



# Fostering Options for Prevention, Containment, and Care Delivery Service Capabilities on COVID-19 (SARS CoV-2) Pandemic Outbreak Symbiosis

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## Abstract

**Context:** The COVID-19 (SARS-CoV-2) pandemic originating in Wuhan, China, has continued to escalate, causing millions of infections, over 100 thousand deaths, enormous economic losses, and global social challenges. Containing the rapid spread of the infection and deaths requires a joint local, national, regional, and international collaborative evidence-based implementation of policies. We aimed to identify, extract, summarize, and extrapolate symbiotic strategies and methods of containing pandemic viral diseases for global implementation against COVID-19.

**Evidence Acquisition:** A literature review was conducted and used to describe and extrapolate strategies and methods used in containing pandemic viral diseases occurring between the years 2000 and 2020. The information was identified, extracted, and summarized from reports from the WHO, the CDC, the National Department of Health websites, and bibliographic databases such as PubMed, Google Scholar, Embase, and Web of Science.

**Results:** Viral containment was found to be fostered and achieved through rapid behavior modifications, community mobilization, and effective testing and treatment strategies. Educating communities on transmission, symptoms, outcomes, quarantine, and isolation, prevention strategies such as sanitizing and using PPE, when and where to report suspected cases, and where to go for testing, counseling, and treatment that have proven to be effective in managing and mitigating viral pandemics.

**Conclusions:** COVID-19 is a viral pandemic that can be contained through a behavioral modification approach, where individuals and communities jointly enforce international prevention policies responsibly and consistently.

**Keywords:** Prevention, SARS-CoV-2, Pandemic, Symbiosis

## 1. Context

The Coronavirus Disease 2019 (COVID-19) is a disease caused by Severe Acute Respiratory Syndrome Coronavirus-2 (SARS CoV-2). It began as a small outbreak in Wuhan, China, and quickly spread and crippled the world, causing millions of recorded infections, over 100 thousand deaths, enormous economic losses, and unprecedented social challenges (1-3). Mortality is highest among the elderly and those with co-morbidities such as diabetes, hypertension, respiratory diseases, and compromised immune system (4-6). The virus belongs to a group of enveloped, positive-sense, single-strand RNA viruses that are known to infect humans, bats, and certain other mammals (2). It has been detected in samples from many different clinical sources and environments and is highly stable at 4°C, as well as a wide range of pH at

room temperature (7, 8). Additionally, SARS CoV-2 is highly sensitive to hand soap and common disinfectants (7). This virus is highly contagious. Chang et al. (9) found that half of the patients treated for mild COVID-19 still harbored the virus for up to eight days after the disappearance of symptoms, indicating that individuals may infect others even after recovery. However, to date, there have been no confirmed reports of the vertical transmission of COVID-19 from mother to child during pregnancy and birth (10).

At present, COVID-19 is a disease that can only be contained by behavior modification, where individuals and communities work to enforce state policies (11, 12). Understanding the modes of transmission and the ways of prevention is vital to contain the pandemic. Historically, effective measures to slow viral spread have proven to be critical, as seen during the Ebola outbreak (11). In this study, we

tried to identify, extract, summarize, and extrapolate the symbiotic strategies and methods of containing pandemic viral diseases for global implementation against SARS CoV-2. Strategies should focus on communities with poor access to information regarding the outbreak and the ways of risk minimization.

We aimed to identify, extract, summarize, and extrapolate symbiotic strategies and methods of containing pandemic viral diseases for global implementation against COVID-19.

## 2. Evidence Acquisition

We used a literature review to identify, extract, summarize, and extrapolate strategies and methods used for containing pandemic viral diseases between the years 2000 and 2020 for implementation against SARS CoV-2. We reviewed reports regarding viral pandemics from the WHO, the CDC, the national Department of Health websites, and bibliographic databases such as PubMed, Embase, Web of Science, and Google Scholar. Information was gathered regarding the country of origin, transmission, symptoms, incubation period, duration of pandemic, number of cases and deaths, and strategies to contain the spread. English was the main language of search using keywords such as “COVID-19 prevention”, “pandemic prevention”, “SARS-CoV prevention”, “prevention of coronavirus”, “prevention of viral pandemics”, and “containment of viral pandemics”. Using an excel spreadsheet, the results were assessed by two reviewers, integrated and summarized, as shown in [Table 1](#). [Table 2](#) shows the consolidated and extrapolated strategies and methods for containing the current COVID-19 pandemic. The limitation of the study included the inability to include other languages due to time constraints in the face of the current, rapidly spreading pandemic.

