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Topic: Challenges faced by the hospitals during COVID-19 case spikes

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1. Summary:

The COVID-19 pandemic is requiring all degrees of government to act in a setting of incredible vulnerability and under weighty financial, monetary, and prevailing burden. With the beginning of new floods of contamination in numerous nations since mid-2020 and the rise of variations, legislatures are faced to the restricted capacity to succession strategy activity. Public, local, and nearby state-run administrations observe they can't depend on following a straight or direct course of strategy activity to make due, exit and recuperate from the emergency. All things considered, states should follow up on all fronts all the while and in synchrony. This requirement for adaptability and flexibility is driving legislatures to reevaluate their staggered administration frameworks and rethink their provincial improvement needs.

Inoculating the worldwide populace against COVID-19 is the main long-haul technique to contain the Covid emergency. Immunization crusades started in December 2020 and were intensified in the primary quarter of 2021. However, they present a critical calculated challenge in all nations and convey huge regional and staggered administration suggestions. Starting at 10 May 2021, 12% of the populace in OECD nations had been to some extent inoculated and 15.8% completely immunized, contrasted with 2.5% and 1.6% in agricultural nations. All over the planet, 4.2% and 4.1% of the populace had been somewhat or completely immunized, separately.

Reference: <https://www.nytimes.com/interactive/2022/02/01/science/covid-deaths-united-states.html>

Introduction:

The world woke up to a risky reality on the eleventh of March 2020 when the World Health Organization (WHO) pronounced novel (COVID-19) a pandemic (Sohrabi et al., 2020; WHO, 2020). Beginning from Wuhan, China, cases quickly spread to Japan, South Korea, Europe, and the United States as it arrived at worldwide extents.

The original COVID-19 pandemic has made an unprecedented worldwide stress on medical services frameworks. This emergency has exacerbated previously existing strains inside medical clinic frameworks which need to adjust costs, nature of care, limit, and proficiency. Overcrowded intensive care units (ICUs) present a perplexing test to managers who are tormented by deciding who will get treatment and who will not, since conceding a patient today implies possibly not having the option to concede a needier patient tomorrow. Via a straightforward model, a 100-bed medical clinic as of now 85% full will rapidly surpass limit assuming they concede more than a solitary patient each day given an about 13-day normal stay for COVID-19 patients. Additionally, staffing meds and gear including ventilators, extracorporeal layer oxygen (ECMO) and dialysis machines are limited assets. [6]

Signs & Symptoms:

Signs and symptoms of coronavirus disease 2019 (COVID-19) may appear 2 to 14 days after exposure. This time after exposure and before having symptoms is called the incubation period. You can still spread COVID-19 before you have symptoms (pre-symptomatic transmission). Common signs and

symptoms can include Fever, Cough, Tiredness. Other symptoms can include Shortness of breath or difficulty breathing, Muscle aches, Chills, Sore throat, Runny nose, Headache, Chest pain, pink eye (conjunctivitis) Nausea, Vomiting, Diarrhea, Rash. [1]

Reference: <https://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-and-recovery-across-levels-of-government-a2c6abaf/>

History:

There have been various examinations to decide the beginnings of SARS-CoV-2 however none has been convincing. The Covid's behind Middle East respiratory disorder (MERS) and extreme intense respiratory condition (SARS) created from bats.

The infection originally showed up on a limited scale in November 2019 with the main enormous bunch showing up in Wuhan, China in December 2019. It was first thought SARS-CoV-2 took the leap toward people at one of Wuhan, China's outside wet business sectors. Later speculations voiced worry that it might have begun as an organic weapon in a lab in China. As SARS-CoV-2 spread the two inside and outside China, it contaminated individuals who have had no immediate contact with creatures. That implied the infection is sent starting with one human then onto the next. It's currently spreading in the U.S. also, all over the planet, implying that individuals are accidentally getting and passing on the Covid. The overall transmission is presently a pandemic. [1]

