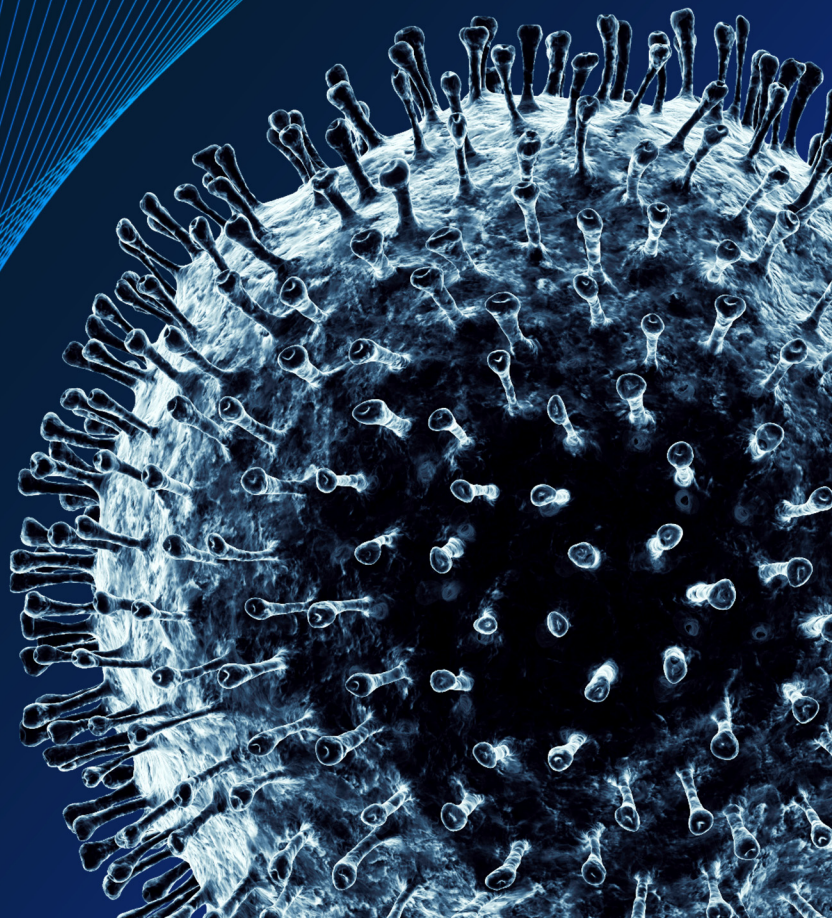
McKinsey & Company

Responding to COVID-19: Addressing the public health crisis

Information for US state leaders

ALL INFORMATION CURRENT ONLY AS OF 4/17/2020



THIS DOCUMENT IS INTENDED SOLELY TO PROVIDE INSIGHTS AND EXAMPLE PRACTICES.

THIS DOCUMENT DOES NOT CONSTITUTE ADVICE.

Introduction

COVID-19 is, first and foremost, a global humanitarian challenge.

Thousands of health professionals are risking their own lives to heroically battle the virus. Governments and industry are working together to understand and address the challenge, support victims and their families and communities, and search for treatments and a vaccine.

State and local governments are facing an unprecedented and rapidly evolving situation.

Government leaders, first responders, healthcare workers, and more are displaying heroic leadership in the face of the crisis. State and local governments are facing the extraordinarily difficult task of addressing unprecedented crises in both public health and the economy simultaneously—and the crises continue to evolve daily.

This document is based on our work with private, public, and social sector organizations around the world

It is meant to provide leaders with information as they respond to the unique health and economic challenges posed by COVID-19, and to offer examples of actions that governments have taken as they aim to protect their people and economies. It is not exhaustive, and it necessarily reflects only this moment in time. We will continue to update it regularly in the weeks to come.

The imperative of our time

Imperatives

1

Safeguard our lives

1a. **Suppress the virus** as fast as possible

1b. **Expand treatment and testing** capacity

1c. **Find cures:** treatment, drugs, vaccines

2

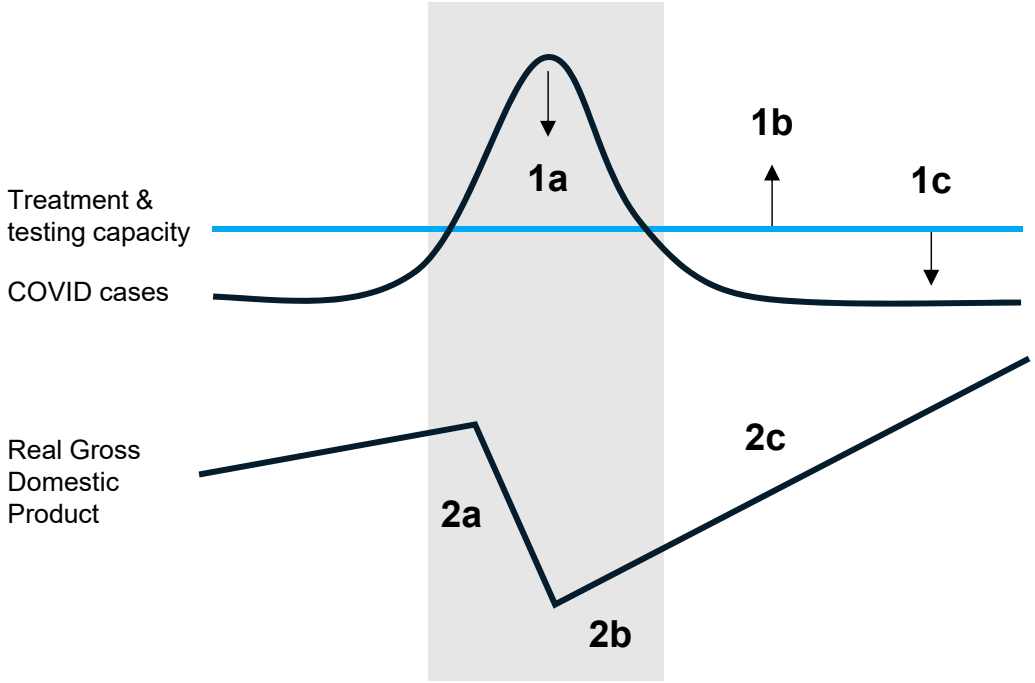
Safeguard our livelihoods

2a. **Support people and businesses** affected by lockdowns

2b. **Prepare to get back to work safely** when the virus abates

2c. **Prepare to scale the recovery** away from a -8% to -13% trough[1]

"Timeboxing" the virus and the economic shock



~ -8% to -13% economic shock

1. Real GDP

Source: McKinsey analysis, in partnership with Oxford Economics

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Addressing the public-health crisis

Critical insights

COVID-19, with a high volume of hospitalizations at peak demand, has had a significant public-health impact for states. States may face strains on capacity and access to care, which can be mitigated with swift and assertive actions

Capacity management:

Hospital bed capacity may be strained, with shortages of medical/surgical and ICU beds possible at peak in certain potential scenarios

A high volume of nurses may be required at peak in certain potential scenarios, which may exceed estimated current workforce in some states; states might consider readily available levers to address demand

A high volume of ventilators and N95 respirator masks may be required to meet demand in certain potential scenarios

Testing:

COVID-19 testing and contact tracing are crucial steps in solidifying treatment paths; both require active management to ensure adequate supplies and workforce exist at the right place and time

