BonAir Response:

Strategic White Paper

COVID-19 EMERGENCY PREPAREDNESS & DISASTER RESPONSE

Air Layered Offense and Defense Strategy for Hospital and Public Center Environments MD Risk Assessment for Puerto Rico based on the STRATEGIC WHITE PAPER, V2 dated 26 MARCH 2020, by the United States of America Air Force

07.07.2020

MT consulting

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Table of Contents

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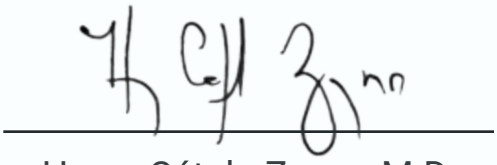

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Overview

The number of COVID-19 infections in the US continues to climb with over three million cases and the number of deaths now reached over 134,000. Still, no specific treatment for Coronavirus exists right now. As the US reopened the economy, in addition to Memorial Day weekend, Father's Day, 4th of July celebrations and mass protests over police brutality and racism, cases trend climbed in more than half states with an increase in hospitalizations. Dr. Fauci from the National Institute of Allergy and Infectious Diseases declares that a second wave of coronavirus might hit the US in the fall/winter timeframe if the virus is not approached the proper way. Social distancing and state lock downs have had an impact in slowing down the spread of the virus allowing additional time to find a successful treatment and eventually a vaccine. In addition, it has provided time to gather or produce the necessary protective equipment and technologies like ventilators and air purification systems.

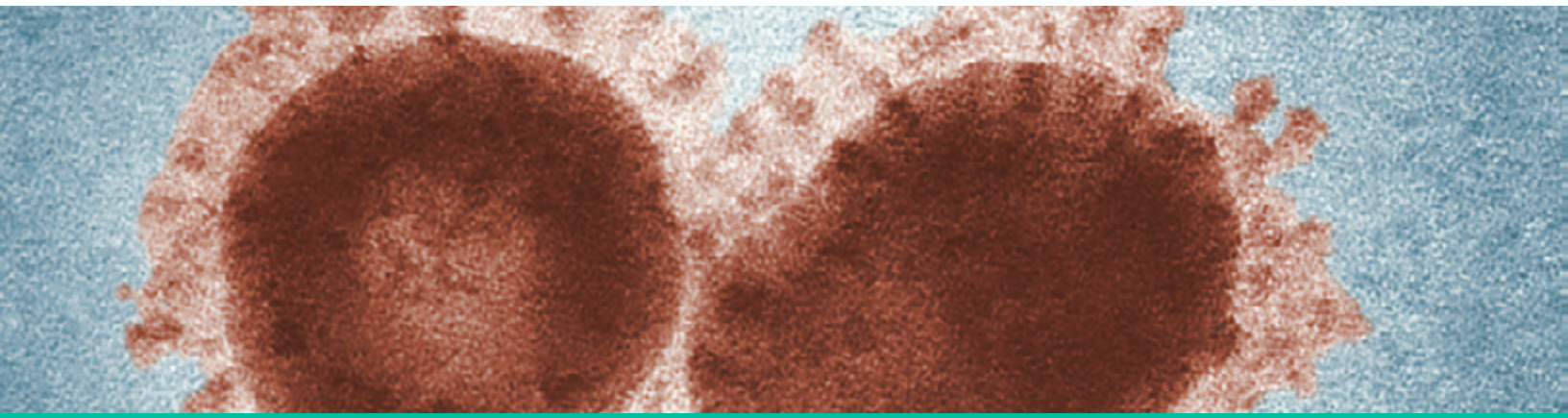
As new discoveries are made every day of how the virus spreads and the impact on the body of the old as well as the young, and an effective treatment and vaccine is found, it is imperative that we minimize the spread of the virus. Since the Nation cannot face another economy recession, it is crucial that we approach the response with a disaster mindset as stated in the **COVID-19 EMERGENCY PREPAREDNESS & DISASTER RESPOSE, STRATEGIC WHITE PAPER, V2 26 MARCH 2020, by the US Air Force**.

The four key areas mentioned in the White Paper has been mostly implemented at the state level. However we must adjust to the daily breakthroughs on virus discoveries particularly in the key areas of Operational Management & Triage and Hospital Operations. Recent studies show that particles of the virus released when talking can remain in the air for 8 to 14 minutes. Therefore, focus should be on air purification.

