ALLOCATING COVID-19 VACCINES WITH ECONOMIC CONSIDERATIONS

Kirsten Axelsen[1,9], Rajini Jayasuriyai [2,9], Kenneth I. Moch [3,9], David Addiss, MD, MPH[4,9], James V. Lavery, PhD[5,9], Stephanie D. Adams, PhD[6,9], Fatima Paruk, MD, MPH[7,9], Robert F. Breiman, MD[8,9], and Russell M. Medford MD, PhD [9,10,11,12].

[1] Senior Policy Advisor, Charles River Associates based in New York
[2] Senior Associate in the Life Sciences Practice at Charles River Associates, Washington DC office
[3] Senior Advisor to the Chairman of the Center for Global Health Innovation, Atlanta, GA
[4] Director and Founder of the Focus Area for Compassion and Ethics at the Task Force for Global Health, Decatur, GA
[5] Conrad N. Hilton Chair in Global Health Ethics, Department of Global Health, Rollins School of Public Health, Emory University, Atlanta, GA
[6] Director of Life Sciences, Global Health Crisis Coordination Center – a division of the CGHI, Atlanta, GA
[7] Director of Clinical Data & Innovation, McKinsey & Company
[8] Chief Scientific Officer, Global Health Crisis Coordination Center, Atlanta, GA
[9] Member of the Vaccine Economics and Equity Group of the Center for Global Health Innovation
[10] Chairman, Vaccine Economics and Equity Group of of the Center for Global Health Innovation
[11] Chairman, Center for Global Health Innovation, Atlanta, GA
[12] Chairman and CEO, Covanos, Inc.

Allocating COVID-19 Vaccines with Economic Considerations

Biopharmaceutical companies are racing to develop vaccines for COVID-19. On the assumption that one or more vaccines will be approved, multiple frameworks[i] are being developed to guide their ethical allocation. However, even with intense parallel efforts to scale up production while clinical development is ongoing, it is unlikely that there will be sufficient supply to reach all people in the U.S. in a short period of time. Equally problematic is the requirement for temperature-controlled storage for several of the experimental vaccines, which has the potential to limit the breadth of distribution to less well-served populations.[ii]

Building on its mission to address complex public health issues, the Center for Global Health Innovation (CGHI) asked Kirsten Axelsen and Rajini Jayasuriya of Charles River Associates (CRA) to co-develop, with the CGHI's Vaccine Economics and Equity Group (VEEG), a white paper that outlines a CGHI Framework for COVID-19 vaccine allocation under conditions of scarcity that considers core public health and ethical principles in the context of optimal benefit to the U.S. economy.[iii]

Any vaccine allocation framework should consider the risk of exposure, morbidity, or death, and how that varies among individuals, particularly in the case of COVID-19 which has had a disproportionate impact on certain populations.[iv] Equally, re-starting the stalled U.S. economy will require people to feel confident working, buying goods and services and interacting socially. People who are at low risk of mortality from COVID-19 remain at a yet to be fully quantified risk for long-term consequences, as well as being agents for viral transmission to those at high risk of mortality. Those that cannot socially distance in their place of work are bearing significant costs, to themselves and the economy, due to the pandemic. These ongoing personal and societal costs need to be considered.

This framework seeks to allocate vaccines to stimulate U.S. economic growth by reducing unemployment and increasing productivity while limiting harm from the pandemic. Beyond the mechanism for allocation, there are many policies and activities that must be undertaken to maximize the health and economic impact of a potential vaccine. These include ensuring that:

- The allocated vaccine supply is stored correctly and used appropriately;
- Real-world data are collected to monitor the health impact of the vaccine, including effectiveness and adverse reactions, particularly in high-risk individuals and underserved populations, to promote long term confidence in the vaccine;
- Information is provided by reliable and trusted messengers; and
- There is ongoing fiscal support to the individuals and industries that are seriously economically impacted and are not prioritized for vaccine allocation in the near term and where work cannot be done remotely.

These complementary policies will contribute to confidence in the vaccine that is critical for its near-term success.