Potential responses for state leaders

> Identify potential hot spots early to triage and prioritize communication and resources
>
> Address critical capacity and access challenges before they become acute

Capacity management:

Increase overall bed supply and convert medical/surgical beds to ICU

Allow healthcare workers to assume flexible roles, budget for overtime, and focus medical professionals on "top of license" activities

Maximize sourcing, manage inventory, and conserve supplies

Testing:

Determine approach to testing and tracing based on availability of testing kits and ultimate goals

Source: Detailed sources and methodological notes underpinning these findings provided throughout the following pages

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Managing capacity

A significant increase in demand for healthcare services due to COVID-19 may lead to shortages in overall bed supply in certain sample planning scenarios

Healthcare facilities could see strained capacity, with potential shortages of medical/surgical beds and ICU beds, if COVID-19 cases surge. Reducing elective demand and converting additional spaces into medical/surgical and ICU beds could increase existing supply to meet demand. Even with assertive actions, additional capacity may be necessary—potential options include use of other medical facilities (eg, free-standing EDs), mechanisms (eg, telemedicine for patient triage), and non-healthcare infrastructure (eg, schools and hotels).

Workforce shortages of critical healthcare professionals (HCPs) may result from increased demand for healthcare services and loss of HCPs to illness, burnout, and other needs in sample planning scenarios

States could have a shortage of physicians and nurses at peak demand in certain scenarios. Contingency planning to address increased staffing needs could include allowing healthcare workers to assume flexible roles, budgeting for overtime, and focusing medical professionals on "top of license" activities. Assertive actions to address labor shortages could include policy changes to increase the pool of providers and structured support systems for childcare and eldercare.

Clinical management of COVID-19 requires a number of critical supplies, many of which are in short supply

The medical supply shortage is a global challenge as countries fight for adequate supply. If procurement is not already underway, critical supplies may need to be obtained and inventory should be actively managed to adequately distribute and conserve supplies throughout the state.

Source: Detailed sources and methodological notes underpinning these findings provided throughout the following pages

Capacity planning assumptions: of those hospitalized, 5% could require ICU admission

Patients that require hospitalization

	Severity category	Distribution Percent	ALOS[1]	Care needed	Description
0	Overflow	-	0	No care	Non-COVID-19 patients or COVID-19 treated patients that need to go into isolation for a period of time
1	Mild 1	1	0	No care	Asymptomatic
2	Mild 2	80	0	Return home or quarantine	Non-pneumonia and mild pneumonia
3	Severe 1	4	1	Acute bed[1]	Strong symptoms necessitating admission, but likely to have short length of stay and can be discharged with follow-up
4	Severe 2	6	4	Acute bed[1]	Stronger symptom severity likely necessitating a longer length of stay needed
5	Severe 3	4	11	Acute bed[1]	High symptom severity, but not requiring intensive care
6	Critical	5	14	ICU bed and acute bed	Critical condition, requiring ICU-level care and likely ventilatory assistance ICU/PPV (respiratory failure, septic shock, and/or multiple organ dysfunction or failure)

Patients who are hospitalized and likely to be placed into an ICU or medical/surgical bed, depending on their severity category:

Severe 1, 2, and 3 patients could be placed in a **medical/surgical bed**

Critical patients could typically be placed in an **ICU bed for the first 10 days** and then **stepped down into a medical/surgical bed for the remaining 4 days** of the average length of stay

Note: Subject to hospital, local, and/or national guideline approval 1 (dyspnea, respiratory frequency ≥30/min, blood oxygen saturation ≤93%, partial pressure of arterial oxygen to fraction of inspired oxygen ratio <300, and/or lung infiltrates >50% within 24 to 48 hours)

Several potential levers may augment hospital capacity by freeing existing beds or bringing additional beds online

	Lower occupancy of existing beds		Bring additional beds online	
	Cancel elective stays and triage non-emergent ED visits to other sites of care	**Length-of-stay improvements**[1]	**Increase bed density in existing rooms or in hospital**	**Leverage unconventional inpatient beds**
Potential actions	Postpone elective procedures (eg, joint replacements) and triage non-emergent cases (eg, diagnostic cardiac monitoring) to other sites of care until after the COVID-19 crisis (ie, decline in daily new cases) This could lower current occupancy by 20%–35%	Focus on reducing average length of stay for non-elective patients by doing the following: • Accelerating placement of healthy long-term-stay patients into appropriate housing facilities (eg, hotel) • Moving stable patients to other healthcare sites (eg, long-term acute-care hospitals [LTACs], ambulatory surgery centers [ASCs]) or to a home-care setting to continue their treatment with remote monitoring In conjunction with placing patients awaiting spots at other facilities, this can lower current occupancy by up to 15%	Convert beds into doubles or triples when space and treatment type allows Convert underutilized non-clinical space to clinical space, (eg, open atrium to an interim ED) Taken together, potential to increase bed capacity by up to 15%	Convert a portion of non-traditional inpatient beds to either ICU (eg, procedural, step down) or for medical/surgical purposes This has the potential to add up to 70,000 beds
Example	CMS issued guidelines to delay elective/non-essential procedures starting March 18 onwards	California has directed local governments to procure hundreds of facilities statewide to house the most vulnerable	NYP converted open atrium into interim ED during Hurricane Sandy	Society of Critical Care Medicine crisis contingency plans call for post-anesthesia care units (PACU) and ORs to be repurposed into ICUs

1.Place patients awaiting placement; patients to other sites of care or home
Note: All guidelines should be in accordance with CDC guidelines

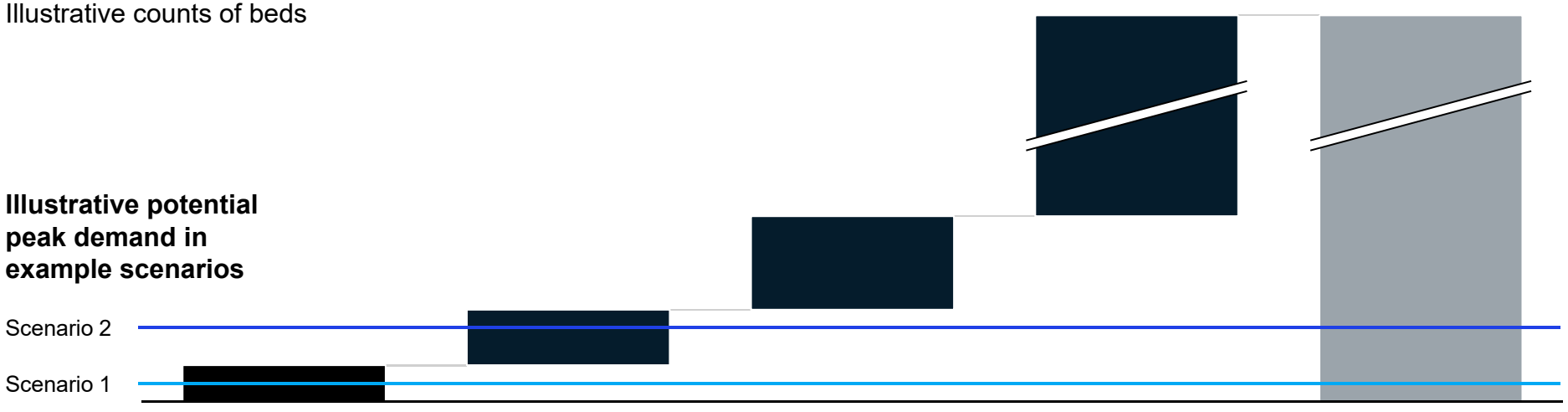
Source: CMS, LA Times, NBC, Coalition for Health Environments Research, Society of Critical Care Medicine, McKinsey analysis