The following outline describes an air quality and management paradigm applicable to any high-risk industry such as hospitals, clinics, food processing plants, and medical materiel warehousing.

Air Layered Offense and Defense Strategy For A Hospital/Medical Center Environment:

1. Operational Management and Triage: (This represents only an Air Layered Strategy).
2. Establish constant repetitive triage during all phases of the response.
3. Clearly identify and differentiate clinical and managerial personnel.
4. Clearly identify who performs assessment and how the assessment is performed.
5. Identify the areas and personnel that needs treatment.
6. Assess the area and define treatment.
7. Home.
8. Hospital Rooms.
9. Hotel Rooms (overflow).
10. Tents (overflow).
11. Community building (overflow).



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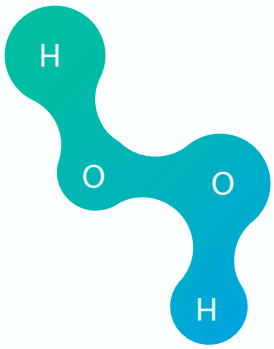
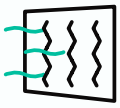
Stabilize and sanitize the environment:

1. If possible, create an air lock chamber going into the room. Describe the process of how this will be performed to prevent air from spreading to other areas. This is especially important in positive pressured rooms.
2. Activated carbon filter, prefilter, HEPA filtration within an Air Scrubber giving 16 to 20 air exchanges an hour.
3. Prefer to attach the air scrubber to the exhaust register to make sure the air is clean before entering a room and attach the purification to the scrubber exhaust port directing air towards patient. This will ensure patient has the best air quality and prevent patient from a potential reinfection. This can be done through a hood, tent, or natural air flow.
4. After patient recovers, clean room and retest.
5. Stabilization of tests and community building with more beds and limited space between patients.
6. If available and space limitations allow, place partitions between patients.
7. Provide self-regulating production of hydrogen peroxide gas to prevent the spreading and cross contamination.
8. If patients are in enclosed area within the building, such as an individual tent, all air entering and exhausting will be HEPA filtered with self-regulating Hydrogen peroxide gas at .01 to .02 ppm. This will stop all cross contamination and protect personnel.



Technology Limitations

The following are some of the limitations of the current technologies and solutions:

1. Air Filtration, Electronic Air Filters/ Plasma.

   - Passive-relying on pathogens to travel to the filter.
   - Generally, fails to kill smaller particulates.
   - Surfaces are not decontaminated.
   - Recurring costs with filter replacement and/or maintenance.
   - No HVAC decontamination feature.
2. Hydrogen Peroxide Misting Systems, Chemical Misting Systems, and Ozone Systems.

   - Overly aggressive.
   - Not safe in areas occupied by humans or other life forms.
   - Not continuous.
   - No HVAC decontamination feature.
   - Relies on human programming and deployment.
   - Labor costs.
   - Recurring costs of chemicals.
   - Ozone does not self-regulate and is banned from use in many locations.
3. Ionic Technologies.

   - Does not kill pathogens.
   - No HVAC decontamination feature.
   - Surfaces are not decontaminated.
   - Air is not decontaminated.
4. Ultraviolet Lights.

   - Limited effect on moving air.
   - Only line of sight protection.
   - Distances decrease effectiveness.
   - May cause skin and eye damage upon extended exposure.

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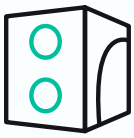
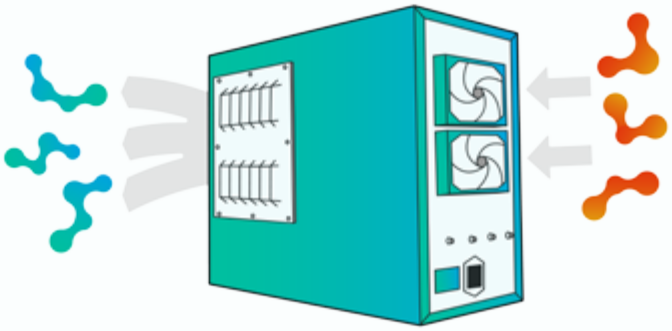
5. Chemical Disinfectants (Janitorial)