Limiting the Harm Of the Pandemic

Prioritizing the population at the highest risk of mortality is a core value in the ethics of healthcare and vaccine distribution.[v,vi] The first objective of ethical vaccine distribution and other public health measures should therefore be to limit the harm of the virus to those most at risk of near-term mortality, considering the vaccine, personal protective equipment (PPE) and social distancing as control options. Targeting high-risk groups including those with underlying medical conditions will need to be paired with efforts to build confidence in the vaccine. Other vaccines which target adults, such as for pneumococcal disease, have been shown to have lower rates of efficacy among older people.[vii] Should this be the case for the initial COVID-19 vaccines, then social distancing and the use of PPE encouraged through public education measures, would still be appropriate until there is sufficient vaccine to achieve broad herd immunity to protect those most at risk.

The identification and prioritization of high-risk groups should consider the disproportionate impact of highly prevalent chronic diseases (HPCDs) such as hypertension, heart disease, obesity and diabetes on healthcare costs, economic productivity and the morbidity and mortality outcomes of COVID-19. To place this into an economic context, 86% of all U.S. healthcare costs are driven by citizens who have multiple chronic conditions. Of the people over 65 who were hospitalized with COVID-19, 78% had hypertension and more than 60% of all hospitalized adults had three or more chronic conditions.[viii]

The economic and societal benefits of targeting high-risk groups have been demonstrated in regards to influenza and pneumococcal vaccination.[ix,x] In the case of COVID-19, this would ensure the scarce supply of hospitalization resources can be used to address those with COVID-19 and other healthcare needs. With respect to the current pandemic, confidence in re-starting the economy will be greater if those most in danger and those who cannot social distance are protected through the vaccine. The elderly may regain independence and contribute to the economy through their own purchasing power. In any framework of vaccine distribution, populations at high risk of mortality should be prioritized particularly if social distancing is not possible, not only to align with the core values of ethical healthcare distribution but also to ensure the indirect stimulation of the economy.

Prioritization by Job Function and Health Risk

In a pandemic some jobs can be productively done remotely or with social distancing, while others cannot. To invigorate a stalled economy, a key component of the "reopening prioritization" requires a cost/benefit evaluation of the level of transmission risk based on the nature of work, including:

- If the work relies on proximity to other individuals;
- If a job allows those to work who otherwise may need to be at home for caregiving and schooling purposes;
- The value of the industry in creating other jobs (this should consider the knock-on impact on further job creation, which is often described as an employment multiplier effect); and
- If the work is instrumental to reducing disease transmission or mortality.

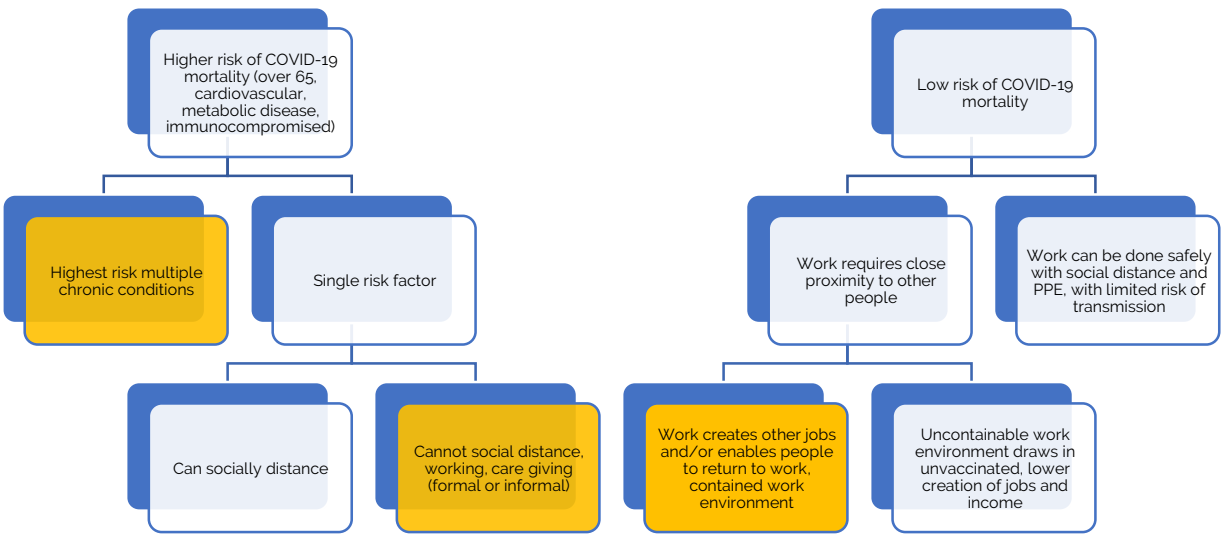
The Work and Risk Allocation Framework described below considers: (1) the opportunity costs of alternative approaches to managing the risk of COVID-19 without a vaccine and (2) the value of vaccines in facilitating economic activity. More specifically, this framework takes into consideration:

- Intensity of the health and mortality risk to the individual from contracting COVID-19;
- Differences in work productivity and COVID-19 transmission with and without measures beyond personal protective equipment (PPE) and social distancing;
- The impact of COVID-19 on employment and the lag in recovery of employment after the vaccine is widely available and administered; and,
- Wider benefits to the U.S. economy

The suggestion that distribution of vaccines includes the prioritization of populations who are at risk of exposure and contracting a virus in their line of employment is not new and has previously been suggested in regard to the influenza pandemic.[xi] However, the criteria for allocation based on the type of work, the value of the industry to the economy and the need to be proximate can be further evaluated and refined.

The CGHI Work and Risk Allocation Framework below graphically depicts a methodology for allocating a COVID-19 vaccine based on the type of work, the economic benefit of the work and the person's risk profile for contracting COVID-19 and experiencing death or serious illness as a result. We recommend further prioritization within job and risk subtypes, as described in greater detail later (orange=priority).

CGHI Work and Risk Allocation Framework



This Framework can be further refined into a multi-criteria approach with scores allocated for different components. Based on the industries in a particular state and the job requirements, more specific criteria can be pre-determined by assessing benchmarks such as the need to be proximate within each industry and the importance of the role to re-starting the sector and thus the economy.

Taking into Account Transmission Rates and Opportunity Costs

It has been widely documented that healthcare providers are at elevated risk and it follows that they should be prioritized for vaccination.[xii] From an economic perspective, protecting healthcare workers has its own multiplier effect, as it facilitates care being provided to others, protecting limited healthcare resources and mitigating the impact of the pandemic.

However, even among healthcare workers, there are differences in risk and approaches to managing this risk. When the vaccine is in limited supply, there should be sub-prioritization based on the amount of time and contact required for patient care and the abilty to effectively use PPE. For example, healthcare workers who have extended contact with high-risk people (bathing, feeding and other activities) where PPE may be not be an effective protective measure should be prioritized for a vaccine. Health workers who are at higher risk of exposure to a patient with COVID-19, such as those that work in an inpatient setting or a nursing home, in particular nurses and staff who spend a longer amount of time touching patients, would also fall into this prioritized category.[xiii] To emphasize the risk of transmission to the vulnerable elderly, it was recently estimated that COVID-19 infection in nursing homes could have been reduced by 44% if there had not been shared healthcare staff traveling between mulitple nursing home sites.[xiv]

The slow but steady revival of elective procedures has shown that medical offices and hospitals have been able to use PPE effectively to limit transmission to rates similar to the general population.[xv] Whenever possible, in an environment of scarcity, institutions that have demonstrated an abilty to reduce transmission with PPE and social distancing should continue those operations, particularly while the demand for vaccines outpaces the supply.

The group at high risk of mortality from COVID-19 can also be subdivided for vaccine priortization based on their need to contact other people to remain healthy, or to care for others. For example, high risk people who require care in nursing homes and those who have conditions that require an unplanned trip to a hospital, such as sickle cell disease or hemophilia, would be prioritized, subject to any safety issues or contraindications for receiving the vaccine. High-risk individuals who can socially distance and use PPE should continue until there is sufficient supply; older non-working adults who can remain healthy without regular interaction could fall into this category. This approach would free up vaccine supply for workers who have a greater multiplier effect on the economy and are at lower risk of mortality but higher risk of transmission, and still ensure the highest risk people are protected.