Additional actions across sites of care in states could increase bed capacity

ILLUSTRATIVE – DEEP DIVES FOLLOW

Various potential levers for states to consider

Illustrative counts of beds



Capacity in existing medical/surgical and ICU beds

Currently unoccupied beds within existing hospitals

Increase capacity and bed density

Expand bed capacity in hospital and convert medical/ surgical/OR/PACU beds to ICU

Utilize beds in outpatient settings

Designate capacity in outpatient (OP) settings (eg, ASCs, LTACs)

Convert real estate into alternative sites of care

Develop new sites (eg, hotels, convention centers)

Each lever has a different level of feasibility. Leaders must take into account the speed at which these levers can be deployed; most outpatient and alternative sites of care may be best suited for lower acuity patients (both COVID-19 and non-COVID-19

Deep dives on following pages 1 2 3

Augmenting hospital capacity could increase available beds in states

Low feasibility High feasibility

1 Potential levers to increase available bed capacity	Feasibility	Speed	Execution considerations
Current state	NA		Existing challenges in hospitals should be considered before any additional actions are taken
Elective stay cancellation	●	Days	Hospitals with a higher percentage of non-elective cases should consider aggressively triaging ED visits to alternate sites; sensitive cases (such as oncology) may remain
Length of stay improvements	◐	Days	HCP bandwidth will be limited during surge and will necessitate efficient discharge planning; scarcity of post-acute sites could potentially require creative placement (eg, converted hotels)
Utilization of non-medical/surgical and non-ICU beds (eg, rehab, psychiatric)	●	Days	Rehab, psychiatric, and alcoholism/chemical-dependency inpatient care beds can be converted into medical/surgical beds (but may be more difficult to convert to ICU beds), while ensuring appropriate care for these services can be delivered elsewhere
Increased bed density	●	Days	Conversion of single and double beds to double or triple has a high degree of feasibility; however, limitations in staffing may result in limitations of bed; in addition, bed placement can occur in non-traditional spaces (eg, cafeterias)
Non-traditional inpatient beds	●	Days	Potential to convert non-traditional inpatient beds (eg, OR, pre-op, and PACU rooms) is feasible given the construct of these settings; typically can be converted to ICU more easily than general medical/surgical

Conversion of select medical/surgical, step-down, and other beds in a potentially overwhelming situation is possible; however, conversion will still be limited by workforce and supplies (eg, ventilators)

Potential bed conversion across other healthcare facilities may provide states with more beds

Low feasibility High feasibility

2 Potential levers to increase available bed capacity

	Feasibility	Speed	Execution considerations
Skilled nursing facilities		**Days**	Vulnerable populations (elderly, multiple chronic conditions) to be kept separate from COVID-19 patients; could be used as overflow for non-COVID-19
Physician offices		**Days**	Medical office buildings and large (often multi-specialty) physician offices that are connected to or located in close proximity to the hospital could be utilized as overflow for non-COVID-19
Assisted living facilities		**Days**	Facility equipment and staffing constraints limit feasibility of bed conversion to 10%–15%; vulnerable population to require separation from COVID-19
Dialysis clinics		**Days**	Facilities run at high capacity/patients may need to continue to utilize dialysis services due to care needs; limited space for non-COVID-19, non-kidney disease patients
Urgent care clinics		**Days**	Best suited as testing and triage sites for COVID-19 patients with mild presentations; ability to convert beds for non-COVID-19 patient overflow from area hospitals
ASC		**Days**	Medical equipment and staff training should be prioritized to treat severe and critical COVID-19 patients; may need to be a COVID-19-only site
LTAC		**Days**	Highly trained staff and equipment could allow conversion of select LTAC sites to designated COVID-19 facility; remaining sites may be needed for current population

Current beds across other sites of care may be allocated to COVID and non-COVID-19 patients respectively

Alternate non-healthcare sites could be set up to support incremental beds in states

Low feasibility High feasibility

3 Potential levers to increase available bed capacity	Feasibility	Speed	Execution considerations
K-12 public schools		**2 weeks**	Typically limited capacity relative to other options; available in all US counties; potential to take control quickly given public ownership
Hotels		**1-2 weeks**	Private ownership could pose challenges; bedrooms provide natural compartmentalization which could limit co-infection
Warehouses		**2 weeks**	Challenging when HVAC is not in place; large open floor plans are conducive to running efficient operations
Public university dorms		**1-2 weeks**	Potential to take control quickly given public ownership; bedrooms provide natural compartmentalization which could limit co-infection
Private university dorms		**1-2 weeks**	Private ownership could pose challenges; bedrooms provide natural compartmentalization which could limit co-infection
Community centers		**2 weeks**	Speed to set up depends on floorplan (determining if site modifications are required) and ownership structure (public is preferable)
K-12 private schools		**2 weeks**	Typically limited capacity relative to other options; available in many US counties; private ownership could pose access barriers
Convention centers		**1-2 weeks**	Typically centrally located; large open floor plans are conducive to running efficient operations (eg, medical staff/patient ratio)
Sports centers		**2 weeks**	Typically less contiguous square footage than a convention center, which could yield less efficient operations

States could leverage volume-based triggers to execute across surge-capacity levers

Best suited for lower-acuity patients (both COVID-19 and not); detailed on next pages

Tier	Potential example actions/interventions to implement	Example activation trigger to next tier
Tier 0: *Establish capacity for non-COVID patients*	Consider creating capacity outside hospitals for lower-acuity non-COVID patients. Per clinical guidelines, begin moving patients to these sites and explore at-home care	First COVID+ test patient in the region
Tier 0: *Below typical flu season surge capacity*	Place COVID-19+ "persons under investigation" (PUI) in isolated areas for treatment/testing	Rising to >85% occupancy
Tier 1: *Rising occupancy*	Cancel elective volume, revise transfer acceptance criteria, begin aggressively optimizing length of stay for non-COVID-19 patients through discharge planning[1]	Rising to >90% occupancy
Tier 2a: *Capacity (net new) reaching maximum*	Non-traditional spaces/rooms (eg, PACU, dialysis rooms, etc) converted to medical/surgical and ICU beds, move young-adult patients to pediatric medical/surgical and ICU beds	Rising to >90% occupancy (net new) Limited clinical operational bandwidth
Tier 2b: *Converted beds reaching maximum*	Significantly increase bed density by doubling and tripling single rooms, filling common spaces (hallways, atrium), etc	Rising to >90% occupancy (net new) Limited clinical operational bandwidth
Tier 2c: *Newly installed beds reaching maximum*	Convert immediately adjacent healthcare and non-healthcare sites to localized field hospitals with inpatient-level care (eg, on-campus physicians' offices, hotels)	Rising to >75% occupancy of newly established care sites Management of external site becoming stretched
Tier 3: *Adjacent care sites reaching maximum*	Convert community/outside healthcare and non-healthcare sites into field hospitals capable of delivering inpatient-level care	Tier 3 sites could require partnership agreements, care site protocols and clinical governance agreements, and regulatory compliance considerations