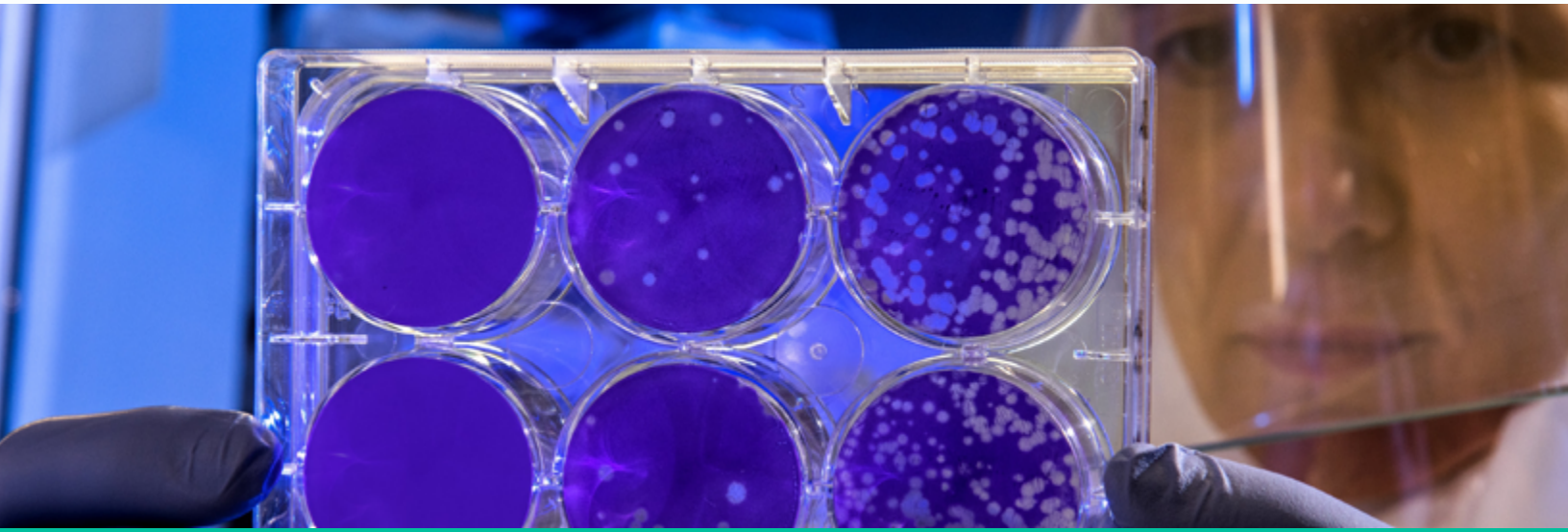
- Not continuous.
- No HVAC decontamination feature.
- Subject to human error.
- Chemical dilution issues.
- Protocol compliance issues.
- Labor costs.
- Ongoing costs of chemicals and application supplies.

6. Key features of Low Level (H2O2) Hydrogen Peroxide Gas Technology



- Preemptively seeks and destroys infectious microbes, scientifically tested to kill specific virus and bacteria.
- H2O2 coverage of air and surfaces auto regulated for not exceeding OSHA limits.
- Safe – produces .02 ppm H2O2 molecules which is 1/50th of OSHA safe limit.
- Kills even the smallest known micro-organic pathogens (viruses, bacteria, mold, volatile organic compounds “VOC”).
- Kills germs in the air and on every surface
- Kills fungi/mold.
- Through oxidation, microbial pathogens are decomposed and rendered harmless.
- Filtrates everywhere air can travel.
- Odorless.
- Eliminates odors.
- Easily installed into HVAC systems.
- Low maintenance.
- Does not produce ozone.
- Works as a continuous infection microbial reduction purification device documented in the COVID-19 Emergency Preparedness & Disaster Response, Strategic White Paper, V2 26 March 2020, by the United States Air Force.





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Key Statements

Low-Level Hydrogen Peroxide (H2O2) Gas Technology for the Continuous Control of Infections Key Statements:

1. Directly fights viruses, including the coronavirus COVID-19, and bacteria in the air and on all surfaces.
2. Advanced air purification emerging technology emits hydrogen peroxide H2O2 in a gaseous state and safely eliminates pathogens.
3. The US Air Force recommends low emission H2O2 in gas for indoor facilities. It was highlighted with operational priority for use in hospitals to reduce the spread of coronavirus COVID-19, inside the facilities.
4. It is also safe for animals.
5. This technology works by releasing self-regulating volumes of molecules of H2O2 (.02 ppm "parts per million"), up to 50 times less than the level approved by the Federal Environmental Protection Agency (EPA).
    - Low level hydrogen peroxide gas destroys bacteria, fungi, and viruses, including COVID 19, throughout the entire environment, including all surfaces, spaces, and materials.
6. Until another emerging technology is developed against coronavirus COVID-19, low level hydrogen peroxide gas is a safe alternative to continuously protect healthcare professionals, employees, and patients.
7. The effectivity of low level hydrogen peroxide gas is supported by clinical evidence in the protection of pregnant women, neonates, children, elderly adults, and pets from pathogens. Among those known pathogens are:
    - HIV, Hepatitis, Influenza A H1N1, Influenza B, Acinetobacter, Streptococcus, MRSA, Escherichia Coli, Klebsiella, and Salmonella, among others.