Complications:

Although most people with COVID-19 have mild to moderate symptoms, the disease can cause severe medical complications and lead to death in some people. Older adults or people with existing medical conditions are at greater risk of becoming seriously ill with COVID-19. Pneumonia and trouble breathing, organ failure in several organs, heart problems, a severe lung condition that causes a low amount of oxygen to go through your bloodstream to your organs (acute respiratory distress syndrome). Blood clots, acute kidney injury, additional viral and bacterial infections. [1]

2. Abstract:

Objective:

Numerous medical clinics were caught off guard for the flood of patients related with the spread of Covid infection 2019 (COVID-19) pandemic. We depict the cycles to create and carry out a flood plan structure for asset distribution, staffing, and normalized administration because of the COVID-19 pandemic across a huge incorporated territorial medical services framework.

Toward the start of the pandemic, an impartial conveyance of medical care administrations across the medical services framework was created. This appropriation of assets was carried out with the possible necessities and assets of the singular ICUs at the top of the priority list, and epidemiologic expectations of infection contagiousness. We depict the cycles to create and carry out a flood plan structure for asset assignment, staffing, and normalized administration because of the COVID-19 pandemic across a huge incorporated provincial medical services framework. We likewise depict an extra degree of flood limit, which is accessible to very much incorporated foundations called "expansion of limit." This alludes to the capacity to approach the beds and assets inside a clinic framework with negligible regulatory weight right away. Many hospitals noted that they were competing with other providers for limited supplies, and that government intervention and coordination could help reconcile this problem nationally. For example, hospitals wanted the government to ensure that they have access to test kits and swabs, make tests faster by allowing more entities to conduct and produce tests, and help hospitals obtain PPE supplies and other equipment such as ventilators. [1]

Reference: <https://pubmed.ncbi.nlm.nih.gov/34904702/>

Findings:

Hospitals revealed that their most critical difficulties focused on testing and really focusing on patients with COVID-19 also, protecting staff.

Hospitals clinics the nation over revealed confronting comparative difficulties, paying little heed to which phase of the cycle they were in — treating patients with Covid 2019 (COVID-19), testing patients who were possibly tainted, or getting ready to treat COVID-19 patients sooner rather than later. The most usually detailed provokes fixated on emergency clinics' endeavors to affirm instances of COVID-19, to guard medical care staff, and to offer required types of assistance to patients requiring emergency clinic care for a wide exhibit of clinical reasons, including COVID-19. Challenges included hardships connected with testing, absence of individual defensive hardware (PPE), and staffing, including specific staffing.

Hospitals announced that extreme deficiencies of testing supplies and expanded sits tight for test results restricted emergency clinics' capacity to screen the soundness of patients and staff.

Main Challenges:

- Hospitals revealed that the absence of testing supplies and postponements in getting test results caused extra difficulties.
- Hospitals clinics revealed that heavier than typical utilization of PPE added to deficiencies.
- Hospitals announced a lack of specific suppliers expected to meet the expected patient surge.
- Hospitals also reported substantial challenges maintaining and expanding capacity to care for patients.
- Hospitals detailed worries about getting other basic supplies, materials, and strategic help & shortage of ventilators. [2]

