R13 - U.S.-Mexico Risk Taskforce to Support the Health Supply Chain Systems for Infrastructure and Workforce Threatened by the COVID19 Pandemic

Monthly Risk-Bulletin   December 2020

The objective of the Monthly Risk-Bulletin is to provide an overview a) of lessons learned during the past month in the project, b) of a score-card-type system to communicate the state of risk of supply chains impacted by COVID-19 supporting health infrastructure and the workforce between the U.S. and Mexico, and c) of a communication system to facilitate the restoration of broken supply chains and the formation of new ones to reactivate trade between U.S. and Mexico. The report aims to offer valuable insights to the general public and decision-makers towards informed preventive actions to reduce the current pandemic's potential impact on critical supply chains and better strategize about feasible social, economic, and environmental risk-mitigating actions against COVID19 and converging threats. This bulletin is jointly produced by the project's PIs, the project's contractors, and the U.S. binational task force serving as advisors to the project.

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I. Introduction

This risk bulleting report provides an overview of the project status, general objectives, and the most important initial lessons learned during the last period of covered performance. The main objectives of this project are support all health supply chain systems for both infrastructure and workforce, and to do it accounting for the inherent cultural regional differences, and considering the current and emerging regional social, economic and environmental risks. As a reference for the publication of the Risk Bulletin, the three main milestones of the project are:

1. Integrate a triple-helix binational taskforce comprised of representatives from academia, industry, and government from the U.S. and Mexico. Address the public health impacts of the COVID-19 pandemic on the U.S. – Mexico health supply chain systems for health infrastructure and for the health of the workforce, considering current and emerging regional social, economic, and environmental Risks.
2. Develop a data-lake platform concentrating near real-time analytics following a risk system approach that can provide strategic information about the evolution of COVID19 and related current and emerging threats, the state of vulnerability of the health supply chain systems and the likely impacts a combination of these may cause to society, the economy and the environment.
3. Publish a monthly U.S.-Mexico COVID-19 Risk Bulletin to provide scientific, technological, and strategic cultural support to secure the operation of the U.S.-Mexico health supply chain systems.

II. Project Status & Lessons Learned

Milestone & Activity	Lesson Learned	Type
Milestone 3: Data-Lake		**Research**
Milestone 4: Risk-Bulletin		
Dr. Gonzaléz-Farias, Director of the Mexican Center for Research in Mathematics (CIMAT) of the taskforce members presented in the CBTS Distinguished speaker series	The Mexican Government started basing their projections based on a COVID-19 dynamic model based on the Gompertz function and previous research at a national level. The model eventually evolved into a more refined and targeted at a county-level modeling effort lead by Dr. Gonzaléz-Farias (Corona et al., 2021; Martinez-Hernandez et al., 2020; Peraza-Garay et al., 2020). - On May 6th, 2020 CIMAT's team reported to the federal government an estimated maximum number of cases of ~420,000 o As of Dec. 16th, Mexico has had more than 1 million confirmed covid-19 cases - According to the initial model the daily cases peak was expected on June 24th, 2020	

o The Mexican's government disclosed this date to the general population months before relaxing social-distancing measures

Mexico was only taking into account test and cases coming from public hospitals, so it was a subset trying to capture the dynamics of the pandemic's superset. The policy was later relaxed to include tests and cases from private certified laboratories and hospitals.

- The forecasting model was improved by introducing Bayes principles and using log-normal distribution to capture the dynamics of each state starting in June and provided a better approximation for each Mexican state in July 2020.
- These forecasting models used to be published at the official CONACyT's coronavirus dashboard but were later removed.
- Further improvements to the model came in the form of incorporating a social mobility index with a parsimonious model. This version provided a much better fit to observed data. However, it needed too many parameters to provide a good fit to the whole population. So, different coefficients of the model had to be used for each geographical region.

