Coronavirus Disease (COVID-19): Protecting the Public during the Pandemic

CARLOS DEL RIO, MD
EMORY UNIVERSITY

CarlosdelRio7
Coronavirus

Enveloped +RNA virus named for solar corona-like appearance of their virions

Cause of 10 – 30% of cases of the common cold

• They replicate at lower temperatures, thus predilection for upper respiratory tract
• The corona helps the enveloped virus survive in the GI tract
• Control of transmission is difficult
“Wuhan pneumonia”

Wuhan, a city in central China, is the capital of Hubei province.

31 December 2019: WHO China Country Office was informed of cases of pneumonia of unknown etiology detected in Wuhan.

07 January 2020: Chinese authorities identified a novel coronavirus (2019-nCoV) as the probable causative agent.
  ◦ Disease now named COVID-19 by WHO
  ◦ Virus named SARS-CoV-2 (https://www.biorxiv.org/content/10.1101/2020.02.07.937862v1)

As of 23 March 2020: > 330,000 confirmed cases and 14,600 deaths
  ◦ As of today ~ 80% in three areas: 24% in Mainland China, 44% in Continental Europe and 10% in US

Human to Human transmission has been confirmed
  ◦ > 3,000 HCW infections
Current Status of the COVID-19
(March 23 2020)

Global case numbers: > 337,500 cases; > 160 countries & > 14,600 deaths
- https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6
- https://www.worldometers.info/coronavirus/

US case numbers*: > 33,500 cases and > 410 deaths

Georgia case numbers*: 620 cases and 25 deaths

*significant undertesting
CoVID-19 Worldwide Progression: March 1-20, 2020

MARCH 3, 2020

MARCH 16, 2020

MARCH 20, 2020
CoVID-19 in Georgia
COVID19 estimates vs Flu in Georgia
(if no aggressive interventions are done)

<table>
<thead>
<tr>
<th></th>
<th>Mid-COVID-19 Estimates</th>
<th>High COVID-19 Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>106,174</td>
<td>1,380,265</td>
</tr>
<tr>
<td>Medical Visits</td>
<td>31,852</td>
<td>690,132</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>10,617</td>
<td>276,053</td>
</tr>
<tr>
<td>ICU Beds</td>
<td>5,309</td>
<td>138,026</td>
</tr>
<tr>
<td>Deaths</td>
<td>1,062</td>
<td>27,605</td>
</tr>
<tr>
<td>Deaths among 65+ population</td>
<td>849</td>
<td>22,084</td>
</tr>
</tbody>
</table>
COVID19 estimates for Atlanta
(if no aggressive interventions are done)

<table>
<thead>
<tr>
<th></th>
<th>Mid-COVID-19 Estimates</th>
<th>High COVID-19 Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>59,500</td>
<td>773,494</td>
</tr>
<tr>
<td>Medical Visits</td>
<td>17,850</td>
<td>386,747</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td>5,950</td>
<td>154,699</td>
</tr>
<tr>
<td>ICU Beds</td>
<td>2,975</td>
<td>77,349</td>
</tr>
<tr>
<td>Deaths</td>
<td>595</td>
<td>15,470</td>
</tr>
<tr>
<td>Deaths among 65+ population</td>
<td>476</td>
<td>12,376</td>
</tr>
</tbody>
</table>
Why you must act now: Georgia

Public leaders & health officials:
The only thing that matters right now is the speed of your response

This model is intended to help make fast decisions, not predict the future

Point of no-return for intervention to prevent hospital overload:

Mar 24 to Mar 29

https://covidactnow.org/state/GA
## Predicted Outcomes after 3 Months

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Estimated Cumulative Infected</th>
<th>Estimated Date Hospitals Overloaded</th>
<th>Estimated Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>&gt;70%</td>
<td>Tue Apr 07 2020</td>
<td>211,000</td>
</tr>
<tr>
<td>3 Months of Social distancing*</td>
<td>&gt;70%</td>
<td>Mon Apr 20 2020</td>
<td>158,000</td>
</tr>
<tr>
<td>3 Months of Shelter-in-place*</td>
<td>5%</td>
<td>outside time bound</td>
<td>6,000</td>
</tr>
<tr>
<td>3 Months of Wuhan-style Lockdown**</td>
<td>&lt;1%</td>
<td>never</td>
<td>&lt;1000</td>
</tr>
</tbody>
</table>

https://covidactnow.org/state/GA
What about Bats?

• Bats make up roughly 20% of all species of mammals and live to reach 40 years or more.

• Their ability to fly means they can transmit viruses far and wide.

• Bats have evolved to tolerate more viruses than other mammals and carry a significant proportion of zoonoses.