## 3. Results

[Table 1](#) describes major viral pandemics between the years 2000 and 2020 and details regarding the country of origin, transmission, symptoms, incubation period, number of infections/deaths, pandemic duration, and methods of containing the virus spread. The six infectious agents identified in this study were all RNA viruses. Three originated from China and the others from Liberia, Mexico, and Brazil. Of the six infectious agents, four (67%) were respiratory pathogens, of which three (75%) were from China and one (24%) from Mexico, with an incubation period averaging one to five days. Common symptoms were flu-like illness, cough, fever, fatigue/tiredness, shortness of breath, and severe pneumonia. The infectious agents from

China were Influenza A virus subtype H5N1 that infected 861 people resulting in 455 deaths between 2003 and 2019, SARS-CoV-1 that infected 8,096 people with 774 deaths in 2002 - 2004, and SARS-CoV-2 that has infected over two million people with over 150,000 deaths from December 2019 to April 2020. The pandemic originating in Mexico was H1N1/09 flu that infected 11% - 21% (0.7 - 1.4 billion), resulting in 151,700 to 575,400 deaths globally from 2009 to 2010. Full details can be seen in [Table 1](#).

[Table 2](#) highlights the various strategies and methods that can be used for containing the current COVID-19 pandemic. The approaches described in [Table 2](#) include using community mobilization groups, media (print and electronic), social distancing, restrictions on physical cash transactions, electronic pre-self-screening and reporting suspected cases, and quarantine. Additionally, the isolation of the infected, contact tracing, use of Personal Protective Equipment (PPE), sanitization for reducing fomite-mediated transmission, identifying elderly residents in Long-term Care Facilities (LTCFs) as a high-risk group, and decentralization of COVID-19 testing sites have been suggested.

## 4. Discussion

Coronavirus disease 2019 is a disease that, in the absence of an effective vaccine, can only be contained by behavior modification at local, national, and global levels, guided by the sound understanding of the disease and its transmission. Intensive community mobilization teams and social media campaigns should be at the forefront of efforts to educate communities, especially those with poor access to information about the disease and risk reduction measures. This requires efforts to gather and disseminate the knowledge of the disease using findings from other geographically and societally comparable settings. In the current pandemic, social distancing measures have shown to be effective in reducing transmission and should be extended to offices, schools, churches, and other large gatherings. Schools and universities have adopted online learning, and churches have begun offering online services. Companies and government departments deemed non-essential are making use of internet-based systems to communicate and effectively work from home. The strategy of widespread testing, contact tracing, and strict isolation of cases has been adopted in some countries (5). The intense and consistent use of face masks, as is the case in China and Japan, has been encouraged with statements from top scientists saying that not wearing a mask is a ‘big mistake’ (5). This has halted the disease significantly in Japan. However, most countries have yet to implement the same strategy, based on a lack of clear scientific advice.

There is no single local, national, or international policy on face mask use that has been fully implemented, even in heavily affected countries like the United States, Spain, Italy, France, Germany, Belgium, and the United Kingdom. What remains clear is the need for widespread testing. In South Africa, the city of Johannesburg has increased the number of COVID-19 testing sites, as was done in countries like the USA. This will serve to estimate disease burden, identify clusters, monitor antibody response levels, and monitor for herd immunity (21). This information can be broken down by municipality, province, and different urban and rural areas to provide insights into the effectiveness of prevention strategies and the spread of the disease across the country. Sharing such progression data can allow other countries to prepare, playing a significant role in flattening the curve, and enhancing the global containment of the pandemic. The lack of co-operation and openness ultimately led to the delayed containment of the 2002 SARS outbreak (22). The lessons learned from the SARS outbreak of 2002-2004 helped China in containing the current COVID-19 outbreak. Additionally, it is crucial knowledge that SARS CoV-2 is sensitive to detergents, ultraviolet rays, and heat, and the use of sanitizers to disinfect surfaces, elevators and door handles is important in enhancing viral infection control (5). The analysis of mortality among different populations has shown that COVID-19 has a drastically higher mortality rate among the elderly, especially those with co-morbidities. Thus, residents in LTCFs urgently need increased protection strategies (23).

## 5. Conclusion

Coronavirus disease 2019 is a disease that can be contained mostly through a behavior modification approach, where individuals and communities ensure international policies are properly enforced responsibly.

## Footnotes

**Authors' Contribution:** CS Yah developed the concept, designed the study, extracted, and reviewed the data, and wrote the initial draft of the article. L Cox extracted the data, reviewed the data, and the article. All authors have consented to the article for submission to Archives of Clinical Infectious Diseases.