Finally, the current model resembles a dynamic compartmental model, which also includes time variation.
- For each age group, the are four levels of infection parameters:

1. Asymptomatic
2. Infected,
3. Mild at home
4. ICU

- The model forecasts:
    a. Recovered cases
    b. Deceased cases
    c. Remaining susceptible population

Mexico is assuming no reinfections, so the susceptible population will decrease, leading to a decrease in R_t

The official reported number of deaths due to COVID-19 in Mexico is approximately 45.74% lower than CIMAT's

	best estimates. They are working on a spatial model to describe the risk of mortality at the county level - GNP, health, resources, hospitality facilities, and others When it comes to the correlation of mobility and decreased transmission. CIMAT observed that mobility per se becomes less significant; it's the time varying mobility dynamics that proved to be more impactful.	
Risk model development and validation process	A 10-minute survey exercise was conducted to receive feedback from the Taskforce members by ranking the importance of variables for the model validation process	
Used Risk-Model V1.0 to run several 'Test-Case Scenarios' with successful outcomes in terms of variables identification, dependencies, and flow of events qualitatively.	Continued proving the feasibility of the V1.0 risk model following our risk-framework 1. Case Scenario 1: PPE shortage 2. Case Scenario 2: Medicines supply chain disruption 3. Case Scenario 3: Covid-19 spread in Mink farms 4. Case Scenario 4: Migration caused by natural threats 5. Case Scenario 5: PPE and Customer Satisfaction in Mexico 6. Case Scenario 6: COVID-19 Spread, and Health Workers Deaths in Mexico	
Risk model development	Added new Anthropogenic Threats, Health System Variables, and one state of risk from qualitative test-cases scenarios and literature review.	

Defined 4 Research problems to incorporate into our Data-Lake System	Each research problem will follow the scientific method, and concrete objectives definitions. The objective is to 1) identify sources of evidence, 2) categorize them into our risk-based framework components, and 3) coordinate with subcontractors for data ingestion, curation, and analysis.
	
	The research problems are:
	Health Infrastructure
	    Research Problem 1: COVID-19 Vaccination
	    Research Problem 2: PPE Shortage
	Health Workforce
	    Research Problem 3: Healthcare sector
	    Research Problem 4: Auto Manufacturing Sector	

Identified HS Codes related to COVID-19 Vaccines	HS Codes are used to classify imports and exports worldwide for taxation purposes and provide useful information about the current demand and supply chain infrastructure. See Table 1 for a breakdown of the most critical categories of codes related to COVID-19 devices and imports.	

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Key Findings from Literature Review

An example of initial findings from the vaccination research problem literature review is shown in Figure 1
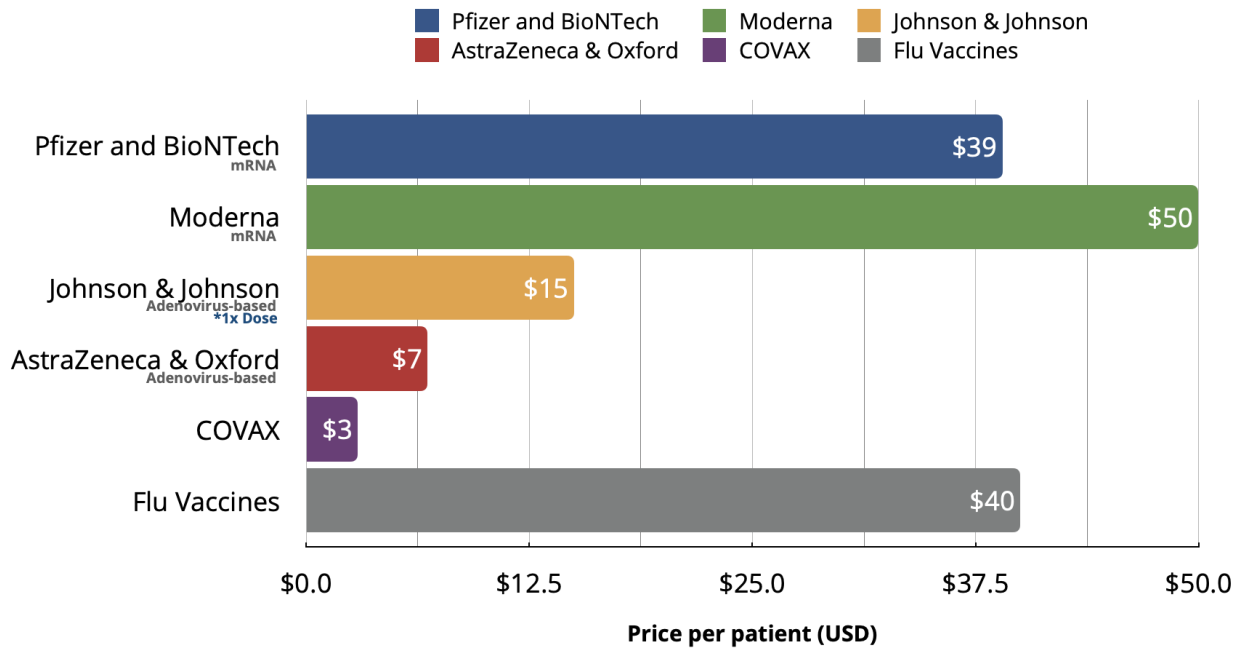

Figure 1.- Approximate wholesale prices listed by vaccine manufacturer (Cohen, 2020; Dooling, 2020; Dooling et al., 2020; Lewis, 2020; Nature, 2020; Quentin, 2020; Ries, 2020; Romero, 2020).