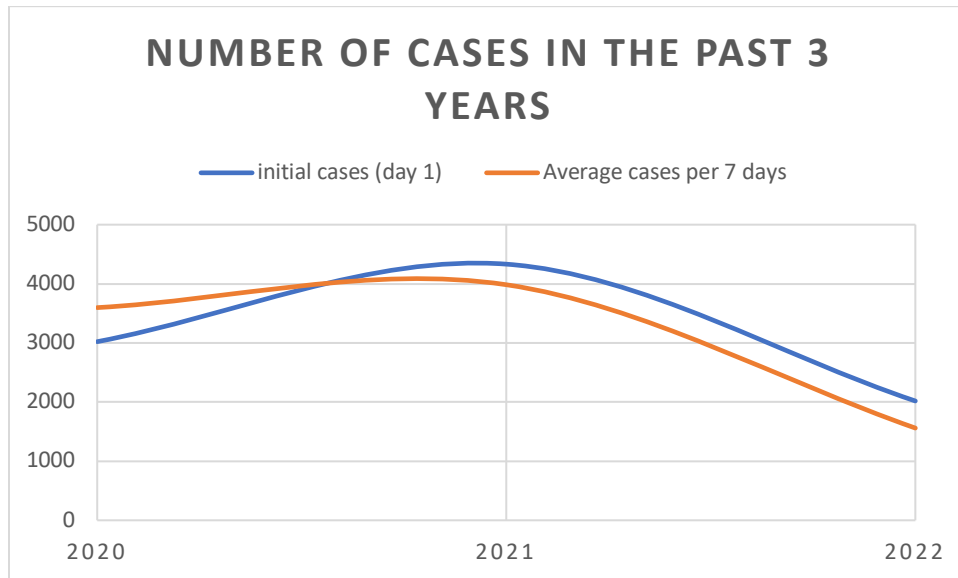
Reference: <https://oig.hhs.gov/oei/reports/oei-06-20-00300.pdf>

Factors affecting the resources (Hospital):

- Length of stay of the patient
- Shortage of meals
- Shortage of staff
- Shortage of ventilators
- Shortage of beds
- Shortage of equipment

3. Basic Analysis:

Figure 1



Reference: https://sit.instructure.com/courses/57962/files/9603383?module_item_id=1477218

Here according to the analysis in figure, we can see On April 8, 2020 there were 3,021 new instances of COVID in New Jersey and the 7 day normal was 3,597. On April 8, 2021, new instances of COVID in New Jersey were 4,332 and the 7-day normal was 3,984. On April 8, 2022, new instances of COVID in New Jersey were 2,018 and the 7-day normal was 1,560.

Assumptions:

Let's just assume, I'm the CEO of a certain hospital in New Jersey & I've been allocated with \$4M due to the surge in the cases of COVID-19 during the pandemic. I've limited space, of course. According to my assumptions, I can easily add another bed in each room (not the ICU). So now, I'll have 180 beds in my hospital. Of course, it'd be a little overcrowded but it's for the best as the regular wards have rooms big enough to fit in two beds together.

The total amount spent per week on drugs, ventilators, oxygen, food, PPE kits would be around \$50,000. But there's a catch, this includes extras as well. This means, as the CEO I could wait & check how much more stuff would be required for the next week surge. Having extra items, at least half of the required items would be essential.

Below is the figure mentioned: (Figure 2)