1.Activities can be done proactively ahead of rising capacity based on public health guidelines and expected surge of COVID-19 patients

Note: All guidelines should be in accordance with CDC guidelines

Source: Expert interviews

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A number of example actions can help address healthcare workforce readiness challenges

NON-EXHAUSTIVE

	Workforce shortages	Workforce readiness/flexing	Workforce morale/"burnout"
Challenges	Increasing capacity: unsuitability of traditional methods such as travelers (eg, travel restriction, global demand); difficulty in rapidly engaging non-traditional sources (medical students, international medical graduates, retired HCPs) due to regulatory, legal, patient safety issues Reducing losses: expected COVID-19 infection of HCPs (~10%–20%); burnout/fatigue of frontline workers; non-clinical needs for workers (childcare, sick care, etc)	Guidance and communication: rapidly evolving evidence-base for COVID-19 with new information daily; non-centralized, disparate communication on roles Flexing and re-skilling: shift restrictions (hourly and weekly); licensure ceilings (eg, who can work in ICUs); time and resources for re-skilling (needed to train in ventilator management); lack of readiness for using tech in pandemic situations (eg, e-ICUs, management of moderate symptoms by phone, etc)	Work-related: overwork and fatigue (eg, staying in hospital for extended periods); anxiety from infection risk for self and others; resource constraints/difficult work environment (eg, re-using of PPE); patient losses and "war-like" decision-making needs (eg, which patients to triage for limited ICUs) Systemic: increase in other duties (childcare, sick care etc); lack of community support (eg, prevention of infection, reducing burdens, etc)
Potential example actions	Policy changes to increase pool of providers (eg, rapid license issuing) Prioritizing of infection control (eg, PPE, public education, etc) Working with FEMA/support organization for systemic response Structuring support systems for childcare, eldercare, etc	Centralized information from nerve center Re-structuring shifts to improve efficiency Identifying and flexing providers who can move to category 1 (eg, double-boarded physicians, nurses with ICU experience etc) Creating rapid re-skilling materials (eg, e-learning for vent management) Optimizing virtual health Identifying senior medical/surgical residents who can be transitioned to independent practice	Support for HCPs in-house (eg, food, childcare, online resources on working in this environment etc) Community support for HCPs—for childcare, grocery pick-up, etc Proactive mental-health support for HCPs

Note: These perspectives are intended to build from CDC and other guidance based on operations and management experience. Please continue to consult CDC, state health department, and medical societies for the most up-to-date guidance. These perspectives are not intended as a substitute for professional medical advice, diagnosis or treatment. Any actions affecting clinical decision-making should be appropriately vetted

Source: Expert interviews

Example roles likely to be in peak demand

Critical care clinicians

Intensivist

Anesthesiology

General emergency medicine

RN – Critical care (ICU, MICU, SICU, CVICU, Specialty ICU, etc)

RN – PICU

RN – Step down

Other key roles

Respiratory therapists

Lab technicians

Telemedicine capable resources

Behavioral health professionals

Environmental services (EVS)

Example healthcare workforce that may flex to support demand in emergency scenario

Critical care (ICU) example

NON-EXHAUSTIVE: EXACT LIST WILL BE HIGHLY DEPENDENT ON CARE MODEL AND TRAININGS

Sample skills needed: Managing patients on ventilators, managing critical care plans, inserting central lines

Categories of suitable roles	Physician role examples:	Nursing role examples:	Resp. therapist examples:
Category 1: Healthcare professionals currently doing this work and **well versed in skills needed**	Intensivist Anesthesiology—critical care medicine General emergency medicine	RN—critical care RN—step-down	Respiratory therapist Nurse anesthetist
Category 2: Healthcare professionals with **complementary or partial skills** who could transition into roles or partial roles needed	Surgery—oncology Surgery—general Internal med.—hematology & oncology Internal med.—cardiovascular disease Internal med.—infectious disease	RN—oncology RN—medical/surgical/telemedicine RN—LTAC	RN—pulmonary RN—critical care RN—ED
Category 3: Healthcare professionals with **related skills requiring training** to cover components or some of the skills needed	Family med.—adult medicine Internal med.—endocrinology, diabetes & metabolism General practice/general family med.	RN—rehabilitation RN—community care RN—case management	Respiratory technician RN—medical/surgical/telemedicine

Note: Subject to hospital, local and/or national guideline approval

Source: Expert interviews

Redeploying some category 2 and 3 clinicians may allow for workforce redistribution in emergency scenarios

Critical care example

NON-EXHAUSTIVE: EXACT LIST WILL BE HIGHLY DEPENDENT ON CARE MODEL AND TRAININGS

	Physician 	Productivity relative to Category 1	Nurse 	Productivity relative to Category 1
Category 1: Focus on top-of-license tasks, including:	Prioritize most acute patients and most complex tasks (eg, codes, bedside procedures, ventilator management) Develop critical-care treatment plan		Care for highest-acuity patients in the unit Perform most complex nursing tasks (eg, set up and connect ventilators, assist with bedside procedures)	
Category 2: Absorb Category 1's mid-level tasks, including:	Focus on ICU's mid-level patients and tasks (eg, simpler bedside procedures like intubation, central line insertion) Develop treatment plan for these patients	**80%**	Care for next level of acuity patients in the unit Perform medium-complexity tasks (eg, prep for procedures)	**30%**
Group 3: Absorb Category 1's lowest-level tasks, including:	Focus on lowest-acuity patients within the unit, including treatment plan Support other tasks requiring a physician (eg, communicating with families, paperwork)	**30%**	Care for lowest-acuity patients within the unit or cover specific tasks for all Perform routine, lower-skill tasks in support of Group 1 nurses (eg, vitals, paperwork)	**10%**

Note: Subject to hospital, local and/or national guideline approval

Source: Expert interviews

Nationally, approximately 1 million additional physicians and >2 million nurses may be able to enter the available workforce

Provider pool across example specialties

Anesthesiologists	**~31K**
Surgical PAs	**~114K**
Cardiologists	**~22K**
Critical care physicians	**~12K**

Provider pool across example sites of care[1]

Nurses outside of hospitals	**~1.2M**
Physicians outside of hospitals	**~500K**

Providers in training

Medical students	**~92K**
Total residents	**~67K**
• Internal med	**27K**
• Emergency med	**7K**
• Anesthesia	**6K**
Nursing students[2]	**~433K**

Retired and inactive licenses

Retired nurses <70 years old[3]	**~150K**
Inactive, licensed nurses	**~450K**
Inactive phsycians[4]	**~160K**

1. Includes clinicians in Offices of Physicians, Outpatient Care Centers, Universities and All Other Settings
2. Includes baccalaureate and master's degree programs
3. Assumes average retirement age of 61 years old
4. Includes retired MDs

Sources: BLS Occupational Employment statistics, AACN, AAMC, ACGME Data Resource Book; USCIS, American Dental Association

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Clinical management of COVID-19 requires a number of critical supplies, many of which are in short supply

Supplies that may currently or soon be in short supply

Recent, current or potential future short supply

Diagnostics and testing

- ELISA and RT PCR laboratory equipment and reagents
- Sample collection tubes
- Swabs for buccal sample collection
- Swabs for nasal sample collection
- Leak proof cups for aspirate collection
- Respiratory viral panel (RVP)
- CT contrast agents
- Regular basic blood panel supplies
- Specimen transport bags