Note: A patent for this technology was registered in 2010 by Mr. Alton Holt, Texas, USA. Also, updates have been registered in the United States Patent and Trademark Office on February 8, 2018.

Addendum:

Strategic White Paper

COVID-19 EMERGENCY PREPAREDNESS & DISASTER RESPONSE

STRATEGIC WHITE PAPER, V2 dated 26 MARCH 2020, by the United States of America Air Force

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Table of Contents

COVID-19 EMERGENCY PREPAREDNESS & DISASTER RESPONSE

STRATEGIC WHITE PAPER
V2 26 March 2020

Objective: Provide strategic and operational direction for response to COVID-19

Vision: Collate expertise from thought leaders with domain expertise to provide tactics and strategies to respond to COVID-19

Outcome: Minimize death and mitigate spread of disease. This response requires the development of a non-conventional medical/social/public/political infrastructure given limitations on resources. To address this issue, this document provides strategic and operational direction for civic leaders, military leaders, and medical professionals in approaching this pandemic, focusing on four key areas: Contingency Response Leadership, Operational Management & Triage, Population Management, and Hospital Operations.

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Forward by Retired Lt Gen (Dr) Paul K. Carlton, Former U.S. Air Force Surgeon General (1999-2002)

Special thanks to Air University and Auburn University for their support in the creation of this document.

FORWARD

During my career spanning over 50 years as an Airman and as a Surgeon I have studied how we can best prepare our society to deal with emerging disasters, both manmade and natural. The President has declared a war against a hidden, invisible enemy that has now reached our homeland. Through my experiences I've grown to appreciate how military principles, strategy, and tactics have proven beneficial to the delivery care for our citizens during a crisis. They are applicable to any war, including the war we come together to face as a nation today. By coupling these military principals with learnings from our civilian partners we can fight this war with new and innovative strategies and technologies and help heal our country so we emerge stronger and better prepared for pandemics that will follow.

This strategy white paper, built by a cross functional team of subject matter experts, addresses key leadership and operational principles that all leaders should consider as we create a united disaster response front in mitigating and ultimately defeating COVID-19 as a nation. As you read this concise strategic white paper, I would like to highlight the following points to facilitate and focus your effort in the response to this deadly agent:

1. This response must be built on a disaster response mindset using the established concepts in the National Incident Management System (NIMS).
2. All disaster responses require strong leadership. We strongly recommend appointing a Contingency Response Leader/Incident Commander who is not a medical clinician, to lead this effort. This allows medical personnel to specialize in fighting disease while leaving critical, non-medical decisions and coordination to specialists in disaster mobilization and response.
3. We must protect our medical facilities and the clinicians who work there as a front line of defense. If we lose our clinical care system, we all lose.
4. The safety of our medical staff is paramount. Just as casualties degrade an infantry unit's ability to engage the enemy, exposure to disease turns medical professionals into patients and removes them from the fight against the virus. We must provide them personal protective equipment, sanitation, and ensure contamination/isolation measures are strictly followed to protect our front line medical personnel from infection.
5. We must posture every health care facility to surge, with a geographic separation of fever and non-fever patients whenever possible.
6. Clean air must be the priority. As clean air is critical to the prevention of the spread of disease as well as the safety of patients and medical personnel, every facility needs to ensure they have the ability to clean and sanitize air and ensure strict isolation protocols are in place and operational.

The military has unparalleled capabilities to provide capabilities that our society needs, and will play a critical role as we fight and win the war against Coronavirus. However, this is not a primary military operation. Our constitution gives our civilian leadership authority over our military for a reason: we serve the American public. The President has called upon the military to support the American people in our time of need, and the military will answer the call. General George Patton was once quoted as saying "An ounce of sweat saves a gallon of blood." By orienting our efforts now, organizing, training, and equipping our society today before we are overwhelmed, we will save the lives of our fellow citizens, helping our country emerge stronger after we defeat this enemy. May God continue to bless America.