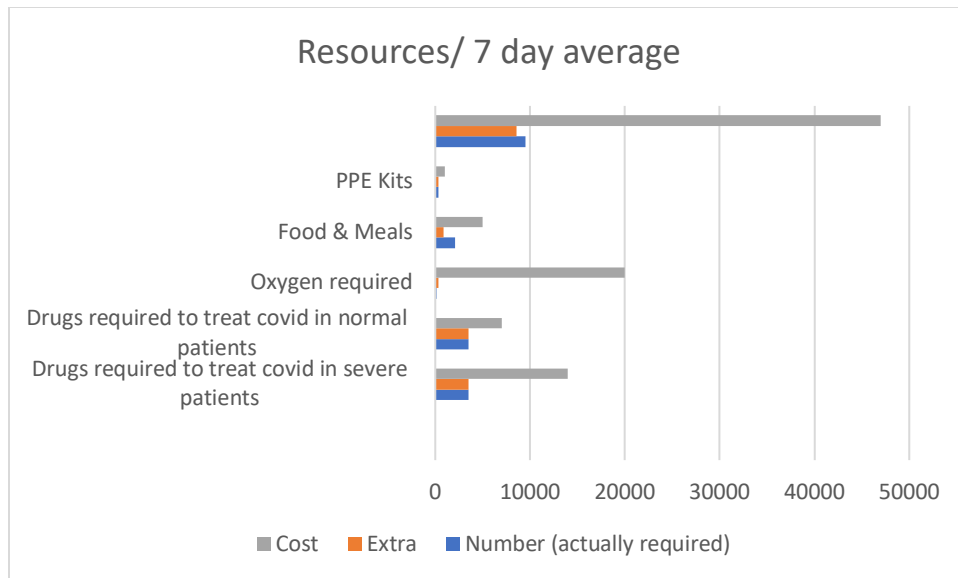


Figure 2

The total amount spent on beds; staff & other equipment's would be around \$180,000. This would be per 6 months/per annum as beds & staff usually work along for a longer period.

Below is the figure mentioned: (Figure 3)

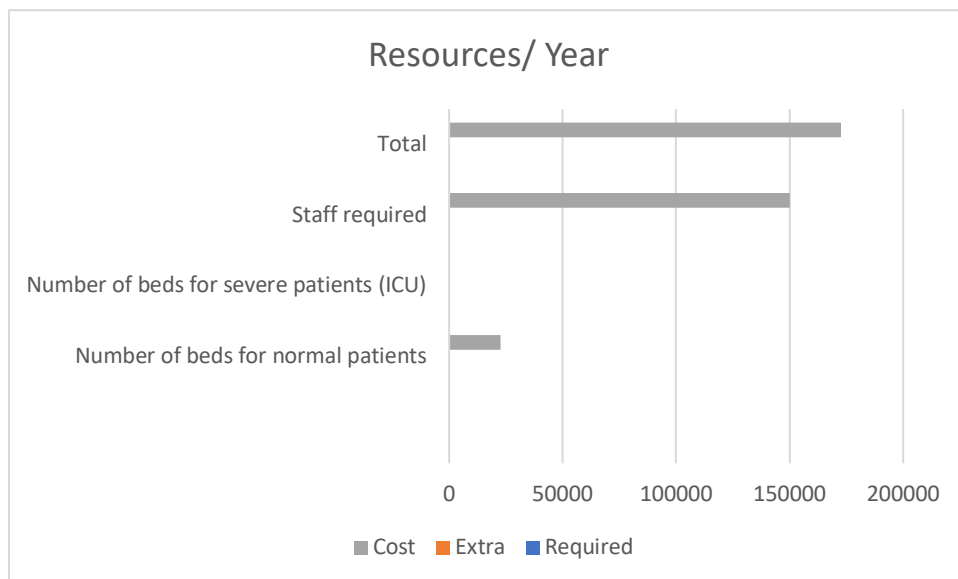


Figure 3

Reference: None, just assumptions.

Cases in New Jersey: (Figure 4)

