

Introduction to Course Vaccine Economics for COVID19

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TVEE
TEACHING VACCINE
ECONOMICS EVERYWHERE

Outline

- Section A: Goals of this course
- Section B: COVID19 Vaccine Supply Landscape
- Section C: COVID19 Demand Landscape
- Section D: Problems that this course will address

Section A

Goals of this course

Course Goals and Rationale

GOALS

- **Depict critical choices & tradeoffs**
 - Focus on choices by countries
- **Quantify:**
 - Costs of vaccine choices
 - Benefits of vaccine choices
- **Application:**
 - Immediately use new skills

RATIONALE

- Economics-the science of choices
- Data
 - Inform choices
 - Highlights knowledge gaps
- No time to lose

Goal 1: Critical choices

- **Elements of a science of choice**

- Coherent stable goals
- Coherent understanding of consequences
- Opportunity costs
- Uncertainty

- **Cost-effectiveness principles**

- Applying cost-effectiveness
- Context matters

- **Choices in Vaccine Supply**

- Global
 - Discovery, Production, Distribution
 - Fairness
- National
 - Costs
 - Priority Allocation
 - Fairness

- **Choices in Vaccine Demand**

- Costs to consumers
- Complex Incentives for consumers

Science of Choice

One cannot make a choice if the goal is not set

- Collective goals conflict with personal sacrifices and costs
- Personal sacrifice for what?

→ Must state goals and get agreement

One cannot take action if the consequences are unknown

- Mental models, Mathematical models, Evidence and how to use it
- How wrong can models be

→ Must share models of consequences and their limitations

Goal 2: Quantify

- Costs of COVID-19 Vaccine Choices
 - Doing thing X means cannot do thing Y
 - Tracking monetary costs
 - Tracking opportunity costs
- Who bears COVID-19 Vaccine Costs?
 - Global community vs. nations
 - Government vs. citizens
- Benefits of COVID-19 Vaccine Benefits
 - Sub-groups differ in benefit, accessibility, demand, motivations

Science of Costing

- Identify relevant costs
- Develop a plan to measure costs and who bears them
- What data needs to be collected as a priority

Goal 3: Applying Principles

- Course project—Students identify a COVID-19 Vaccine Choice
- Design an achievable project to inform this vaccine choice
- Propose a workplan to produce needed information

Student Projects

- Relevant to vaccine policies in 2021
- Achievable in 1-2 months
- Applies methods of costing, economic evaluation, data

EXAMPLES Things to measure

- Costs of reallocating or expanding cold-chain
- Costs of retooling digital vaccine information systems
- Costs of outreach to vaccine hesitant groups
- Population sizes of high risk and low risk groups
- Size of COVID-19 vaccinator workforce
- Lessons learned from 2020 Flu Campaigns for 2021 COVID campaigns

Project Details

Step 1— Two half-page concept notes for 2 good ideas

Discuss with instructors for feasibility, salience, impact

Step 2—Two page workplan of methods to make the economic model, collect the data, analyze data, present findings

Discuss with instructors for troubleshooting

Step 3—Five page proposal with 10 slide powerpoint

Present to fellow students

OK to work in groups (encouraged)

Section B
COVID19 Vaccine Supply
Landscape

Vaccines and Herd Immunity

Herd Immunity for COVID-19 needs 60-70% to be immune

Either by recovering or getting vaccinated.

Vaccines not too helpful after a patient's recovery

Vaccines that just prevent severity won't help herd immunity

FDA standards say a vaccine needs to be at least 50% effective vs placebo

Vaccine Trials

Phase	Name	Reason	<u>Costs</u>
Phase 1	Safety Trials	Is it safe in 10-20 humans? What doses?	\$4 million
Phase 2	Expanded Trial	Does impact vary across 100-200 humans?	\$13 million
Phase 3	Efficacy Trial	Is it more effective than placebo in 10,000s of humans?	\$20million

Odds of failure highest in phase 1. Lower for phase 2.