• Bats have suppressed their immune system thus allowing them to tolerate more viruses without getting sick.
  • Innate immunity likely works slightly differently in bats

• More than 500 coronaviruses in China come from bats.
  • China is a “hotspot” for bat-borne coronaviruses to emerge.

• Usually there is an intermediary animal which passes the virus to humans.
# Global Coronavirus Outbreaks to Date

<table>
<thead>
<tr>
<th></th>
<th>SARS-CoV</th>
<th>MERS-CoV</th>
<th>2019-nCoV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
<td>Guangdong, China</td>
<td>Saudi Arabia</td>
<td>Wuhan, China</td>
</tr>
<tr>
<td><strong>Animal Reservoir</strong></td>
<td>Bats --&gt; Civets</td>
<td>Bats → Camels</td>
<td><strong>Bats → ?</strong></td>
</tr>
<tr>
<td><strong>Cell Receptor</strong></td>
<td>ACE2 receptor</td>
<td>DPP4 receptor</td>
<td>ACE2 Receptor</td>
</tr>
<tr>
<td><strong>Incubation period</strong></td>
<td>2-10 days</td>
<td>2-14 days</td>
<td>2-14 days</td>
</tr>
<tr>
<td><strong>Basic reproduction # (Ro)</strong></td>
<td>About 2</td>
<td>&lt; 1</td>
<td><strong>2-3.5?</strong></td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td>Fever, cough, atypical PNA, ARDS, occasional diarrhea</td>
<td>Fever, cough, atypical PNA, ARDS; GI sxs and AKI</td>
<td>Fever, cough, atypical PNA → can progress to ARDS, MODS</td>
</tr>
<tr>
<td><strong>Asymptomatic Transmission</strong></td>
<td>No</td>
<td>Yes</td>
<td><strong>Unknown</strong></td>
</tr>
<tr>
<td><strong>Nosocomial Transmission</strong></td>
<td>58% of cases</td>
<td>70% of cases</td>
<td><strong>Yes, unknown how common</strong></td>
</tr>
<tr>
<td><strong>Case Fatality Rate</strong></td>
<td>10%</td>
<td>35%</td>
<td><strong>Unknown (proportion of fatal cases 2.5-3% overall; 10-15% in hospital pts)</strong></td>
</tr>
<tr>
<td><strong>Outbreak Contained</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
The number of **people** that **one sick person** will infect (on average) is called $R_0$. Here are the maximum $R_0$ values for a few viruses.

- Hepatitis C (2)
- Ebola (2)
- HIV (4)
- SARS (4)
- Mumps (10)
- Measles (18)

---

**The Atlantic**

**SCIENCE**

The Deceptively Simple Number Sparking Coronavirus Fears

Here's what the oft-cited $R_0$ number tells us about the new outbreak—and what it doesn't.
**Wuhan coronavirus**

Most estimates put the mortality rate below 3%, and the number of transmissions between 1.5 and 3.5.
COVID-19 Transmission

Respiratory secretions - main mode of transmission
  ◦ Spread through respiratory droplets in the air and that land on surfaces
  ◦ Transmission from people before onset of symptoms or without symptoms possible but contribution off these infections appears to be small

Stool – unlikely to be a source

Perinatal – no transmission observed
No particular signs and symptoms can discriminated COVID-19 from other respiratory infections such as influenza.
Clinical Course of COVID-19

Incubation period is ~5 days (range = 2 – 14 days)

~80% have mild illness (~80%)
  ◦ fever (83 – 98%)
  ◦ cough (76 – 82%)
  ◦ myalgia or fatigue (11 – 44%)

~ 30% of hospitalized patients required intensive care
  ◦ 5-10% require mechanical ventilation

No approved medication
  ◦ NIH clinical trials have started

Supportive care has been very successful for most patients
COVID-19 Mortality

COVID-19 mortality rate by age

Coronavirus mortality rate based on pre-existing conditions

Testing for COVID-19

Testing by detecting RNA of virus:
- Nasopharyngeal swab and Throat swab
- Lower respiratory sample if possible

Until recently only available at CDC
- Now available in most state laboratories (GA DPH now has it)

Commercial labs (ej: Quest, LabCorp, ViraCor) now are performing testing

Time from sample acquisition to test result is still longer than desired

Still needed: greater ability to obtain testing without coming to hospital or busy clinic
Quarantine vs. Isolation