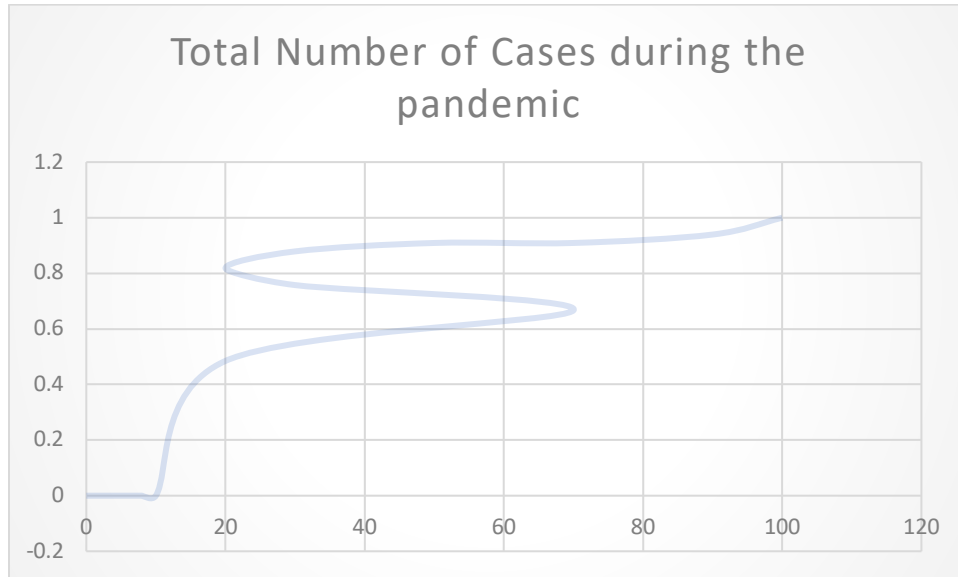
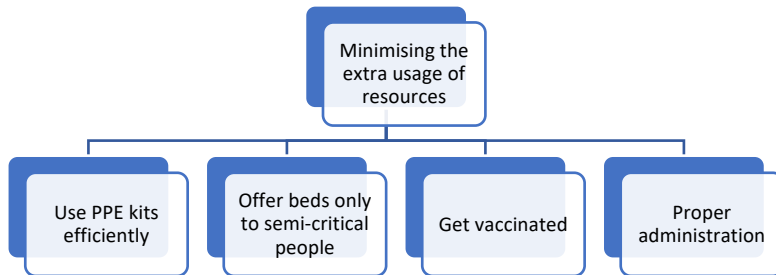


Figure 4

These are the total number of cases during the pandemic. (Figure 4)

4. Decision Analysis:



PPE KITS: It'd help & keep the staff safe.

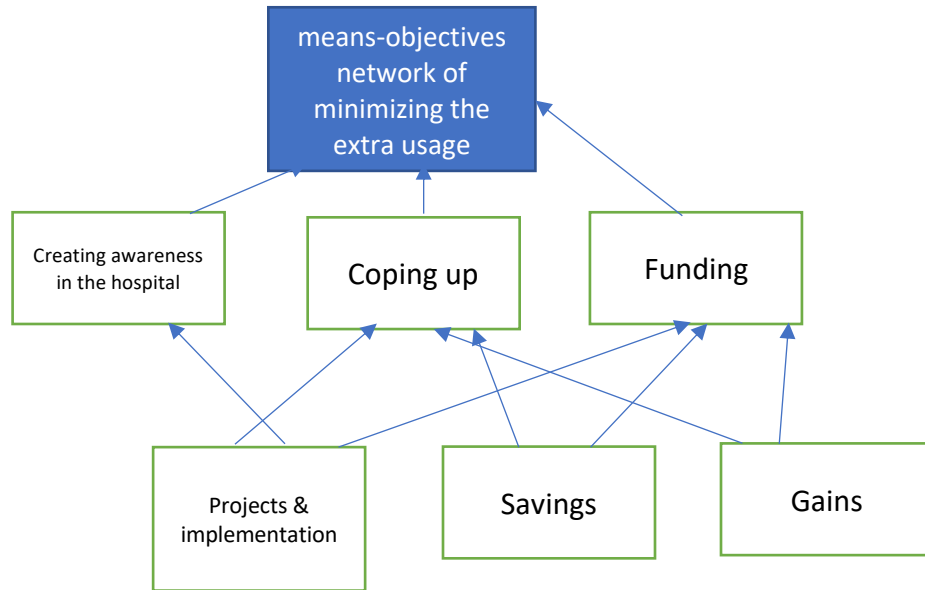
Vaccination: The staff & employees should get vaccinated as it'd help them fight COVID-19.

Proper Administration: It'd help in saving the money & will also help the staff.

Preserving the PPE and blood supply that would be utilized for elective systems in anticipation of a COVID-19 patient flood. Involving a medical procedure units and beds for potential COVID-19 patients. Reassigning careful clinicians and staff to help with COVID-19 reaction.

Reference: None, just assumptions.

