolation or mandated quarantine (lock down) could be substantial and with disastrous implications.[41]

As the COVID-19 pandemic continues to expand, with uncertainties surrounding re-emergence and unavailability of a vaccine, hospital settings and dental practices are scrambling to implement and intensify infection control measures to protect themselves and patients from exposure to the coronavirus. It has also been suggested that SARS-CoV-2 surveillance should be maintained because a resurgence in contagion could be possible as late as 2024.[42] SARS-CoV-2 transmission from asymptomatic and pre-symptomatic hosts makes it more critical than ever that we develop methods of mass-analysis that provide better and faster prediction of COVID-19 infection. One of our greatest challenges globally is prophylactic prevention and control of transmission of SARS-CoV-2 from asymptomatic patients.

Unintended consequences and socio-economic burden of COVID-19

The COVID-19 pandemic will be written in the annals of history as the largest global social engineering experiment, with unprecedented interventions ever undertaken, exposing the vulnerabilities of Governments, economies, livelihoods and lives, including dental health care workers and their practices, worldwide. Similarly, the United Nations has declared the COVID-19 pandemic to be the greatest test the world has faced since World War 2.[43]

Furthermore, the pandemic vividly demonstrates the health, social and economic burden that that the infectious coronavirus and COVID-19 has imposed in an intimately connected world.[44] Pandemic misinformation, anxiety and fear, fuelled by social and mainstream media, is crowding out urgently needed public health guidance and scientific facts. Unprecedented containment and mitigation policies including lockdown, travel restrictions, isolation and quarantine, school closures and limiting dental and health care services to emergency care only, have been implemented in an effort to limit the spread of COVID-19 and to relieve the potential strain on health care systems. The resulting unintended consequences of these measures has potentially resulted in a wide spread devastating impact on social and economic systems with accompanying wide scale job losses, loss of income, compromised food security, and emotional stress. A further and more complicated challenge to Government now, is how to prepare and

deal with all the unintended consequences created by the 'lockdown' intervention and restore the devastating effects of COVID-19. To quote: "Is economic meltdown a price worth paying to halt delay what is already amongst us?"[45]

The healthcare information and resources burden resulting from COVID-19

The rapid advance of COVID-19 around the world has laid bare the unpreparedness of health care systems, availability of resources, and the limits of our knowledge.

During 'lock down' restrictive measures were implemented allowing only emergency health and dental care. The restrictive measures imposed on oral health care, poses many potential implications for individuals and oral health care providers such as: fear and anxiety, social stigma, disruption and discontinuity of care, neglect, inappropriate use of medication, misdiagnosis, non-diagnosis, malpractice, misconduct under the protection of restrictive legislation. In addition the dental health care workers are facing financial and emotional hardship, due to closure of their practices. Opening their practices now have brought about new challenges including the cost and administrative implications as a result of required personal protection equipment (PPE) and the Government regulations imposed on practices to ensure safe practice. Infection control and prevention globally seems to be a point of considerable confusion within the dental profession.[46] At the fore, inadequate availability of appropriate PPE, lack of knowledge and appropriate training on how to manage infection control and prevention within this new environment, and general fear and anxiety of being exposed to the coronavirus and associated COVID-19 disease.

In addition, the wave of reviews and descriptive studies being produced are just as large as the pandemic itself and characterized by inadequate testing and reporting of epidemiological data, as well as rapid and biased reporting of observations that have not been tested by the peer-review system. Despite the exponential increase in the number of publications and epidemiological data on the number of COVID-19 cases and deaths around the world, fundamental questions about how SARS-CoV-2 spreads in a population and who is at risk of both infection and severe complications is still unanswered.

Conclusion

The COVID-19 pandemic has brought upon us a 'forced sabbatical leave' and a multitude of global challenges that transcends political, cultural, socio-economic, medical, and engineering boundaries, that no individual, healthcare system, Government nor Country can afford. Each pandemic is different and no one can predict when and how it will end. That question that needs to be answered is: why after 7 global pandemics, an ongoing annual flu epidemic, and 100 years later do health care systems and Governments world-wide still have to prepare for viral respiratory outbreaks?