Table 2. Identified COVID-19 Related Goods World Customs Organization joint report classification and U.S. Imports and Tariffs COVID-19. (Updated June 2020 & May 2020)(WHO/WCO, 2020).

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Category	HS Codes	Category	HS Codes
COVID-Test Kits	4	Oxygen Therapy Equipment	10
Protective Garments	26	Other medical devices	15
Disinfectants and sterilization products	15	Other Medical Consumables	21
Vehicles	4	Other	6
Total			101

Category	HTS Codes	Category	HTS Codes
COVID-19 test kits/testing instruments	6	Non-PPE medical consumables and hospital supplies	19
Disinfectants and sterilization products	9	Personal protective equipment	27
Medical imaging, diagnostic, oxygen therapy, pulse oximeters, and other equipment	22	Medicines (pharmaceuticals)	20
		Other	9
Total			112

Table 2. Identified COVID-19 Related Goods World Customs Organization joint report classification and U.S. Imports and Tariffs COVID-19 - Updated June 2020 & July 2020 (Cohen & van der Meulen Rodgers, 2020; O'Laughlin, 2020)

Product	Description	HS Code	HTS Code
Needles			
	Syringes, with or without needles	9018.31	

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	Description	Code	Sub-description	HTS Code
	Other articles of plastic, not elsewhere specified or included			9018.31.0040
	Tubular metal needles and needles for sutures	9018.32		
	Needles (except for tubular metal needles and needles for sutures), catheters, cannulae and the like	9018.39		
	Tubular metal needles and needles for sutures and parts and accessories thereof			9018.32.0000
	Non-PPE medical consumables and hospital supplies	3926.9		
	Other articles of plastic, not elsewhere specified or included			3926.90.9990
Syringes	Hypodermic syringes, with or without their needles			9018.31.0080
	Other syringes, with or without their needles, not elsewhere specified or included			9018.31.0090
	Parts and accessories for syringes, with or without their needles			9018.31.0090
	Non-PPE medical consumables and hospital supplies	3926.9		
			Plastic medical pads for transporting medical equipment; medical waste containers such as puncture resistant sharps containers for razors or needles; plastic face masks	3926.90.9990
			Plastic medical pads for transporting medical equipment; medical waste containers such as puncture resistant sharps containers for razors or needles; plastic face masks	3926.90.9996
Alcohol Pads	Pads made primarily of non-woven textiles, but further worked into other forms, e.g. hemmed pads or pads assembled into multiple layers	6307.9		
		6307.9		
	Plastic medical pads for transporting medical equipment; medical waste containers such as puncture resistant sharps containers for razors or needles; plastic face masks			3926.90.9990
Dry Ice	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	Dry ice		2811.21.10

Key takeaways from the literature review on supply chain, sustainability and wellbeing

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Source: Web of Knowledge.
Search terms:
Supply Chain* AND
Sustainability
Search results = 8,426
Date:12/13/2020

The Top 10 keywords (excluding search terms) from results used to generate Figure 1 were:
- *Performance*
- *Supply Chain Management*
- *Management*
- *Framework*
- *Impact*
- *Model*
- *Green*
- *Design*
- *Corporate-Social Responsibility*
- *Innovation*

Figure 3. Supply Chain and Sustainability keyword co-occurrence networks.