Health facilities infrastructure and equipment

- Ambulance with air isolation system for transport of contagious patients
- Mobile, basic diagnostic X-ray system
- Portable ultrasound
- Resuscitator
- Medical triage/treatment/isolation facilities
- Isolation room negative pressure HEPA filtration machines
- Packaging transport substance for viral sample transport
- Ventilators with portable and back-up power supply
- Ventilatory peripherals and disposables
- Anaesthesia machines
- Beds

Personal protective equipment

- Gloves
- Goggles
- Gowns (disposable and linen)
- ISO masks (medical grade)
- Surgical masks and caps
- Eye/face shield
- Tyvek suits, sleeves, hoods or equivalent
- Safety box/sharps container (must be labelled “biohazard”)
- Scrubs

Medical equipment

- Infrared thermometer
- Laryngoscope, adult, child set
- Endotracheal tubes
- Ventilator disposables (ie, HMEs, HEPA filters)
- Oxygen concentrator
- Oxygen face mask with reservoir bag, disposable
- Pulse oximeter, portable
- Syringes: 0.5 ml autodestruct (AD) and 5 ml reuse prevention (RUP)
- Infusion setup including pump
- Oropharyngeal and Nasopharyngeal airways
- Pulse oximeters
- Incentive spirometer
- Tracheostomy kits and devices
- Acapella valves
- Nasoenteric tube feeds
- Sequential compression devices

Disinfection consumables/ biohazardous waste management

- Alcohol-based hand sanitizer
- Disposable bags, for biohazardous waste PPE and clinical waste without sharps
- Body bags, suitable for burial or cremation
- Disinfectant
- Soap, surgical
- Sets including mask, gel, and soap for targeted population
- Chlorine

Drugs and medical consumables

- Paracetamols/Antipyretics
- Oxygen
- Infusion compound (Ringer's lactate)
- Antibiotics (for secondary infections)
- Hydroxychloroquine

Advanced

- Home care kits for home isolation of asymptomatic cases or mildly symptomatic
- Antivirals/vaccines (in development)

Source: Adapted from job aid for respiratory/ droplet-borne disease, supplemented with information from WHO Disease Commodity Package (Feb 7 2020), CDC Coronavirus (Feb 27, 2020) and Supply Chain and infectious disease expert interviews

There are a number of ways to help mitigate the strain COVID-19 places on availability of medical supplies

Note: these are example actions and not prescriptive

Details follow

Sourcing strategy and alternatives

Expand medical-supply sourcing and begin identifying non-medical alternatives

Expand and diversify sourcing partners for critical items[1] across geographies; options include the following:

- Traditional domestic distributors, suppliers
- Domestic and international manufacturers
- Peer industries that use similar products (ie, manufacturing, industrial, chemical industries)

Work with clinical leadership to identify non-medical alternatives to supplies, eg,

- Respirators: painting and construction N95 substitutes
- Eyewear: industrial or ski goggles

Implement actions to maintain appropriate levels of critical supplies

Inventory control and balancing

Control buying at system level and ensure supplies reach greatest point of need

Centralize all sourcing and distribution; prioritize at-risk supplies for increased tracking; maintain continuous line of sight on consumption and expected inflow of key products

Develop a system for proactive rebalancing and redistribution across sites involving the following components:

- Inventory on hand against current burn rate
- Expected inflow of med/surg and Rx supplies
- Expected epidemiological outlook and site maximum capacity

Continue open dialogue with suppliers, distributors, and public agencies critical for contingency planning[2]

Increased and constant stakeholder collaboration between supply-chain and infection-control teams, distributors, manufacturers, peer industry partners, and public agencies could promote success of the above

Clinical conservation

Promote conservation and set clinical scenario plans

Establish and enforce clinical protocols around the use of at-risk supplies by situation and enforce

- Develop tiers of clinical scenarios against supply levels/risk of shortage and set supply conservation protocols appropriately for each
- Work in collaboration with infection prevention team to vet appropriate guidelines
- Communicate plans to clinical site leaders and ensure all care providers are aware/ adopt the new protocols immediately

System integration and risk management

Connect with response areas outside of supply chain to ensure organizational readiness for a worst case scenario

Create distribution strategy and sourcing support for various care-delivery models

- Surge sites (eg, to expand bed capacity)
- Patient testing inflow (ie, ambulatory, acute, drive-throughs)
- Home health

Engage with other government organizations and NGOs

- Engage with state DOH to collaborate on actions needed to maintain appropriate supply levels
- Review NGO support opportunities

Prepare for worst case scenario supply shortage and prepare mitigation strategy

1. Recommended to begin with critical PPE supplies and subsequently scale to larger list of items included on COVID-19 critical supply list
2. Eg, coordinating on emergency supplies and public response

Source: Hospital supply chain expert interviews

There are four approaches to explore with clinical and engineering experts for demand management of PPE

Example actions for exploration

DEEP DIVES FOLLOW

	1	2	3	4
	Prioritize and extend usage	**Reuse/reprocess**	**Adjust clinical workflows**	**Adjust care team guidelines**
Example questions for providers to consider	Which activities are critical to use PPE for the safety of your clinical staff? And in which settings? How can you extend the life of each PPE item to ensure maximum but effective usage? How do you enforce or track policies regarding PPE usage?	Which supplies can you reuse and how many times? How can your distributor help with reprocessing of PPE? Do you have the equipment and supplies available to disinfect N95 respirators or eye protection items while ensuring its continued efficacy? Should you consider storing used N95 respirators or eye protection items for potential future reprocessing?	How can you leverage technology and novel approaches to limit physical interaction with suspected and confirmed COVID-19 patients? How should you organize your space to decrease number of staff encounters with COVID-19 patients? Should you create COVID-19-specific cohort pools of staff to limit number of people required to use PPE during a given shift?	How do you limit clinical staff encounters with suspected and confirmed COVID-19 patients? How do you limit non-essential staff from entering spaces with suspected and confirmed COVID-19 patients?

All guidelines should be created alongside infection-prevention teams and be in accordance with CDC and local DOH policy guidelines

Source: Expert interviews

A number of potential actions can be considered to prioritize and extend use of PPE

1 Prioritize and extend usage: potential example actions

Approach	Prioritization	Extension
Overview and potential strategies in crisis scenario	Preserving PPE use for activities with the highest risk to healthcare providers if required, examples include: Exploring reserving N95 respirators for aerosol-generating procedures or high-risk environments Exploring prioritize face-shields (over eye protection) for prolonged close encounters and aerosol-generating procedures	Wearing the same equipment continuously for encounters with multiple patients without removal if required, such as the following: Exploring use of N95 respirator for up to four hours after donning unless soiled or damaged Exploring use of face masks for as long as possible unless soiled or damaged Exploring use of isolation gowns across multiple patient encounters (absent co-infections)
Possible implementation approach	Develop with clinical, infection prevention, and system leadership: Comprehensive list of all high-risk activities, including, but not limited to, aerosol-generating procedures Internal triggers for implementation (eg, supply levels) Communications plan	Develop with clinical, infection prevention, and system leadership: List of PPE candidates for continuous use based on system operations and constraints Internal triggers for implementation Clear guidance around when and how to remove equipment Communications plan

All guidelines should be created alongside infection-prevention teams and be in accordance with CDC and local DOH policy guidelines

Source: CDC guidelines: Strategies for Optimizing PPE Use; expert interviews

A number of potential actions can be considered to explore repeated wear and reprocessing of existing supplies