Jobs Have Different Value to the Economy

Economic activity in different industries has different effects on job creation, both directly and indirectly through a multiplier effect. Industries differ in the job creation generated by their expansion, with respect to supply chain impacts and through purchasing power generated by the wages paid. In general, jobs that require labor-intensive inputs or have higher wages tend to have a larger effect on creating other jobs in the economy, also called the "employment multipler". The table below shows the industries that account for approximately 90% of the U.S. Gross Domestic Product (GDP), the number of people employed and the effect that industry has on creating other jobs. These eleven industries account for 136,000,000 jobs in the U.S.[xvi]

The relative contribution of industries to the broader U.S. Economy, based on GDP and jobs

Industry	Value of industry as a percentage of U.S. GDP 2019 Q4 (a)	Thousands of U.S. jobs in 2019 (b)		Number of additional jobs created for every 100 jobs in industry group (c)	
Financial activities (Insurance, real estate, rental, and leasing)	21.2	8,746	*	364	***
Professional and business services	12.7	21,313		418	****
Government (Federal and Local)	12.3	22,593		not provided	
Manufacturing	10.9	12,840		744 (durable), 514 (non-durable)	
Health care and social assistance	7.5	20,413		206	
Wholesale trade	5.8	5,903		235	
Retail trade	5.4	15,644		122	
Information	5.3	2,859		573	
Leisure and Hospitality (Arts, entertainment, recreation, accommodation, and food services)	4.2	16,576	**	378 (arts, entertainment), 161 (accommodation and food services)	
Transportation and warehousing	3.3	5,618		276	
Educational services	1.3	3,765		194	

(a) Bureau of Economic Analysis October 2020

(b) Bureau of Labor Statistics

*estimate includes jobs in finance only

**leisure and hospitality in Bureau of Labor Statistics

(c) Economic Policy Institute, matched industry by name but differing organizations may use different classifications

*** estimate for Finance and Insurance Only

**** Professional, scientific and technical services

Sources: Bureau of Economic Analysis,[xvii] Bureau of Labor Statistics,[xviii] Economic Policy Institute[xix,xx]

There is a need to trade-off the importance of the sector regarding job creation and the generation of economic activity with its ability to use social distancing and PPE to control viral transmission. Much of the work in the two largest industries, that account for 34% of GDP, may be done with social distancing. These industries are also large job creators both directly and indirectly. Other work may be more challenging to do with social separation and PPE, such as manufacturing. Within an industry there may be sub-sectors more amenable to the use of PPE and social distancing and that create more jobs.

Furthermore, there are industries that are critical to allowing others to return to work, including education and healthcare. Sub-population prioritization within such critical industries may be possible. For example, secondary school education may be more feasible with social distancing than elementary education. Having young children attend in-person schools allows parents to work more productively, while parent participation in the workforce is relatively unaffected if college-age students meet online. Daycare centers are similar to elementary education in their multiplier effect on productivity. Reducing transmission through vaccine allocation for formal and informal providers of young child care and education would thus be likely to have a meaningful economic impact and should be a priority to allow others to return to work.

Workplaces Which Would Maximize the Value of the Vaccine to Society

Even if the vaccine or vaccines are highly efficacious, until there is sufficient supply of and adequate distribution/storage protocols for COVID-19 vaccines, there is a low likelihood of achieving broad herd immunity in the U.S.[xxi,xxii] Additionally, the lower the effectiveness of a vaccine, the lower the impact of immunization on herd immunity. When allocating vaccines, it is therefore important to consider not only the individuals vaccinated but also the likelihood that restarting a specific industry will bring together others who are not vaccinated, resulting in increased transmission, thereby slowing productivity and reducing consumer and worker confidence.

For example, manufacturing, warehouse work, health care and education are environments that can be relatively contained via testing and vaccination requirements for individuals who enter a space where contact is required, coupled with continued social distancing and masking whenever possible. In other environments, such as live theater or restaurants, vaccinating workers would not necessarily reduce transmission, since non-vaccinated people would be brought together when the establishments re-open. While the vaccinated individuals would be protected, the susceptibility of the unvaccinated patrons would reduce the benefit of allocating vaccine to that industry. This would suggest a greater focus on vaccine allocation to manfacturing and warehouse workers for example (which can be contained and cannot be done virtually) and continued fiscal support for the arts and entertainment industries until there is sufficent vaccine supply.

Thus, to the extent that distribution decisions are able to be made based on economic impact, vaccines should be allocated to industries where there are a high number of jobs that create other jobs, where PPE and social distancing are not feasible, provided that it is possible to ensure that the vaccine is used to reduce transmission within the vaccinated workers and unvaccinated individuals would not be drawn into proximity with the industry.