Preparedness and research forms the basis and must continue to evolve to keep pace with the heightened risk associated with pandemics. Since the start of the outbreak, research and rapid reporting has gone through various stages: (i) spreading and testing, (ii) clinical manifestation and management of those serious and critical ill, (iii) the reasons for and mapping of asymptomatic versus serious cases, (iv) vaccine development, and (v) rapid, effective and affordable testing. Researchers in the physical (engineering), medical, biological, behavioural and environmental sciences should collaborate to study these challenges related to the transmission and spread of infectious respiratory disease and reducing diseases severity, to define new research problems, develop new hypothesis, help solve user-centered and community-based problems, to educate and change behaviours, and to provide critical information to assist decisionmakers to mitigate risks associated with infectious respiratory viral diseases.

A novel virus is always going to be a problem because the population has no immunity and there is no vaccine. Development of vaccines is currently in progress. Neutralizing antibodies and vaccines could play significant roles in controlling the COVID-19 outbreak. However, longitudinal serological studies are urgently needed to determine the extent and duration of immunity to SARS-CoV-2.

Lockdowns are socio-economically not sustainable, and the stakes for the world is enormous. The infectious and aerosol sciences community needs to step up and tackle the current challenges presented by COVID-19, to provided evidence-based recommendations that will better prepare us for future inevitable pandemics.

For current numbers in COVID-19 please visit: https://www.worldometers.info/coronavirus/

References

1. Gorbalenya AE, Gulyaeva AA, Lauber C, et al. Coronaviridae Study Group of the International Committee on taxonomy of viruses. The species severe acute respiratory syndrome-related coronavirus: Classifying 2019-nCoV and naming it SARS-CoV-2. Nature Microbiol 2020; 5: 536-544.

2. World Health Organization. Timeline of WHO's response to COVID-19. June 30, 2020. https://www.who.int/news-room/detail/29-06-2020-covidtimeline

3. Wang L-S, Wang Y-R, Ye D-W, Liu Q-Q. A review of the 2019 novel coronavirus (COVID-19) based on current evidence. Int J Antimicrobial Agents 2020; https://doi.org/10.1016/j.ijantimicag.2020.105948

4. Johns Hopkins Coronavirus Resource Center. Global Map COVID-19 Dashboard by the Center for Systems Engineering . Accessed on the internet in July 31, 2020 at: https://coronavirus.jhu.edu/map.html

5. World Health Organization. (WHO) Coronavirus disease (COVID-19) Situation Report- 192. Accessed on the internet on 31 July, 2020 at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200730-covid-19-sitrep-192.pdf?sfvrsn=5e52901f_8

6. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. N Eng J Med 2020; 382: 1199-1207.

7. De Wit E, van Doremalen N, Falzarano D, Munster V. SARS and MERS: recent insights into emerging coronaviruses. Nat Rev Microbiol 2016; 14: 523-534.

8. Bai Y, Nie X, Wen C. Epidemic prediction of 2019-nCoV in Hubei province and comparison with SARS in Guangdong province. The Lancet 2020; Available at: SSRN: https://ssrn.com/abstract=3531427

9. Bahl P, Coolan C, de Silva C, et al. Airborne or droplet precautions for health care workers treating coronavirus disease 2019? J Infect Dis 2020; https://academic.oup.com/jid/advance-article/doi/10.1093/infdis/jiaa189/5820886?searchresult=1

10. Tricco AC, Garrity CM, Boulos L, et al. Rapid review methods more challenging during COVID-19 : Commentary with a focus on 8 knowledge synthesis steps. J Clin Epidemiol 2020; https://doi.org/10.1016/j.jclin.epi.2020.06.029