2 Reuse/reprocess: potential actions

Approach	Repeated wear	Reprocessing
Overview and potential strategies in crisis scenario	Use of the same equipment across interactions with multiple patients with removal between encounters if deemed appropriate; examples include the following: Exploring reuse of N95 respirators and facemasks across multiple encounters, discarding when soiled or damaged, or when airflow is compromised Exploring reuse of gowns and eye protection across multiple encounters	Disinfect equipment using sterilization techniques designed to remove pathogens while maintaining PPE integrity if deemed appropriate Methods explored by providers include: N95: UV/heat decontamination[1] N95: Hydrogen peroxide vaporization[2] N95: Ethylene oxide sterilization[3] Eye protection: EPA disinfectant wipes followed by water/alcohol
Possible implementation approach	Develop with clinical, infection prevention, and system leadership: List of items eligible for reuse Guidelines for maximum cycles of reuse Guidelines for safe “donning” and “doffing” of equipment with appropriate training protocols Implementation triggers for reuse (eg, supply levels) Communications plan	Develop with clinical, infection prevention, and system leadership: List of items eligible for reprocessing Strategy for reprocessing (in-house development vs external vendor) Plan to implement, including incorporation of reprocessing times, collection and reallocation of equipment, etc Maximum number of reprocessing cycles for chosen method

All guidelines should be created alongside infection-prevention teams and be in accordance with CDC and local DOH policy guidelines

1. Live Science, March 24; https://www.livescience.com/sanitizing-medical-masks-for-reuse-coronavirus.html
2. News & Observer, March 26; https://www.newsobserver.com/news/coronavirus/article241520921.html
3. Annals of Occupational Hygiene. 2009 Nov; 53(8): 815–827; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2781738/

Source: CDC guidelines: Strategies for Optimizing PPE use; expert interviews

A number of potential actions can be considered to change traditional care processes and cohort patients

3 Decreasing interactions and cohorting patients: potential actions

Approach	Decrease interactions	Cohort patients
Overview and potential strategies in a crisis scenario	Explore novel strategies to minimize number of face-to-face interactions with infected or possibly infected patients if deemed appropriate, such as the following: Extend IV tubing to put pumps/bags in hallway instead of patient rooms Use of tele-medicine monitors (eg, baby monitors, mobile phone video calls, etc) to enable RN triage prior to room entry Cluster medication administration and vital sign timing	As capacity and operations allow, creation of COVID-specific treatment areas complete with all required resourcing, such as the following: Explore developing COVID-only ED, ICU, and medical/surgical patient areas with designated clinical staff Explore designating COVID-testing areas to minimize ED use for general screening (eg, fever tents, drive-through screening)
Possible implementation approach	Develop with clinical, infection prevention, and system leadership: Rigorous examination of impact on patient care and staffing of chosen strategies Clear guidelines and training around new clinical processes, with extensive input from RN leadership Sourcing strategy for required supplies to enable implementation	Develop with clinical, infection-prevention, and system leadership: Rigorous examination of impact on patient care and staffing requirements of chosen strategy Evaluation of possible care spaces and capital expenditures required to accommodate new units Environmental-services (EVS) support to evaluate opportunity for additional safeguards (eg, appropriate ventilation, etc) Robust communications and safeguards to restrict entry into units by approved personnel only

All guidelines should be created alongside infection-prevention teams and be in accordance with CDC and local DOH policy guidelines

Source: CDC guidelines: Strategies for Optimizing PPE Use; expert interviews

A number of potential actions can be considered to adjust care-team structures and minimize number of individuals involved

4 Adjust care-team guidelines: potential actions

Approach	Clinical team	Non-clinical team and visitors
Overview and potential strategies in crisis scenario	Explore reducing clinical-team size to minimum number of HCPs required to maintain safe patient care, such as the following: Increase length of RN shifts to 12 hours (if currently at 8 hours), capacity and work restrictions allowing Eliminate non-essential MD providers (eg, avoid having full teaching team perform daily visits at academic medical centers unless required for care) Leverage tele-health as clinically appropriate for all primary team and consultation visits	Explore limiting the number of non-clinical interactions to bare minimum of individuals required to maintain safe conditions, such as the following: Create EVS support for COVID-cohorts, capacity allowing Convert non-essential face-to-face support services if deemed appropriate (eg case management) to consultations using tele-health Limit all visitations if deemed appropriate (possible exclusions: end of life, maternity, pediatric)
Possible implementation approach	Develop with clinical, infection prevention, and system leadership: Sufficient staffing support to accommodate increased care burden (eg, decrease staffing ratios for RNs) Guidelines for essential provider team needs Pilot study to test approach before widescale adoption	Develop with clinical, infection-prevention, and system leadership: Sufficient staffing to accommodate increased care burden (eg, decrease staffing ratios for RNs) Perspective on PPE needs for EVS staff protection Infrastructure to enable remote visitations Clear communications regarding need for new visitation policies

All guidelines should be created alongside infection-prevention teams and be in accordance with CDC and local DOH policy guidelines

Source: Medscape Hospital Hacks for COVID Shortages (accessible here); expert interviews

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Addressing the public-health crisis

Managing capacity

- Infrastructure
- Workforce
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Testing and containment

Testing and containment

Testing and containment have become foundational components of COVID-19 response

Quickly scaling testing capacity may be critical to informing resource allocation. The “test, track, and isolate” strategy has allowed countries like Norway and South Korea to limit the spread of the virus effectively through early action. The United States has used a “contain and restrict” strategy to contain the COVID-19 outbreak in high-burden settings as it works to ramp up testing.

As the pandemic evolves, the role of testing is also likely to evolve

As more states and provider systems manage the overall COVID-19 outbreak and move towards containment, the focus of testing may shift towards contact tracing and targeted quarantine efforts, societal reintegration efforts, and epidemiologic study. States and provider systems could act quickly and collaborate in order to enable the new focus areas for testing while continuing with the testing that is needed for clinical care and treatment planning.

Contact tracing is an important tool as part of a comprehensive COVID-19 response

Contact tracing is most effective when the start of the process is closely linked to widespread testing. Contact tracing can require a large, dedicated public health workforce along with technology, telecommunications, protective gear and training. There are a number of key design questions to answer in designing every step of the contact tracing process.

Note: This material is intended to provide insight and best practice rather than specific client advice. It is not intended to guide clinical decisions and treatment. This document does not recommend or endorse any methodology or technology relating to contract tracing. Data on the impact of tracking and tracing approaches for reducing the spread of COVID-19 is limited at the time of writing. All methodologies and technologies need to be assessed for their impact on issues of privacy and civil liberties.