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**Table 1.** The Characteristics of Emerging Global Viral Pandemics Occurring Between 2000 and 2020

Name and Nature of Pandemic	Origin	Transmission	Symptoms	Incubation Period	Global Infections	Global Deaths	Duration of Pandemic	Prevention Strategies
<b>Covid-19 - RNA Virus</b>	Wuhan Province, China	Zoonotic (potentially bats); human-to-human, via: (1) respiratory transmission via droplets (potentially airborne) and direct contact; (2) fomites	Cough; fever; fatigue; shortness of breath; pneumonia	1-5 days (up to 14 days)	Over 2,000,000	Over 140,000	December 2019 to present	Strict hand hygiene; using a flexed elbow or disposable tissue to cover nose and mouth when coughing or sneezing; avoiding close contact with people who may be unwell; self-isolation and staying away from others in the household in case of developing symptoms (6, 13)
<b>Ebola - RNA Virus;</b>	Liberia, West Africa	Zoonotic (fruit bats, non-human primates); human-to-human via: (1) blood or body fluids; (2) fomites; (3) contact with semen from a man who has recovered from ebola (no evidence of ebola spread through vaginal fluids)	Fever; severe aches and pains; weakness and fatigue; diarrhea and vomiting; abdominal pain; unexplained bleeding or bruising; other symptoms may include red eyes, skin rash, and hiccups (late-stage)	2-21 days;	28,600	11,325	2014 to 2016	Strict hand hygiene; avoiding contact with body fluids and contaminated objects; abstaining from handling a victim's body; avoiding contact with body fluids or flesh of non-human primates and bats; avoiding hospitals in which infected patients are being treated; ensuring proper infection control, sterilization measures, and ppe use; monitoring travelers from affected countries for symptoms, especially fever, for 21 days, and seeking medical assistance and isolation if symptoms develop (14, 15)
<b>Severe acute respiratory syndrome (SARS) -RNA Virus</b>	Guangdong Province, China	Zoonotic; human-to-human via: (1) respiratory transmission via droplets; (2) fomites; (3) fecal; (4) oral route	Flu-like symptoms; fever; muscle pain; fatigue; cough; sore throat; shortness of breath; pneumonia (viral/secondary bacterial)	4-6 days (up to 14 days)	8,096	774	2002-2004	Strict hand hygiene; disinfection of surfaces; avoiding contact with body fluids; disinfection of items that have come into contact with someone infected with sars; keeping symptomatic children at home; reasonable social distancing/isolation; clinical isolation of those who are infected, with strict infection control (16)
<b>Influenza A virus subtype H5N1 - RNA Virus</b>	China	Zoonotic (birds) via close contact with infected birds; human-to-human (unusual)	Cough, chest pain, bloody sputum; fever and chills; nasal congestion; body aches, headache; epistaxis, bleeding gums; fatigue and sleep disturbance; gastrointestinal disturbance; breathing difficulty, pneumonia	2-5 days	861	455	2003-2019	Strict hand hygiene; coughing and sneezing into an elbow or disposable tissue; isolation of infected individuals; using a face mask (17, 18)

<b>Zika-RNA Virus</b>	Brazil	Zoonotic (via the bite of infected aedes mosquito); human-to-human, via: (1) passing from mother to child; (2) sexual transmission; (3) transfusion with contaminated blood products	Rash; body itching; fever; headache; body aches and pain (especially lower back); conjunctivitis	3-12 days	> 1.5 million	Deaths were rare, but 11 deaths per 1,000 births occurred in Brazil	2015-2016	Wearing clothing to cover exposed skin; using insect repellents; mosquito control measures such as mosquito nets; use of condoms during sex (19)
<b>H1N1/09 flu-RNA Virus</b>	Mexico City, Mexico	Zoonotic (pigs); human-to-human, via: (1) respiratory transmission via droplets; (2) fomites	Fever; cough; congestion; fatigue; headache; complicated pneumonia	1-4 days (up to 7 days)	0.7-1.4 billion	151,700-575,400	2009-2010	Strict hand hygiene; mostly locking down the epicenter of the outbreak and halting trade; travel restrictions to affected regions; face mask use; quarantining travelers from affected regions if suspected of having the infection (20)