11. Centers for Disease Control (CDC). 1918 Pandemic influenza historic timeline. March 20, 2018. https://www.cdc.gov/flu/pandemic-resources/1918-commemoration/pandemic-timeline-1918.htm

12. Ries J. Here's how COVID-19 compares to past outbreaks. Health News. March 12, 2020. https://www.healthline.com/health-news/how-deadly-is-the-coronavirus-compared-to-past-outbreaks

13. Saunders-Hastings P, Krewski D. Reviewing the history of pandemic influenza: Understanding patterns of emergence and transmission. Pathogens 2016; 5(4): 66. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5198166/

14. Centers for Disease Control (CDC) 1957-1958 Pandemic (H2N2 virus). Jan 2, 2019, https://www.cdc.gov/flu/pandemic-resources/1957-1958-pandemic.html

15. Kilbourne ED. Influenza pandemics of the 20th century. Emerg Infect Dis 2006; 12(1): 9-14. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3291411/

16. Jackson C. History lessons: The Asian flu pandemic. Br J Gen Prac 2009; 59(565): 622-623. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2714797/

17. Jilani TN, Jamil RT, Siddiqui FM. HiNi Influenza (Swine Flu). StatPearls, Dec 14, 2019, https://www.ncbi.nlm.nih.gov/books/NBK513241/

18. Collington P. Swine flu: lessons we need to learn from our global experience. Emerg Health Threats J 2011; 4: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3168221/

19. Uras Umrat: Coronavirus: Comparing COVID-19, SARS and MERS. Aljazeera News/ Health. April 8, 2020. https://www.aljazeera.com/news/2020/04/coronavirus-comparing-covid-19-sars-mers-200406165555715.html

20. Hewings-Martin Y. How do SARS and MERS compare with COVID-19. Medical News Today. April 10, 2020. https://www.medicalnewstoday.com/articles/how-do-sars-and-mers-compare-with-covid-19

21. Ceccarelli M, Berrettta M, Rullo EV et al. Differences and similarities between severe acute respiratory syndrome (SARS)-coronavirus (CoV) and SARS-CoV-2. Would a rose by another name smell as sweet? Eur Rev Med Pharmacol Sci 2020; 24: 2781-2783. https://www.europeanreview.org/wp/wp-content/uploads/2781-2783.pdf

22. Prompetchara E, Ketloy C, Palaga T. Immune responses in COVID-19 and potential vaccines: Lessons learned from SARS and MERS epidemic. Asian Pacific J Allergy Immunol 2020; 38: 1-9. http://apjai-journal.org/wp-content/uploads/2020/03/1.pdf

23. Petrosillo N, Viceconte G, Ergonul O, et al. COVID-19, SARS and MERS: are they closely related? Clin Microbiol Infect, 2020; 26: 729-734. https://www.sciencedirect.com/science/article/pii/S1198743X20301713

24. World Health Organization (WHO), Influenza (seasonal). November 6, 2018. https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal)

25. Al-Osail AM, Al-Wazzah MJ. The history and epidemiology of Middle East Respiratory Syndrome coronavirus. Multidiscip Respir Med 2019;12: 20. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5545842/

26. Al-Hazmi A. Challenges presented by MERS coronavirus and SARS coronavirus to global health, Saudi J Biol Sci 2016; 23(4): 507-511. https://www.sciencedirect.com/science/article/pii/S1319562X16000668

27. Hao, X, Cheng S, Wu D, et al. Reconstruction of the full transmission dynamics of COVID-19 in Wuhan. Nature 2020. https://www.nature.com/articles/s41586-020-2554-8_reference.pdf

28. The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. J Autoimmunity 2020; 109: 102434. https://www.researchgate.net/publication/339673284_The_deadly_coronaviruses_The_2003_SARS_pandemic_and_the_2020_novel_coronavirus_epidemic_in_China