Source: Detailed sources and methodological notes underpinning these findings provided throughout the following pages

To manage the crisis, Western countries are largely instituting the "early China model" – containment and testing

As of April 1, 2020

Most appropriate for high-burden settings → Most appropriate for low-to-medium burden settings

	Contain and restrict movement	Test, track, and isolate
	"Early China model" (See Appendix for case study)	"South Korea model" (See Appendix for case study)
Characteristic actions	Border closures and city-level lockdowns, quarantines "Shelter-in-place" restrictions on individual movement Mandatory closures of businesses	Aggressive testing of suspected cases, clusters (5,000+ tests per million population) Contact tracing and isolation via surveillance Quarantine enforced by government monitoring

Testing per capita

Country	U.S.	France	Spain	U.K.	Italy	Norway
National responses	State and city-level closures; testing lagging other countries	National lockdown with strict police enforcement; has performed targeted vs widespread testing	National lockdown limiting non-essential movements; reported logistical issues limiting testing capabilities	Early strategy focused on scaling testing vs lockdowns, though officials began enforcing lockdown March 20	Imposed strict regional and national lockdowns early; testing per capita is ~4x most peer EU countries with some regions testing nearly full population	Quickly scaled testing, eg, drive-through testing available 7 days after first confirmed case; instituted punishment for quarantine violations

1. Based on University of Oxford, Our World in Data: "How many tests for COVID-19 are being performed around the world?", accessed March 20, 2020. US, Italy, and Norway figures from March 20, Spain from March 18, UK from March 17, France from March 15.

Sources: University of Oxford, Sante Publique France, Istituto Superiore di Sanità (ISS), UK Department of Health and Social Care, Ministerio de Sanidad, Consumo y Bienestar Social, US CDC, press search

Testing and operational planning can be critical during the COVID-19 outbreak

Testing

Contact tracing

Isolation for epidemic control

COVID-19 testing is a crucial step in solidifying treatment paths as well as in contact tracing. Understanding the potential for exposure of a person infected with COVID-19 can help prevent further transmission through appropriate physical isolation

In times of testing kit shortages and rapid case growth in certain geographies, there are discussions around whether to focus on testing for contact tracing with the ultimate goal of isolation, or for operational planning of treatment (eg, cohorting) and limiting testing to patients whose results will change current treatment plans

Source: Center for Disease Control and Prevention; Wang D, et al. JAMA 2020: Feb 7.

Overview of COVID-19 strategic testing

To date, COVID-19 testing in the US has been focused on testing to determine appropriate care and treatment planning, and mostly for symptomatic patients or patients exposed to COVID-19 infected individuals who have presented at the hospitals or other clinical service settings including physician office and urgent care centers.

As more states and provider systems manage the overall COVID-19 outbreak and move towards containment, **the focus of testing may shift** towards:

- Contact tracing & targeted quarantine efforts,
- Societal reintegration efforts, and
- Epidemiologic study

There are areas of potential **collaboration for states and provider systems** that could quickly enable the new focus areas for testing while continuing with the testing that is needed for clinical care and treatment planning. These could include efforts to:

- **Develop necessary requirements and identify and validate available serologic tests**
- **Consider a parallel set of testing strategies including serologic, PCR and sequencing to better understand the nature of COVID-19** including chance of mutation, reactivation and antibody resistance
- **Develop understanding for COVID-19 herd immunity and implication for public health measures**

Categories of COVID-19 testing

Focus of next slide

Category	Potential use case	Most likely assay	Site of testing	Potential considerations (not exhaustive)
Clinical care & Treatment planning	Targeted testing to determine appropriate treatment planning and clinical care determination	Molecular (e.g., RTPCR)	POC/bedside Lab	What is the appropriate prioritization with testing shortages? Whether and in what settings to leverage POC Molecular tests? How should testing be administered to support clinical care in the face of testing shortages?
Contact tracing & Targeted quarantine	Testing symptomatic patients and patients who were exposed to COVID-19 to enable contact tracing and targeted quarantine protocols. Targeted testing for healthcare workers and other critical employees	Molecular and serologic	POC/bedside Lab	What infrastructure is needed to support this category? How should positive test outcomes be utilized, and what is the re-testing period? How should negative test outcomes be utilized? In case of targeted quarantine, how to define prioritization for critical employees? How should immunity in healthcare workers be utilized for patient cohorting?
Societal reintegration	Testing to determine reintegration, including “clearance” for back to work, access to public spaces, transportation, etc.	Serologic and molecular (to rule out active infection)	POC “Authorized” centers Drive-through At home	What activities should require “clearance”? How should results be authenticated? What centers should be “authorized”? How should positive test outcomes be utilized, and what is the re-testing period? Whether and what techniques can be used to increase capacity and speed (e.g. sample pooling)?
Epidemiologic study	Understand total and broader prevalence in population and likely susceptibility to inform public health policy and reopen efforts	Serologic	Study sites Drive-through At home	What level of testing will be required to draw necessary conclusions? What policies should be affected by test results? Whether and what techniques can be used to increase capacity and speed (e.g. sample pooling)?

Parallel paths and actions to consider in the near-term

NOT EXHAUSTIVE

Parallel paths	Potential action to take in the near-term
Identify and validate available serologic tests	Have you identified serologic tests that have desired sensitivity and / or specificity levels? Have you ensured supply continuity and availability? Have you developed a mandated protocol for serologic test validation across states to determine scalability and analytical/clinical sensitivity considering the end-to-end process, assay, sample collection (e.g., venous draw vs. finger prick method)? Have you defined standards for result authentication and application across a variety of activities (e.g., work place, public spaces, large events, social events, consumer spaces, etc.)? Have you considered how serologic immunity testing outcomes might be utilized (e.g., cohorting vulnerable patients with immune caregivers)?
Understand COVID-19 viral characteristics and immune response	Have you established studies to follow known IgG antibody positive patients to understand immune response? How will you continue to track and test previously PCR positive COVID-19 patients to track behavior of the virus and re-infectivity / reactivation likelihood? Is there a need to genomic sequencing to understand potential COVID-19 mutations?
Determine overall testing strategy	Have you begun to test broader population on regular intervals to understand level of immunity in the population and implications for reopening? Which entities if any have established patient registries for COVID-19 positive patient base? How often will you adjust overall testing strategy? Is there a step-wise return approach that can be taken for communities that achieve the necessary threshold? Have you determined implications for vulnerable populations (e.g., immunocompromised or with pre-existing conditions)?

Consider how clinical and molecular testing could continue to occur to an extent possible

Contact tracing involves the identification of individuals with potential exposure for targeted quarantining and medical assistance

Testing

A positive COVID-19 test identifies an individual has the virus

Contact tracing is most effective when the start of the process is closely linked to widespread testing

Contact tracing

Identification

Once an individual is diagnosed, contacts are identified by determining those who have had meaningful exposure during the period of potential transmission (which begins before symptom onset)

Notification

All individuals who have been potentially exposed to the infected person are listed as contacts

Contacts are notified of their status, implications, and next steps (e.g., how to find care)

Depending on local public health guidance, quarantining or isolation could be required

Follow-up, monitoring & support

Regular follow-up conducted with contacts to monitor for symptoms and test for infection where needed

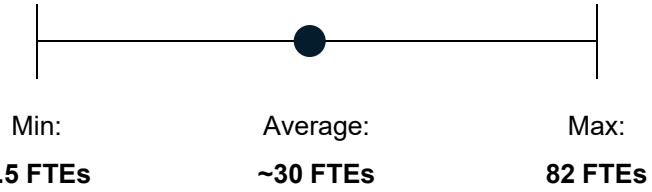
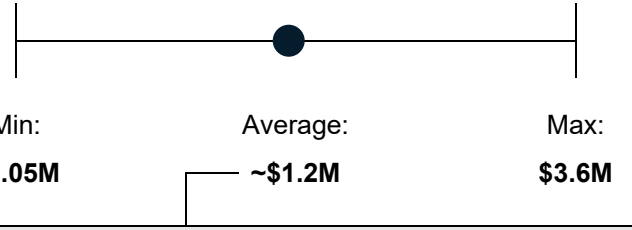
This information is used to determine most appropriate intervention for contact (e.g., quarantining) and additional support needed

Although elements of contact tracing are consistent, specific approaches to contact tracing differ significantly in terms of technological sophistication (e.g., traditional contact tracing via phone and in-person contact vs. tech-based tracing); details in next chapter. Governments also need to take decisions on implications of alternative approaches to tracking and tracing for privacy and individual liberties.