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- Source: Web of Knowledge.
- Search terms:
  - Supply Chain* AND
  - Wellbeing
- Search results = 80
- Date: 12/13/2020

The Top 10 keywords (excluding search terms) from results used to generate Figure 2 were:
- *Management*
- *Supply Chain Management*
- *Framework*
- *Sustainability*
- *Performance*
- *Sustainable Development*
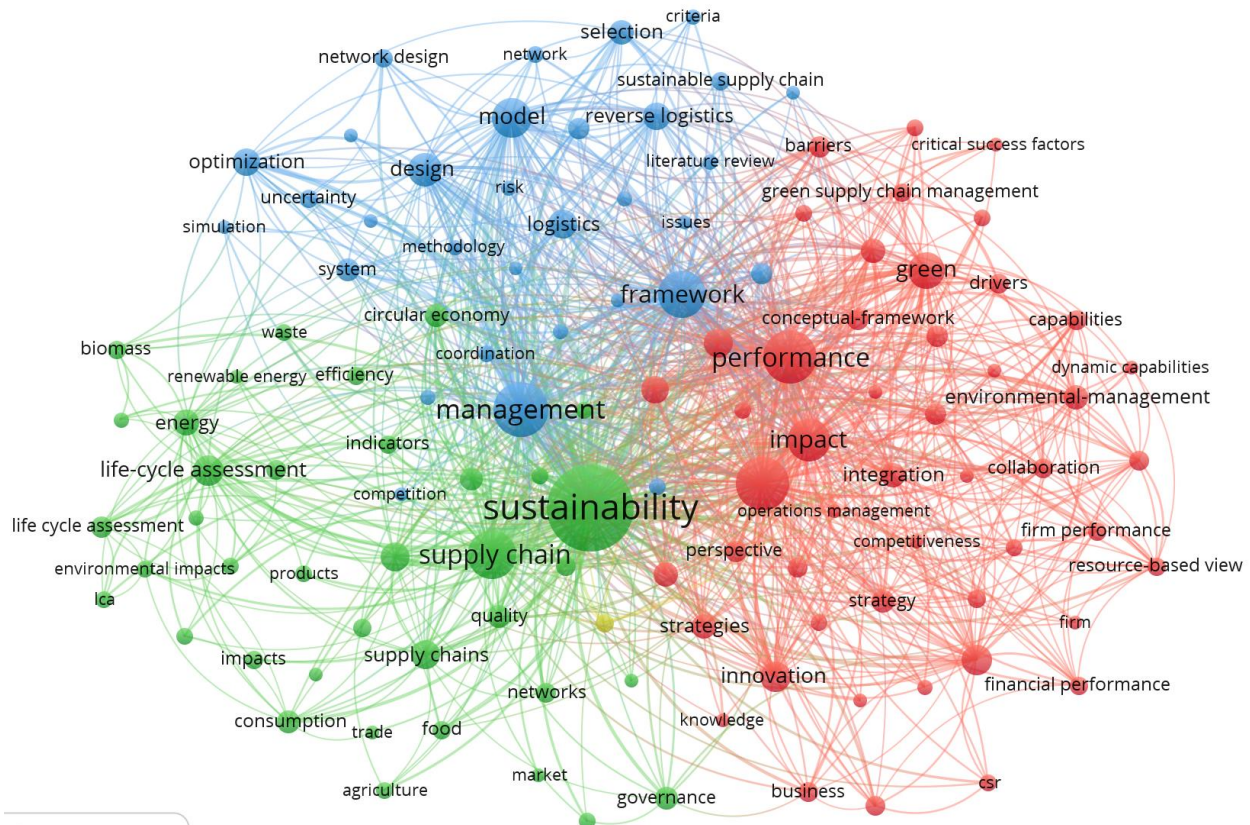- *Food Security*
- *Water*
- *Governance*
- *Impact*

Figure 4 Supply Chain and Sustainability keyword co-occurrence networks.

III. Risk Communication Mechanism

A weekly meeting was set across all Data-Lake System participating teams to discuss case studies of binational interests as set by the Taskforce. These meetings are focused on designing and developing a triad of dashboards: U.S., Mexico, and a Binational (U.S. & Mexico). SGL is developing a risk-based dashboard conceptual model to introduce a risk communication logic capable of combining risk-analytics representing three distinct geographical domains, all risk factors, and a stochastic inductive logic.

IV. Restoration and Creation of Supply Chains

The Taskforce was called for the identification of supply chain references in need of monitoring. Two supply chains were set for consideration: 1) Supply chains supporting the health sector, and supply chains supporting the automobile manufacturing sector. These are related to the 'workforce' as one of the strategic interests committed to studying in the project's scope of work. Initial conversations started with Taskforce members representing the U.S. and Mexico to find data that can guide and support a platform design to address the restoration and creation of supply chains impacted by COVID-19 and other converging threats.

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