Sincerely,

Paul K Carlton Jr

PAUL K. CARLTON Jr, Lt Gen (ret), USAF, MC, CFS
Surgeon General, U.S. Air Force (1999-2002)

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TABLE OF CONTENTS

Summary of significant changes

V2 26 March 2020

- Acknowledged additional key contributors
- Outcome statement added
- Added scope of project (p1)
- Reinforced roles/responsibilities of Emergency Manager and senior Public Health advisor (p2)

DISCLAIMERS

This document contains the most up to date information from subject matter experts serving both in the military and civilian sectors. However, as with every contingency operation or disaster response, newly discovered information may supersede what had previously been recommended. None of the authors have any financial interest in any of the recommendations.

We do not endorse any particular vendor or specific company. Any reference in this white paper to a specific product or type of product, process, service, or a vendor/company does not constitute or imply endorsement, recommendation, or favoring of the specific product or type of product, process, service, or vendor/company. We are constantly scoping applications for established or emerging technologies that may help us control the COVID-19 outbreak.

EXECUTIVE SUMMARY

This paper highlights four key areas with emphasis on the innovative practices needed to overcome to this pandemic with the overarching themes of keeping our public informed, our medical care teams safe, and our nation strong. By coupling the learnings of the military forces with civilian partners we can create a mechanism for rapidly understanding and creating new tactics and recommendations to help slow the rapid onset of COVID-19 cases in the United States.

The themes presented are timeless, based upon established and accepted frameworks. The management recommendations are based upon best science available at publication. This paper does not address clinical practice guidelines, development or deployment of testing, return to work for hospital workforce, or the quest for a vaccine or cure. These are important topics that deserve national attention and careful deliberation at all levels, but are beyond the scope of this paper.

As the COVID-19 threat evolves we will study it and understand more about how to manage this challenge. We as a nation must dedicate ourselves to being continuous learners, not satisfied until we defeat this pandemic and return to a new normal. Together all of us are smarter than any one of us as we continuously learn from each other to best care for our citizens.

Contingency Response Leadership:

- This is a disaster response, not a medical condition treatment protocol
- Insist on approaching the COVID pandemic through an Emergency Management / National Incident Management System (EM/NIMS) compliant framework
- Identify and empower senior Emergency Manager (EM), senior Public Health advisor to the EM and support functions

Operational Management & Triage:

- Institute constant repetitive triage during all phases of the response
- Utilize all resources (personnel, equipment, supplies) to their fullest capability
- Institute telemedicine to virtually force multiply, protect medical personnel and minimize casualties

Population Management:

- Physical distancing is the key to managing disease spread throughout the population
- Team with civil leaders and medical professionals at all levels
- Constantly emphasize public health principles through a broad education campaign
- Safely manage the majority of patients at home

Hospital Operations:

- In-patient care must be reserved for those that require advanced care and air quality must be prioritized
- Immediately institute Split-Operations
- Continually review and follow most current CDC recommend isolation protocols

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CONTINGENCY RESPONSE LEADERSHIP

Leadership, with input from Public Health/Public Health Emergency officials as well as with the service-delivery support from local treatment facilities, must approach the COVID pandemic through an Emergency Management / National Incident Management System (EM/NIMS) compliant framework. A pandemic should not be approached as a medical issue; leaders must approach it from the mindset of disaster response. The best time to shift to a contingency mindset and operations is BEFORE you need it.

Key Strategic Considerations:

- Structure according to the five NIMS Components: Preparedness, Communications & Information Management, Resource Management, Command & Management, Ongoing Management & Maintenance.
- Synchronize with the NIMS infrastructure (ESF-8 Emergency Support Function 8)
- Identify and empower Incident Commander with staff of designated advisors including senior public health specialist and other support functions IAW NIMS structure
- Disasters always overwhelm available resources if we execute "business as usual"
- Triage must occur throughout the care process; the goal is to save as many lives as possible
- Keeping the medical system fluid and surviving to "fight another day" is as critical as saving lives

Recommended Operational Priorities:

- Command, Control, and Communication (C3) must be established with a centralized leader with authority to act on behalf of the senior civil authority
  - Appoint an Incident Commander (IC)
  - Senior medical person/public health officer heads medical effort and reports to IC
- Isolation and Triage must be constantly evaluated for effectiveness
- Accurate assessment/inventory of current assets available on-scene for "the fight"
- Utilize skills of staff – this need supersedes "credentialing" – all staff, not just clinicians
- Maintain a database of volunteers:
  - Look to state and national medical related boards and national medical societies for volunteers
  - Retired or former clinicians, nurses, and other hospital personnel that want to help
  - Ex-military medics/corpsmen and first responders
  - People with unique skillsets/assets that may be employed in an emergency (i.e. power production, Biomedical Equipment Technicians, Electronics Skills, HVAC, Transportation)
- Prepare for Surge Hospital creation: Create alternative locations into in-patient facilities
  - Based upon current study of the virus we recommend tents as the default for fever care
  - Hotel or motel into hospital, school buildings into hospital, convention or community center into hospital, existing outpatient clinic into hospital, park into surge hospital
- Invest in principals now of "Layered Clean Air Defense"
  - Traditional public health models (physical distancing, quarantine, case contacts, etc)
  - Traditional infection control practices
  - Separation of fever patients from other patients
  - Air handling to decrease the exposure of well people (patients, medical staff) to Coronavirus (Increase room turnover, directed air flow, etc.)
  - Application of established technology in new ways to decrease risk of spread of virus (These include airs scrubbers, filtration systems, and other technology (such as low-level OSHA approved chemicals that show promise in decreasing the spread of Coronavirus)
- Take care of hospital personnel and their families
- Coordinate early with the state and outside agencies

OPERATIONAL MANAGEMENT & TRIAGE

In every disaster response, leaders must balance resources with casualties. As such, triage throughout asks two questions constantly, who needs treatment now and who must be isolated. In the pre-hospital setting, the priority is on identifying those that need in-person evaluation and those that can be managed virtually at home.

Key Strategic Considerations:

- The majority of COVID patients can and should be managed and monitored in the outpatient setting via telemedicine/patient communication portals
- Streamline traditional in-person triage systems and converted whenever possible to telephone triage and protect hospital staff
- Give clear instructions on where and how to report to those patients told to seek the next level of care

Recommended Operational Priorities:

- Utilize telemedicine, if available, to identify those that need in-person evaluation, this evaluation should be repeated on a regular basis for patients that are stable but have symptoms of COVID
  - If unavailable, use available technology to scale up quickly
  - Telemedicine should be used by all healthcare providers for all care that does not need immediate in-person evaluation to minimize asymptomatic COVID disease spread and resource use
- Efforts should be made to quarantine at home when possible and minimize contact with others.
  - Utilize pharmacies that have drive-thru windows
- COVID Triage protocols should focus on identifying at-risk patients and those that are unstable
- For in-person triage, streamline by taking a temperature while getting a pulse ox.
  - If the temp is elevated and the pulse ox is low, get a chest X-ray.
  - CXR Infiltrates and/or hypoxia will flag those patients who should be admitted and lack of these will flag patients who can recover at home.
- Triage areas/tents should be away from the main hospital to avoid cross-contamination
- Designated areas for receiving patients must be implemented to preclude contamination of patients and workers
- All patients are received at the initial triage points and are kept out of the main facility
- Keep all fever/URI patients separate from non-fever/non-URI patients when utilizing in-person evaluation by a healthcare provider
- Examine potential for using layered air principles as treatment/air sanitizing means
- Fresh air ventilation can be an effective disinfectant. Open windows/fans should be utilized
  - Fan vents in each room should be directed outside air or a purification system
- Isolation measures/protective equipment should be utilized, and when feasible, sterilized for re-use
  - N95 face masks
  - Sterile gloves/hand sanitizing agents
  - Contact with patient limited to 1-2 people
  - Disposable supplies are rapidly becoming exhausted. Washable masks and gowns should be obtained/made and laundered in hospital as needed
  - Follow current CDC guidelines for reuse and sterilization of supplies

POPULATION MANAGEMENT

In dealing with the population, isolation is the key to prevention. Unfortunately, it is challenging for the general population to view this pandemic as a disaster response effort as the enemy is invisible with no significant initiating event as there is with explosive types of disasters. It will be critical for leadership to understand the movement of the population and their potential non-urgent mindset. To assist with management of the population, it is valuable to conceptualize them into three categories: Sick, Well, and Person Under Investigation; each category with unique needs and issues.