<table>
<thead>
<tr>
<th>Isolation</th>
<th>Quarantine</th>
</tr>
</thead>
<tbody>
<tr>
<td>To separate <strong>ill</strong> persons who have a communicable disease from those who do not have that disease</td>
<td>• To separate and restrict the movement of <strong>well</strong> persons who may have been exposed to a communicable disease</td>
</tr>
<tr>
<td>restricts the movement of ill persons to help stop the spread of certain diseases</td>
<td>• Monitor to see if they become ill</td>
</tr>
<tr>
<td>Example: Isolation for patients with infectious tuberculosis</td>
<td>• These people may have been exposed to a disease and do not know it, or they may have the disease but do not show symptoms.</td>
</tr>
<tr>
<td></td>
<td>• Quarantine can also help limit the spread of communicable disease.</td>
</tr>
</tbody>
</table>

Preparedness and Response Framework for Pandemics

- Find cases (has been a challenge with limited testing)
- Isolate
- Contact tracing with quarantine
- Don’t look for all cases
- Stay home when ill
- Social separation

Preparing your healthcare system

Review your facility emergency plan
Create an emergency contact list
Communicate about COVID19 with staff and patients
Protect your workforce
  ◦ Screen patients and visitors for symptoms of acute respiratory illness
Ensure proper use of Personal Protective Equipment (PPE)
Conduct an inventory of available PPE
Encourage sick employees to stay home
Separate patients with respiratory symptoms so they are not waiting with other patients
Consider strategies for patients to stay home

Personal Protective Equipment

Gown  Gloves  N-95 Respirator  Face Shield

Personal Protective Equipment are Single Use Only
Discard after leaving the patient room and perform hand hygiene
Challenges in Infection Prevention

In the case of 2019-nCoV, the difficulty in controlling the virus includes:

• presence of many mild infections: difficulty in identifying and isolating cases at an early stage

• limited resources for isolation of cases and quarantine of their close contacts

• Training needed to donning and duffing PPE
  • Great video from NETEC: https://www.youtube.com/watch?v=bG6zI8nenPg
What about masks?

**Surgical mask:**
- Meant to protect the environment from the wearer (designed to keep the surgeon’s respiratory pathogens away from a patient)
- Does a good job of trapping large droplets and some aerosols

**Respirator (N95 Mask):**
- Fits tighter to the face and is meant to help protect the wearer from inhaling droplets in the environment
Non-pharmacologic measures

- Border screenings/closures
  - Little value at this point

- Mass gatherings
  - Important to prevent them – may have significant impact on conferences and sporting event
    - In Atlanta the NCAA Basketball final 4 and the Decennial Conference in Infection Prevention

- Public transportation
  - Potential place for spread

- School closures
  - Have to be implemented early to have impact

- Isolation of infected
  - Critically important, need testing to identify those infected!
Goals of Mitigation Strategies

• Minimizing morbidity
• “Flattening” the epidemic curve to avoid overwhelming healthcare services
• Keeping impact on economy manageable
• Slowing progression of epidemic to allow for vaccine and other treatment development

[Diagram showing the effects of protective measures on the number of cases, adapted from CDC / The Economist]
Social Distancing

“TO LIMIT THE SPREAD IN THE COMMUNITY WE NEED TO SPREAD THE COMMUNITY”
Social Distancing and Personal Hygiene

- Stay home if sick
- Notify MD office before visit
- Limit movement
- Limit visitors
- At least 2 weeks supply of medications and food

https://www.cdc.gov/nonpharmaceutical-interventions/index.html

- Early
  - Stay home if sick
  - Hand hygiene
- Mild-moderate
  - Reduce large gatherings
  - Reduce mixing
  - Consider distance learning
- Substantial
  - Distance learning
  - Closure

- Early
  - Stay home if sick
  - Hand hygiene
  - Telework
- Mild-moderate
  - Reduce meetings
  - Stagger schedules
  - Limit travel
- Substantial
  - Telework
  - Cancel travel and conferences
Social Distancing

**The Power of Social Distancing**

**Now**
- 1 person infects 2.5 people

**5 Days**
- 1.25 people infected

**30 Days**
- 15 people infected

**50% Less Exposure**

**5 Days**
- 1.25 people infected

**30 Days**
- 15 people infected

**75% Less Exposure**

**5 Days**
- 0.625 people infected

**30 Days**
- 2.5 people infected
School Closure

- Types of school closure: school, class dismissal, reactive closure, proactive closure

- Things to consider: timing of closure/intervention in the outbreak, disruption for healthcare systems, effects on communities, social and ethical issues (lower SES families will likely be disproportionately affected by a given intervention), cost/benefit analysis

- Cost effectiveness of closing schools. Think about the economic and social impact of closing schools in regard to the epidemiologic data available

Preparing your school or university

Emphasize preventive actions for students and staff
  ◦ Staying home when sick
  ◦ Hand and respiratory hygiene

Review and prepare with student and occupational health
Information-sharing systems with staff, students, and partners.