29. Walker PGT, Whittaker C, Watson OJ, et al. The impact of COVID-19 and strategies for mitigation and suppression in low -and middle-income countries. Science 2020; https://science.sciencemag.org/content/early/2020/06/11/science.abc0035?utm_campaign=fr_sci_2020-06-12&et_rid=698988279&et_cid=3363427

30. Worldometer. COVID-19 Coronavirus pandemic. Accessed on the internet on October 24, 2020; Available at: https://www.worldometers.info/coronavirus/

31. Coronatracker. Analytics. Updated May 17, 2020. Accessed on the internet at: https://www.coronatracker.com/analytics

32. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. Chinese J Epidemiol 2020; 41: 145-151.

33. Li Y, Ren B, Peng X, et al. Saliva is a non-negligible factor in the spread of COVID-19.

Mol Oral Biol, 2020; https://onlinelibrary.wiley.com/doi/epdf/10.1111/omi.12289

34. Peng X, Xu X, Li Y, et al. Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci 2020; 12(1): 9. https://www.nature.com/articles/s41368-020-0075-9.pdf

35. Zhao S, Lin Q, Ran J, et al. Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. Int. J. Infect. Dis. 2020, 92: 214–217.

36. World Health Organization. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) 16-24 February 2020 [Internet]. Geneva: World Health Organization; 2020 Available from: https://www.who.int/docs/default- source/coronavirus/who- china-joint-mission-on-covid-19-final-report.pdf.

37. Britton T, Ball F, Trapman P. A mathematical model reveals the influence of population heterogeneity on herd immunity to SARS-CoV-2. Science 2020; https://science.sciencemag.org/content/sci/early/2020/06/22/science.abc6810.full.pdf

38. Althouse BM, Wenger EA, Miller JE, et al. Stochasticity and heterogeneity in the transmission dynamics of SARS-CoV-2. Accessed on the internet on June 14, 2020 at: https://covid.idmod.org/data/Stochasticity_heterogeneity_transmission_dynamics_SARS-CoV-2.pdf

39. Dowdy D, D'Souza G, Early herd immunity against COVID-19: a dangerous misconception. Johns Hopkins University & Medicine, Coronavirus resource Centre, 2020. Accesses on the internet at:

https://coronavirus.jhu.edu/from-our-experts/early-herd-immunity-against-covid-19-a-dangerous-misconception

40. Anderson RM, Hesterbeek H, Klinkenberg D, Hollingworth TD. How will country-based mitigation measures influence the course of the COVID-19 epidemic.

The Lancet 2020, 395(10228): 931-934. https://www.thelancet.com/pdfs/journals/lancet/PIIS0140-6736(20)30567-5.pdf

41. Hollingworth TD, Klinkenberg D, Hesterbeek H, Anderson RM. Mitigation strategies for pandemic influenza A: balancing conflicting policy objectives. PLoS Comput Biol 2011; 7: e1001076.

42. Kissler SM, Tedijanto C, Goldstein E, et al. Projecting the transmission dynamics of SARS-CoV-2 through the post pandemic period. Science 2020; 368: 860-868. https://science.sciencemag.org/content/368/6493/860

43. Atkinson S. G20 leaders must answer to COVID-19. Science 2020; 368(6487): 111. https://science.sciencemag.org/content/368/6487/111

44. Bourouiba L. Turbulent gas clouds and respiratory pathogen emissions: potential implications for reducing transmission of COVID-19. J. Am. Med. Assoc., 2020; 323(18): 1837-1838. https://jamanetwork.com/journals/jama/fullarticle/2763852

45. Jefferson, T, Hennegan C. COVID-19- The tipping point? March 2020. Centre for Evidence based medicine. March 2020 https://www.cebm.net/2020/03/covid-19-the-tipping-point

46. British Association of Private Dentistry. BAPD return to practice position paper. May 2020. https://bapd.org.uk/pdfs/3410-Corona-BAPD-Policy-Document.pdf