Key Strategic Considerations:

- Separate patient with known/suspected COVID from all other patients
- Set up dual clinical systems (Fever/Non-Fever) whenever possible, organized by region/municipality
- There are three categories:
  - Sick: people that have either tested positive for COVID or have symptoms suspicious for COVID. In this pandemic, regardless of a confirmed diagnosis, patients with symptoms consistent with an upper respiratory infection need to be managed as having COVID.
  - Well: people that have no symptoms and have not been exposed to the COVID virus by strictly adhering to social distancing protocols.
  - Person Under Investigation (PUI): we don't know if this person has an infection

Recommend Operational Priorities:

- The priority is for healthy providers and patients to stay healthy by following contact and isolation protocols
- We must have a robust education campaign must be conducted as many people are not following social distancing recommendations
  - Education must also include any discoveries as to what may lessen the ability for the disease to propagate
  - A consistent education/training program must be applied to these people in order to ensure a uniform baseline of training has been delivered to these people
- Keep Sick patients at home if possible and provide remote care through telemedicine with close monitoring
  - Follow isolation protocols set by the Center for Disease Control (CDC)
  - Develop strategies to prevent spread to family members, especially at-risk family members
- Develop, implement, and enforce contact and distancing protocols
- Leverage all available media/communication assets to educate the population so as they may help themselves.
  - Goal is to accord everyone the opportunity to heal themselves to preclude a visit to a treatment facility.
  - As information about COVID is learned, it can immediately be transmitted to a multi-demographic population.
  - Must leverage all current communication outlets (Radio/TV/Social Media/Patient communication portals such as MiCare)
  - Message must be uniform and consistent across all outlets
- Set up a call center with a clinician to answer questions/triage patient

HOSPITAL OPERATIONS

In-patient care for COVID patients must be reserved for those that require advanced care and air quality must be prioritized. If the pandemic worsens, death increases not only in the patients with COVID, but in other patients with other forms of life-threatening disease as access to care will become incredibly limited. Resources must be prioritized, and personnel must be protected. Operations must be focused on saving those that can be saved, not on saving everyone.

Key Strategic Considerations:

- High rates of COVID infection can occur in hospital personnel: protect your hospital personnel, especially older providers.
- Vaccine and treatments for COVID will optimistically take 6-12 months, necessitating strict resource and personnel protection
- Fresh air seems to save lives based upon studies of prior (Spanish Flu), recent (SARS) and current COVID experiences. Therefore, we advocate tents as the default for most COVID patients.

Recommended Operational Priorities:

- Clinicians must follow current self-protection measures as with any infectious disease
- Immediately institute Split-Operations though triage
  - Strict isolation protocols for Sick COVID patients with highest level of severity patients sent directly to ICU for critical care
  - Lowest acuity patients should remain in tents (Serviced with Oxygen/Fresh Air) or are sent home and monitored via telemedicine
- Reevaluate configuration of rooms and air flow
  - Evaluate air flow patterns to avoid direction of air movement to towards the side of the mask of a healthcare worker
  - IV tubing should be long enough to reach outside room to preclude the need to don PPE to change fluids
- Avoid confined spaces for treatment of COVID patients whenever possible
  - Fresh air is a natural disinfectant
  - Utilize Alaskan shelters/tents currently in WRM to serve as isolation wards for affected patients
  - Shelters should utilize an exchange of fresh air as much as possible, to protect patients and staff
- Institute Air Quality protection measures: A 'Layered Clean Air Defense" developed by former USAF Surgeon General Lt. General Paul K. Carlton Jr.
  - Surface protocols (CDC guidelines)
  - Physical distancing and traditional public health guidance (CDC guidelines)
  - Build patient flow from established principles (Clean air principles)
  - Air handling/patient flow from est Public Health principles (refining solutions)
  - Identify established technology and repurpose for M-IADS (ongoing)
  - Virucidal killing: Low level H202 gas or low level Hypochlorous Acid, or other proprietary technologies as they emerge. These may be stand-alone units or retrofitted to HVAC systems.
  - Air Scrubber technology (HEPA, UV, Ceramics)
  - Develop the research protocol executed in the same way as we did rapid surgical innovation using the Joint Trauma System (JTS) from 2003-Current
- Prioritize funding for ventilators as there will be a shortage
  - Consider alternatives such as venous-venous extra-corporeal membrane oxygenators
  - Develop and train on contingency use of ventilators, including the ability to care for 2-4 patients with one ventilator. These protocols are rapidly evolving.