6% of vaccine candidates traditionally make it to market

R and D costs of discovering one new profitable vaccine ~ \$1 billion in costs of failed trials

COVID-19 Vaccines (Oct 2020)

- 149 Candidates in Pre-Clinical
- 38 Candidates in Clinical trials in US, Europe, China
- Russia has approved a vaccine that has not completed Phase 3
- US has 4 in Phase 3 Trials
 - Johnson & Johnson JNJ-78436735
 - Moderna/NIAID mRNA 1273
 - University of Oxford/AstraZeneca AZD1222
 - Pfizer and BioNTech BNT162

Vaccine Candidate Examples

Phase	Candidate	Finances	Doses Promised	Tech
3	Moderna/NIAID mRNA 1273	\$1.5 billion	100 million	mRNA
3	Pfizer and BioNTech BNT162	\$1.95 billion	100 million	mRNA
3	Johnson & Johnson JNJ-78436735	\$1 billion	100 million	Adenovirus Vector
3	University of Oxford/AstraZeneca AZD1222	\$1.2 billion	300 million	Adenovirus Vector
3	Novavax (protein adjuvant)	\$1.6 billion	100 million	Protein adjuvant
1/2	GlaxoSmithKline and Sanofi	\$2 billion	100 million	Protein adjuvant

mRNA vaccines require 2 doses and require -80 degree freezers

Investments

- Financing needed for pre-clinical and clinical trials
- Financing to prevent manufacturing bottlenecks
 - Typically discover first, build plant second
- With COVID-19 Vaccines Public Funds to Build Plant Capacity Now
 - Automated filling machines
 - Training factory workers
 - Setting up ingredients supply networks for pre-chemicals, vials

Advance Market Commitments

- Coalition for Epidemic Preparedness Innovations (CEPI) and GAVI the Vaccine Alliance jointly started COVAX in 2020
 - COVAX facility is [pooling nations](#) to offer money now, vaccines later for member countries
 - COVAX is raising \$16 billion over 18 months to secure 2 billion doses
 - Self-financing members pay in and get a guarantee of enough vaccine for 20% of their population
 - 92 low income countries accumulating a fund of \$2 billion by donors to achieve equivalent access—“no one is safe until everyone is safe”
- US government’s “Operation Warp Speed” has already invested \$10 billion to in vaccine R and D in exchange for guaranteed doses
- US politicians expected to allocate to America first
- US has not joined COVAX, but National Academy of Science unanimously recommends joining

Where supply ends

- The supply problem ends when the transport plane lands
- Yay—now we have 10 million doses of safe and effective COVID-19 vaccine at the airport!
- Now what?



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Supply choices in countries

- When to use private sector workers in COVID-19 vaccine delivery?
- What will new cold chain plans look like?
- How to track coverage in real time?
- How to communicate and engage communities about the new vaccine?
- How to train the existing workforce?

Financing

- Adding this new COVID-19 Vaccine will cost resources?
- Advocacy means knowing what the costs will be and who will bear them
 - Will the costs be borne fairly by those who will benefit?
- How to get the most benefit from COVID-19 vaccine delivery choices

Section C
COVID19 Vaccine Demand
Landscape

Demand

- Interest in a safe effective vaccine for COVID-19 is very high
- Benefits of being vaccinated differ across groups
 - Highly vulnerable groups who have high mortality
 - People with 2 or more comorbidities cancer, kidney disease, COPD, obesity, heart failure, type 2 diabetes
 - Workers who have high exposure rates
 - Frontline health workers
 - Clinical workers in hospitals, clinics, long term care
 - Non clinical workers in health care who are exposed
 - First responders: Emergency medical personnel, police, firefighters,
 - Older adults above 65
 - In group living
 - In community
 - Teachers, School staff,
 - Other workers essential to functioning of society who have high exposure eg food workers, coal miners,

Reaching People

Routine vaccine delivery systems around the world have had a focus on children

Some flexibility to respond to new populations for H1N1, Ebola

But now have to deliver COVID-19 Vaccine and not spread

Traditional SIA's need adaptation

Social distancing and lockdowns have produced vaccination backlogs

Building Trust

- Polarizing politicians have tied the vaccine to their regime and to nationalism
- Worries about safety because of accelerated development
- Worries about safety because of need to go to a health setting
- The role of “stories” and “brands” and “motivation”

How money can address vaccine hesitancy

- Building relationships via civil society, faith community, local leaders
- Talking to people and hearing their concerns
- Being transparent about questions and answers
- Deploying existing tools of comprehensive primary health care

And also maybe...