5. Means Objectives:



Creating Awareness: It'd help the hospital to control the usage of resources.

Coping up: Here, coping up means coping up with the numbers & making sure everything is on point.

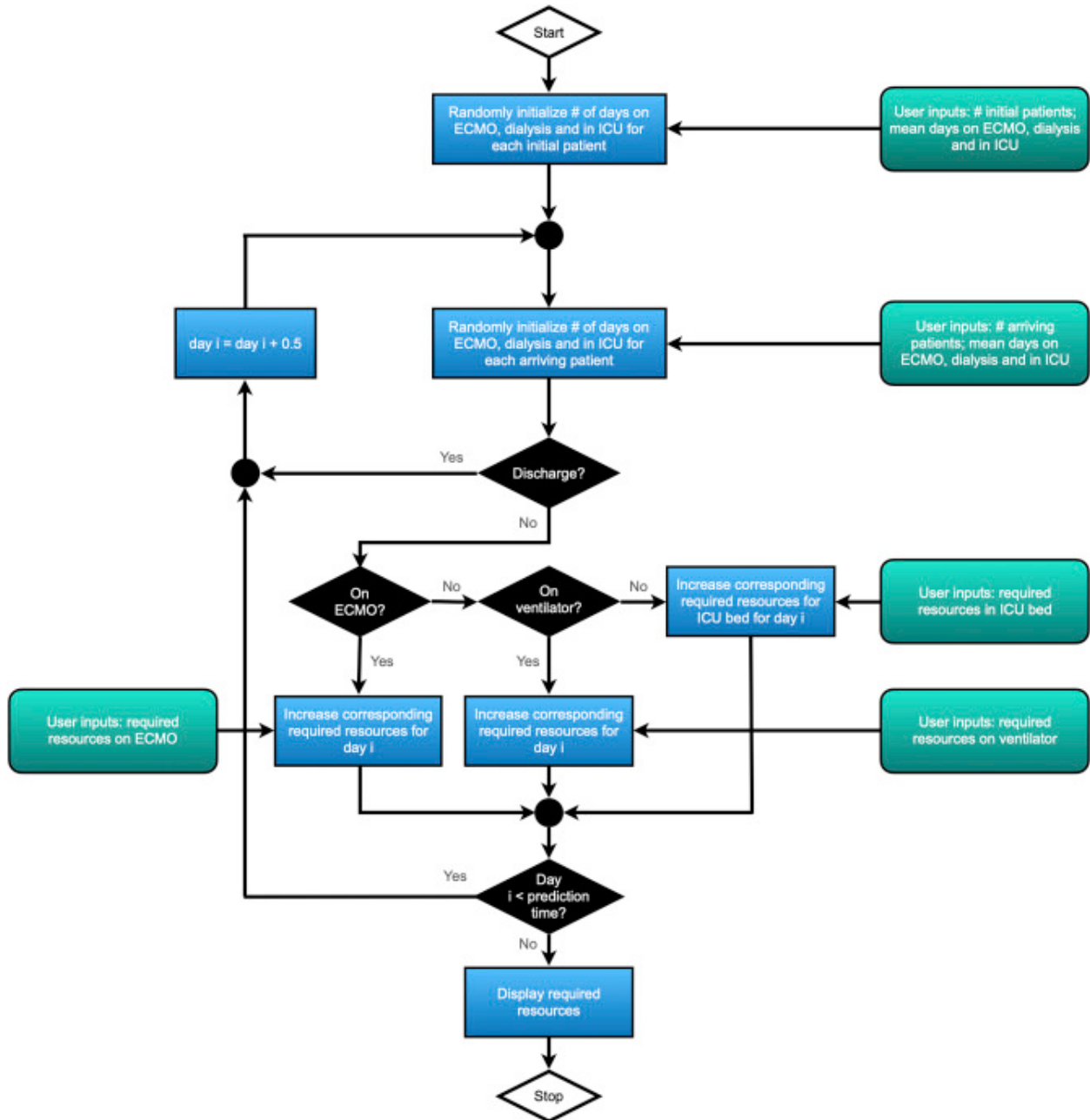
Funding: Providing masks, funding for vaccination, testing, PPE kits, meals & other resources.