Review emergency operations plans in case of outbreak on campus
  ◦ Prepare for temporary class suspension and event/activity cancellation
    ◦ Use of virtual classrooms?
  ◦ Prepare for on campus quarantine

Ensure availability of nutrition and medication

Ensure continuity of education and research

Preparing your business and employees

Empower employees to stay home when sick
- Remote work and communication solutions
- Review human resources policies, workplace and leave flexibilities
- Review pay and benefits available to encourage appropriate sick leave

Encourage good hand hygiene
- Alcohol based hand sanitizer at high touch areas (water/coffee dispensers)

Prepare for wide-spread outbreaks
- Social distancing (school/daycare closures, restriction on gatherings)
- Travel restrictions from government or other agencies
- Absenteeism
- Develop Enterprise-wide Bio-preparedness (Pandemic) Plans

Prevention advice you can use:

**Hygiene**
Wash your hands often with soap and water or alcohol-based solutions.

**Coughs and sneezes**
Cover your nose and mouth by putting them into your elbow or with a single-use handkerchief.

**Distance**
Avoid contact with people when they sneeze, cough or have a fever.

**Cleaning**
Do not share food, cutlery or other objects without washing them properly.

**Masks**
Masks are not recommended if there are no symptoms.
DECLARING, IN ACCORDANCE WITH SECTION 2-181(A) OF THE CITY OF ATLANTA CODE OF ORDINANCES, THERE TO BE AN EMERGENCY IN EXISTENCE WITHIN THE TERRITORIAL JURISDICTIONAL LIMITS OF THE CITY OF ATLANTA DUE TO THE EXISTENCE OF AN EXTREME LIKELIHOOD OF DESTRUCTION OF LIFE OR PROPERTY WITHIN THE TERRITORIAL JURISDICTIONAL LIMITS OF THE CITY OF ATLANTA DUE TO THE UNUSUAL CONDITION OF THE COVID-19 PANDEMIC; AND ORDERING THE CLOSURE OF ALL BARS AND NIGHTCLUBS THAT DO NOT SERVE FOOD, GYMS AND FITNESS CENTERS, MOVIE THEATERS, LIVE PERFORMANCE VENUES, BOWLING ALLEYS, AND ARCADES, AND PRIVATE SOCIAL CLUBS, LOCATED WITHIN THE TERRITORIAL JURISDICTIONAL LIMITS OF THE CITY OF ATLANTA IN EXERCISE OF MY EMERGENCY POWERS GRANTED PURSUANT TO SECTION 2-181(B)(4) OF THE CITY OF ATLANTA CODE OF ORDINANCES TO; DECLARING THAT RESTAURANTS, AND OTHER EATING AND DRINKING ESTABLISHMENTS WHERE FOOD IS SERVED MUST CEASE OFFERING DINE-IN SERVICES, BUT MAY CONTINUE PREPARING AND OFFERING FOOD TO CUSTOMERS VIA DELIVERY SERVICE, DRIVE-THROUGH, OR TAKE-OUT; PROVIDING THAT CAFETERIAS IN HOSPITALS, NURSING HOMES, OR SIMILAR FACILITIES SHALL NOT BE SUBJECT TO THESE RESTRICTIONS AND MAY CONTINUE NORMAL OPERATIONS; AND FOR OTHER PURPOSES.
Need to consider likely public response: “most respondents would comply with recommendations but would be challenged to do so if their income or job were severely compromised”

“During a pandemic, short-duration, rapid-turnaround public surveys can provide timely information to public health officials about the acceptability of recommendations and needed communication to the public if problems are found.”

Conclusions

1. It is going to get worse before it gets better

2. We need to “prepare for the worst and hope for the best”

3. This is going to be long (3-4 months) and there will be significant pain.
   a. We need to protect our healthcare workers but also need to be prepared as some will get infected
   b. We need to provide psychological support/counseling

4. We can make a difference as persons, society and healthcare system
   a) Help promote social distancing
   b) Make sure those sick with fever or respiratory symptoms stay home

5. This too shall pass, how long it lasts is really up to us
The Future

Rapid Diagnostic Test
Antiviral Therapy?
Identification of “Super” spreaders, most efficient transmission routes, period of infectivity, etc.

Spectrum of Disease:
  ◦ asymptomatic transmission

Vaccines
Understanding why outbreak occurred and prevent from happening again
Resources

- **CDC**
  - [https://www.cdc.gov/coronavirus/about/index.html](https://www.cdc.gov/coronavirus/about/index.html)

- **WHO**
  - [https://www.who.int/health-topics/coronavirus](https://www.who.int/health-topics/coronavirus)

- **IDSA:**
  - [https://www.idsociety.org/public-health/Novel-Coronavirus/](https://www.idsociety.org/public-health/Novel-Coronavirus/)

- **NYT:**
Questions?