- Cash transfers too
- Enforceable mandates (if democratically and socially supported)

Fairness Under Shortage

- There won't be enough vaccine for everyone in month 1
 - Might take a year or more in some settings
- Need Phases
 - Consensus that Health Worker Phase and High Risk Patient Phase 1
 - Phase 2 priorities need to be locally worked out
- Geography
 - Unclear whether to tackle all places at once or tackle easier places first

Equity Efficiency Tradeoff

- Should we do these at the same time with a budget of \$100 million?

Difficult to Reach Area	Easy to Reach Area
1 million people in a remote jungle having a civil war	10 million people in a city with modern roads
Delivery costs \$100 per dose	Delivery costs \$10 per dose

Section D

Problems to Address

Choices abound

- Need to focus our efforts

Specific Question of Choice.. Do A or Do B

The answer should not be obvious

Data on costs and consequences of A and B should be attainable

Stakeholders should be reachable

- Need Speed
 - People need answers right away
 - Developing cost and impact models that can be rapid

Example 1: Cold Chain Costs

- What will it cost to add COVID-19 to the cold chain?
- Step 1—find data on square meter capacity of current stock
- Step 2—find data on utilization of current cold chain stock
- Step 3—find current costs per square meter
- Step 4—make a model of various COVID-19 vaccine candidate cold chain requirements
 - Single dose vials
 - Multi-dose vials
- Step 5— Produce model of costs to add 1 million new COVID-19 doses

Example 2: COVID-19 Vaccine in an SIA

- Step 1— Make a model of the new features required to keep health workers and patients protected in and SIA
 - What PPE?
 - What facilities?
 - New personnel to communicate safety protocols
 - New personnel to supervise protocols
 - Pilot testing new protocols
- Step 2—Derive data on unit costs of ingredients
- Step 3—Multiply costs times numbers of units

Example 3: COVID-19 Vaccine Tracking Costs

- Step 1 Examine current performance of vaccine information system.
- Step 2 Interview VIS workers about adaptation costs
- Step 3 Identify gaps in coverage of VIS that new application of COVID-19 might worsen
- Step 4 Make model of ingredients for VIS upgrade
- Step 5 Apply unit costs to the model

In this course...

- During Unit 1 students will brainstorm choice problems for COVID 19 vaccine that need to be informed.
- Nominate 2 possible applications in 200 word problem statements
 - What is the choice problem?
 - Who needs to decide?
 - What do they need to know?
 - How feasible will your model be?
 - Where will data come from?

What is ahead?

- Unit 1: Intro to principles of vaccine economics
 - Models of Choices
 - Models of New Vaccine introduction
 - Financing for COVID-19 Vaccines
- Unit 2: Costing immunization programs
 - How to acquire cost data
 - How to make a cost model
- Unit 3: Economic Evaluation of Vaccines
 - Introduction and Scope
 - How to measure and value health outcomes
 - Designing an economic evaluation and making a decision tree
- Unit 4: COVID 19 Vaccine applications

Summary

COVID-19 Vaccines are coming—many are promising enough to get to Phase 3 trials

Hard choices will be necessary with tradeoffs

Best choices will deliver most benefit for least cost

Supply side efforts focused on getting a vaccine discovered and produced

Urgent need to make good supply side choices after the airplane lands

Urgent need to support vaccine demand after local supply sets up

Shortages are definitely coming

Fairness and transparency need to be built now