Projects: Will help in keeping the policies strict.

Saving & Gains: Will help in funding.

Reference: None, just assumptions.

6. Decision Tree:



Reference: Just assumptions.

7. Conclusion:

Ventilators:

- Leasing ventilators, purchasing single-use crisis transport ventilators, or getting ventilators from an associated office.
- Dividing supplies of ventilators among clinics.
- Wanting to move patients needing ventilator to a close by medical clinic.
- Changing clinical gear over completely to use as ventilators (e.g., sedation machines and bi-level positive aviation route pressure machines).
- Fitting ventilators with extra hoses to interface more than one patient to a solitary machine.

PPE KITS & Beds:

- Preserving the PPE and blood supply that would be utilized for elective systems in anticipation of a COVID-19 patient flood.
- Involving a medical procedure units and beds for potential COVID-19 patients.
- Reassigning careful clinicians and staff to help with COVID-19 reaction.

Finance, Inventory & Staffing:

- Opening a credit extension to move finance along.
- Assessing pay cuts and cutbacks.
- Carrying out compulsory and deliberate downtime for staff that are not occupied or fundamental, during which time staff wouldn't be paid yet would remain on staff.
- Utilizing adaptable staffing and furloughing staff.
- Distinguishing awards and other financing potential open doors.
- Lessening stock not connected with COVID-19.

Food, Patients:

- Involving wandering consideration centers locally and telehealth to emergency patients in the facility, in the vehicle, or via telephone to restrict Emergency Department visits.
- Laying out hotlines for schooling and counsel.
- Making sure there's enough meals for the patients, staff & the doctors. [1]

Reference: <https://oig.hhs.gov/oei/reports/oei-06-20-00300.pdf>

8. Citations & References:

CDC, Human Coronavirus Types, CDC Fact Sheet. Accessed <https://www.cdc.gov/coronavirus/types.html> on April 3, 2020. [1]

Hospital Experiences Responding to the COVID-19 Pandemic: Results of a National Pulse Survey March 23-27, 2020 OEI-06-20-00300 - <https://oig.hhs.gov/oei/reports/oei-06-20-00300.pdf>. [2]

Duggal A, Orsini E, Mireles-Cabodevila E, Krishnan S, Rajendram P, Carpenter R, Khouli H, Hatipoglu U, Dweik R. Surge capacity and capability of intensive care units across a large healthcare system: An operational blueprint for regional integration. *Am J Disaster Med*. 2021 Summer;16(3):179-192. doi: 10.5055/ajdm.2021.0400. PMID: 34904702. [3]

Buhari Doğan, Mehdi Ben Jebli, Khurram Shahzad, Taimoor Hassan Farooq, Umer Shahzad, Investigating the Effects of Meteorological Parameters on COVID-19: Case Study of New Jersey, United States, *Environmental Research*, Volume 191, 2020, 110148, ISSN 0013-9351, <https://doi.org/10.1016/j.envres.2020.110148>. [4]

<https://www.oecd.org/coronavirus/policy-responses/the-territorial-impact-of-covid-19-managing-the-crisis-and-recovery-across-levels-of-government-a2c6abaf/> [5]

<https://www.nytimes.com/interactive/2022/02/01/science/covid-deaths-united-states.html>

Sven Brüggemann, Theodore Chan, Gabriel Wardi, Jess Mandel, John Fontanesi, Robert R. Bitmead, Decision support tool for hospital resource allocation during the COVID-19 pandemic, *Informatics in Medicine Unlocked*, Volume 24, 2021, 100618, ISSN 2352-9148. [6]
<https://www.sciencedirect.com/science/article/pii/S2352914821001088>