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The logistics and distribution of the COVID-19 vaccine has been said to be one of the most difficult logistics challenges possibly ever. This is due to the many different factors of how to distribute, produce, and store it, which is made all the more complicated by the multiple vaccines. This as well as multiple levels of government that have to be interacted with to get it to the end consumer and all of those levels having their own specific requirements and procedures. As we are in a health crisis, finding Non-Value-Added (NVA's) activities and making this a lean as possible supply chain is of the utmost importance. While overarching areas of general supply chains cannot be eliminated, certain process can be.

To begin to look at what can be eliminated, you have to first look at what a typical basic supply chain is. There are usually three to six areas, for the purposes of this essay we will go with the five-category model which includes plan, source, make, deliver, and return. All of these were and are necessary for the COVID-19 vaccine to be made and distributed to the public. This is because even though it is a vaccine to currently try and stop the spread of a global disease, it like anything else, is a product that has to be developed and shipped to a consumer. All of these areas are needed, but when getting down to the processes inherent to the actual work on the ground of a real-life supply chain there are certain NVAs that can be eliminated or have been eliminated to make the process more streamlined and leaner.

For example, some processes that are axed in this scenario are the varying wholesalers as well as middlemen due to there only being interactions between the direct manufacturer and governments. No one is selling the same products under a different name or at different prices to the average person, the government is acting on behalf of all of us and purchasing the vaccines. Multiple manufacturers of vaccines are selling directly to governments, then the governments are distributing them to health care

centers or other places, which then gets it to the consumer. Since cash flow is not a factor besides the first interaction, no additional information besides who is getting the dosage and if the vaccines are being used, is being exchanged. This has to be done due to the needs of data analytics in this situation. So, the government interaction is the only middleman between the consumer and the manufacturer. This reduction in information management eliminates the NVA of mass information keeping since hundreds of companies are not interacting between each other to get consumer data and money. Only state governments are interacting with health care professionals to get data back to the federal government for more information on the current demand of vaccinations, how many have been administered and who they have been administered to. Which then allows them to analyze how much will be needed to order from the manufacturers.

Another NVA that should be considered is the use of warehouses and inventory. When creating a lean supply chain, the least amount of cost incurred is the highest priority besides getting the end product to the consumer. So, the use of excessive warehouses and/or storing inventory is something that needs to be minimized. Since the vaccines require extremely specific conditions of super low temperature transport and storage. These conditions make it harder to keep inventory or have excessive warehouses since the vaccines has a short shelf life as well as that they have conditional needs to stay viable.

Lastly, unnecessarily long distribution chains are also can be thought of as forms of NVAs. So, while using the cold chain makes things easier to cut down on inventory and excessive warehouse costs, it also means that distribution is much more of a challenge since only specific facilities have the capacity to store them. This creates a challenge in distribution since it is going from a possibly disadvantageous position in relation to populations, roads, or other such factors. More hurdles mean more cost in not just money, but also time. Possible solutions for this are putting together major centralized sites for distribution that way processes are streamlined and easily managed. Another idea is designating semi-

permanent locations you are always distributing to and making those hubs for where consumers have to come to you. So, very little distribution is needed, and consumers always know where to come to.

Overall, because of the time sensitive nature of these vaccines and this crisis, the reality of the vaccine distribution is much different than a typical supply chain in how it cuts out middlemen and the possibility of overuse of inventory, excessive warehousing, and unnecessarily long distribution chains. All of these things have made it to where all the states in the US are administering above 65% of their vaccines given to them, and that at least 60 million people in the US have gotten their first dosage of any of the three currently approved vaccines. It is a marvel and a testament to how well logistics can work towards a goal when a crisis occurs and will for sure be a case study in colleges or board rooms as to importance of logistics not only in everyday life but also in global or national crises.