Prioritization Based on Likely Take-up and Collection of Data

The allocation mechanism should also consider likely take-up. For example, there is significant variability between states and populations in vaccination rates for influenza[xxiii] and other diseases.[xxiv] While there are differences in trust and risk factors that influence vaccination rates, states can elevate vaccination rates through several policies, including providing convenient and trusted avenues for vaccination and other incentives such as requiring education before allowing an individual to opt out of the vaccine.[xxv,xxvi]

A significant effort focused on the collection of data and evidence on the vaccines would help address misinformation, which is a major risk to the uptake of vaccines. Consideration should be given to creating registries and other data tracking mechanisms, refining the capacity to analyze health data. Any prioritization scheme for the use of limited supplies of vaccine that does not address the critical issues of vaccine safety and effectiveness (by discrete populations defined by age, socio-economics, co-morbid conditions, etc.), logistics, compliance, public attitudes and trust, negatively impacts the goal of gaining control of the pandemic through population immunization and represents a lost public health opportunity that will cost lives and delay economic recovery.

Mitigating the Differential Impact on Low-Income People and Diverse Communities

A vaccine allocation framework should also address issues arising due to income and inequity. There is a growing body of evidence that there are differences in race and ethinicity that influence the likelihood of contracting COVID-19 and the probability of related mortality, with a particularly high impact in Black, Hispanic and Native American populations.[xxvii,xxviii] Furthermore, people in the lowest income quartile in the U.S. have experienced the greatest job loss and largest decline in spending power compared to the start of 2020, while higher wage employment groups are largely back to pre-pandemic levels. For example, employment was 16.2% lower for workers making less than $27,000 a year in the U.S. in August 2020 compared to January 2020, while employment was down only 1.6% for workers making over $60,000 a year in that same time period.[xxix] Many of the vaccine allocation recommendations described in the CGHI Framework are de-facto targeted at lower income employment groups (working in home health care, day care) and low- to middle-income workers (manufacturing). The focus on high- risk individuals and proximate workplaces should help to ensure lower income and Black, Hispanic and Native American communities are prioritized.[xxx]

It will be important to consider not only the near-term economic damage of the pandemic but also the long-term impact.[xxxi] It is clear that economically disadvantaged population groups have higher morbidity and mortality from many diseases including COVID-19; it is equally clear that the many underlying causes of healthcare dispartity will not be easily solved. To the extent possible, the distribution of pandemic vaccines should not be a further contributing factor to the economic, health and healthcare disparties that these disadvantaged and underserved populations face.

Key Points and Recommendations

1) The rate at which the U.S. economy recovers is dependent upon the rate at which objective progress is made in controlling COVID-19 through continued emphasis on public health measures including social distancing, PPE and the use of vaccines.
2) An effective vaccine distribution strategy must take into account core public health and ethical principles as well as economic principles.
3) From a public health and economic perspective, the groups at highest risk of mortality should be prioritized. The allocation to highest risk groups, based on age, co-morbidities and the preservation of a working healthcare system, is consistent with an allocation mechanism focused on economic benefit during a period of limited vaccine supply. Effective vaccine distribution strategies must consider ethical principles as well as economic ones. At the same time, the development of empirical models that are sufficient to inform policy recommendations will be critical.
4) Vaccine allocation to working individuals with lower mortality risk should take account of the value of the job to the economy (including the degree to which a sector facilitates the employment of others, for example schooling or care provision that would allow others to return to work, and the employment multiplier effect), and the need to have proximity to other individuals to do the work effectively. Even within industries, sub-prioritization should occur with priority allocated to jobs that require greater proximity and/or allow others to work more productively. Both formal and informal workers should be considered.
5) Care should be taken to not re-open sectors of the economy that bring unvaccinated individuals together, particularly under the auspices of economic growth, unless there are processes in place to reduce the risk of transmission (testing, social distancing, masks, ability to contact trace); otherwise this has the potential to do more harm than good.
6) Credible reliable data about the vaccine, its effect on sub-populations and its long-term efficacy are critical to correcting misinformation and building confidence. This suggests prioritizing allocation to areas where efforts to increase take-up of the vaccine will be effective and where data can be collected. It is important that real world performance of the vaccine be monitored.

The views expressed herein are the authors' and not those of Charles River Associates or any of the organizations with which the authors are affiliated.

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