**Table 2.** Extrapolated Methods and Strategies for Containment of COVID-19 (SARS-CoV-2) (6, 13-20)

Strategies and Methods of Prevention	Description of Strategies and Methods of Containing SARS-CoV-2
<b>Community mobilization groups</b>	Formation and training of dedicated community health workers (of all social, race, and career backgrounds) to provide awareness, sensitization talks, sharing of flyers, and house-to-house campaigns. This community team acts to: <ul style="list-style-type: none"> <li>-Be the liaising pathway between communities and treatment centers</li> <li>-Provide accurate updates of the pandemic, as well as myth dismantling</li> <li>-Provide information about the pandemic including the sources of exposure to the virus, incubation period, symptoms, outcomes, prevention methods such as hand washing, proper use of personal protective equipment (PPE) like masks, sanitization of surfaces, social distancing, where and when to report suspected cases, where to seek advice/counseling, isolation, and treatment</li> <li>-Provide links to appropriate social media (print and electronic)</li> <li>-Make people aware that COVID-19 is a disease that can be contained only through social behavior modification, where the individual and communities enforce state policies in a responsible manner</li> </ul>
<b>Media (print and electronic)</b>	The use of appropriate print and electronic media to promote accurate information regarding the pandemic. This can include: <ul style="list-style-type: none"> <li>-Social media platforms such as Twitter, Facebook, LinkedIn, and WhatsApp</li> <li>-Radio and television channels</li> <li>-Newspapers, magazines, and flyers</li> <li>-Websites of hospitals, government departments, the WHO, and other central organizations</li> </ul>
<b>Social distancing</b>	This involves prohibiting large gatherings, closing schools, discouraging touching others, limiting transport and travel, and in most scenarios, requesting individuals to keep 1-2 meters between themselves and others when they are in public. Social distancing aims to reduce the transmission of virus-containing droplets between individuals in public places.
<b>Limiting physical cash transactions</b>	The use of electronic and cash-less transactions should be encouraged and enforced, as physical cash can transmit the virus.
<b>Electronic pre-self-screening and reporting of suspected cases</b>	Self-screening using a free online platform accessible from a mobile phone is an effective way of identifying individuals for testing. By making the platform available through a mobile phone, individuals who are identified as being potentially symptomatic can be phoned to arrange to test.
<b>Quarantine</b>	Keeping an asymptomatic individual at home or in confinement for 14-21 days (the estimated viral incubation period) if he is suspected to have been exposed to the virus. This could be applied to individuals arriving from abroad or those who are suspected of exposure to an infected individual.
<b>Isolation of the infected</b>	The separation of a confirmed infected individual in an isolation facility where strict infection control measures are implemented. Many countries have adopted this method, including China, Japan, and South Africa. Technology, such as mobile phones to access support platforms, should be used to mitigate the negative psychological effects of isolation.
<b>Contact tracing</b>	The testing and identification of COVID-19 suspected and positive cases, followed by isolating and treating. Then, immediately contacting and following up those who may have come in contact with an infected person, listing, testing, isolating, and treating the infected. It is a continuous chain testing, isolating, and treating cascade.
<b>Personal protective equipment (PPE)</b>	It aims to reduce the transmission of a pathogen. Masks and goggles that are worn in public, if used correctly, may reduce the exposure of the wearer to the virus by protecting an exposure site (eyes, nasal mucosa, mouth). Masks may be particularly useful as SARS-CoV-2 is present in droplets and may potentially be airborne. Strict PPE protocols should be followed at health centers, mobile clinics, and testing centers.
<b>Sanitization for reducing fomite-mediated transmission</b>	This involves: <ul style="list-style-type: none"> <li>-The routine washing of hands with soap and water (or hand sanitizers), especially after touching something that may be contaminated with the virus.</li> <li>-Washing clothing after exposure to a suspected individual or a potentially contaminated surface.</li> <li>-Frequent washing and drying of handmade, material masks.</li> <li>-Sanitization of all surfaces in hospital environments, as part of routine infection control policies. This has been extended to all working environments.</li> <li>-Where elevators are used, the regular disinfection of surfaces and limiting the number of individuals allowed in at any one time.</li> <li>-Disabling finger-print recognition devices and using a low-touch alternative.</li> <li>-Passenger number restrictions and regular disinfection of public buses and other modes of transportation.</li> </ul>



-Cremation of deceased infected individuals.

<b>Identifying elderly residents in long-term care facilities (LTCFs) as a high-risk group</b>	The provision of special care to the elderly in care or retirement homes, as they include a high-risk group. This includes paying extra attention to disinfection, prohibiting visitors, isolation, symptom monitoring, and early intervention. Compartmentalization of staff among defined zones can aid transmission reduction efforts.
<b>COVID-19 antivirals or treatment</b>	There is currently no specific drug approved by the FDA or any other drug licensing body for the treatment of COVID-19. Care needs to be taken to not promote the use of drugs or substances to treat or prevent COVID-19 where no scientific evidence exists to support their safety and efficacy.
<b>COVID-19 vaccine</b>	As yet, there is no vaccine available to prevent COVID-19. Many candidate vaccines are currently undergoing clinical trials. An effective vaccine will reduce the transmission of SARS-CoV-2, and once enough numbers are vaccinated, herd immunity will be achieved, protecting those that cannot be vaccinated.
<b>Decentralization of COVID-19 testing sites</b>	Widescale testing is the only way to estimate the prevalence and incidence rates in a population. Decentralized testing using a highly sensitive and specific test is a crucial part of monitoring the effectiveness of a country's prevention and containment strategies. Various SARS-CoV-2 tests are available, with some being developed to detect exposure to the virus, for use in serosurveys. These aim to detect and estimate the levels of immunoglobulin in the body, specific to SARS-CoV-2. Widescale serosurveys can provide an estimate of the proportion of a population that has been exposed to the virus and is potentially immune.

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