Source: WHO

Landscaping of resources needed for contact tracing for COVID-19 shows wide variation, however there is limited budget information

Data collected prior to April 30

Resources	Considerations	Resource estimates[1]
Workforce	Contract tracing can require a large, dedicated public health workforce to support operations Workforce usually including: • Contact Tracers • Care Resource Coordinators • Case Investigators	Number of Tracer FTEs per 100k population: 
Funding	Key funding items include: • Workforce (incl. contact tracers and managers) • Technology build (e.g., app) • Telecommunication (e.g., call center) • Protective gear for workforce (where appropriate) • Training delivery	Total budget allocated per 100k population: 

Limited information available: # of FTEs required and overall costs associated with contact tracing contingent upon level of technology leveraged (e.g., interviews conducted by officers vs. data platform) and whether systems are already in place

1. Estimated from data collected across countries and U.S. states implementing contract tracing for COVID-19; see following slides

How is contact tracing usually implemented?

	Diagnosed case of COVID-19	Identify contacts	Notify contacts	Monitor and support contacts	Graduation from contact status
Traditional contact tracing model		Patient is interviewed by clinician/ contact tracer to create a "line list" of contacts based on exposure during the period of potential transmission	Notification by phone/in person by contact tracer with description of what it means to be a contact In some cases, quarantining or isolation, or testing is required or recommended	Daily phone call/visit from contact tracer	Notification by contact tracer of change in status
Key Questions leaders need to consider (non-exhaustive)		Do you include presumptive cases and who maintains the central system? Who does the tracing (e.g., patient, provider, tracer)?	What qualifies as a contact? How do you notify contacts, but do not risk identifying the individual? What information & resources do you provide to which cohorts?	What resources do you provide remotely vs in person and to which cohorts (e.g., high risk)?	How do you determine if risk has changed and ensure a closed loop system?
		How can you protect the privacy of citizens?[1]			
Traditional resources required (Non-exhaustive; not including technology)		Case investigator or provider De-identified database of confirmed cases and contacts	Qualified tracer Maps and contact lists Information (leaflet) explaining contact tracing process, next steps, and emergency contact information	Case or contact manager PPE for case manager Thermometer or diagnostic Masks and supplies for cases	Contact manager Database with updated diagnosis or cure status

1. Examples to follow; please note the examples in this document are not exhaustive

How can applications and technology fit in?

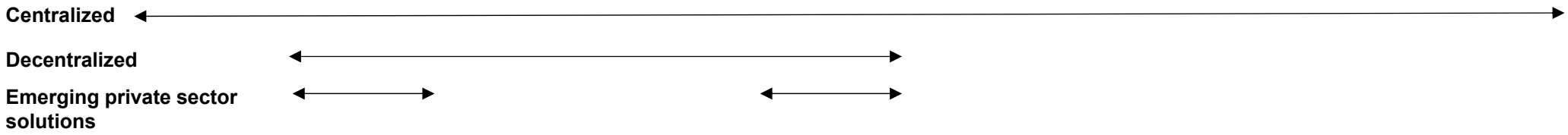
	Diagnosed case of COVID-19	Identify contacts	Notify contacts	Monitor and support contacts	Graduation from contact status
Traditional contact tracing model		Patient is interviewed by clinician/ contact tracer to create a "line list" of contacts based on exposure during the period of potential transmission	Notification by phone/in person by contact tracer with description of what it means to be a contact In some cases, quarantining or isolation, or testing is required or recommended	Daily phone call/visit from contact tracer	Notification by contact tracer of change in status

Potential uses of technology

(not all will be applicable for all contexts – non-exhaustive)

A	B	C	D	E	F	G
App/ tech based designation of contacts (by either patient or contact tracer)	Use of cell phone data to create an initial set of contacts based on proximity (may be refined by patient/contact tracer)	Notification by text/app as an alternative or supplement to speaking with a contact tracer	Anonymized mapping of case and contact location for public risk awareness	Texts/app notifications as a supplement/ replacement for daily visits	Identifiable location monitoring to support contact compliance	Notification by text/app if status changes and deletion of data from CT databases

Centralized efforts often span more uses with private efforts being more specific



While technology can support, multiple conditions are required

Rapid and scaled testing capacity

Widespread diagnostic capabilities needed for rapid case detection, enabling contact tracing to be leveraged

Apps are an aid not a solution; an ecosystem of policies and off-line teams to upkeep a repository of contact traces

Skilled and adequately equipped workforce

Contract tracing can require a large, dedicated public health workforce

Need to ensure workforce receives basic training on prevention, isolation and quarantine principles, privacy & data management, as well as adequate personal protective equipment if making in-person visits

Coordinated response

Multi-agency and multisectoral coordinated approaches to allow scaled interventions that account for state and local capacities and capabilities

High Adoption rate

Majority of citizens need to use the app for it to be effective, potential drivers for the network effect are beneficial for the user, high data quality of the confirmed cases, and single regional solution to reduce competing apps

Data privacy/citizen rights

Compliant to regulations, including local and regional privacy bodies (e.g., GDPR), for collecting and processing personal data (e.g., location, identifiers, health records)

Control of the backend to ensure security of data and privacy is upheld

Ability to respond fast to change and concerns

See next slide

Tools serve to enhance productivity and limit exposure of the workforce while lowering costs and increasing speed of response

Source: Johns Hopkins publication, PIH, MA Gov, WHO

Conclusion

Amidst the chaos and incoming advice, it’s hard to know exactly what leaders should do today

We hope this document provides leaders with actionable information to consider as they respond to the unique health and economic challenges posed by COVID-19. In particular, we would like to point out examples of steps that governments have already taken to protect their people and economies and emphasize that state and local government leaders can initiate immediate actions to save lives while also protecting livelihoods.

The next normal will likely look unlike anything we’ve seen before the coronavirus

The pandemic that changed everything. We aim to provide leaders with an integrated perspective on the unfolding crisis and insight into the coming weeks and months. On the following page, we’ve provided a number of additional resources you can access for guidance and information.

Additional resources

For all formal guidance, you can find up-to-date information at CDC's COVID-19 website, with a section specific to healthcare professionals or healthcare organizations: https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/index.html. You can also visit the WHO, CDC, and FEMA's COVID-19 portal at https://www.coronavirus.gov/.

We have developed a broader perspective on implications for businesses across sectors that can be found here: https://www.mckinsey.com/business-functions/risk/our-insights/COVID-19-implications-for-business. This supplemental material discusses implications for the wider economy, businesses, and employment. It describes some of those challenges and how organizations can respond to protect their people and navigate an uncertain situation.

Our public-sector specific insights can be found here: https://www.mckinsey.com/industries/public-sector/our-insights. This material is targeted towards public sector leaders in the COVID-19 crisis.

There are a number of academic institutions publishing credible, up-to-date information on the spread of COVID-19, such as https://coronavirus.jhu.edu/map.html.

McKinsey
& Company