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   October 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.-Mexico binational task force serving as advisors to the project.

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I. Introduction

This first risk bulletin report (September 2020) introduced the project to DHS Stakeholders and the general public providing 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.

This report introduces an initial discussion about the report card-type that will be used to define the status of threats, system vulnerabilities and impacts as defined in the risk framework introduced in the first Risk Bulletin (September 2020), as these relate to each component of the health supply chain systems. It is expected that this bulletin will be jointly produced, to provide scientific, technological, and strategic cultural support to secure the operation of the U.S.-Mexico health supply chain systems. The Risk Bulletin will primarily serve to inform the general public of our ongoing efforts and general lessons learned during the discussed timeframe.

The Data-Lake System will provide access to risk analytics and to its sources, including datasets, predictive models and experts' opinions, needed to produce evidence-based support on the causes and effects posed by COVID-19 on the U.S. health supply chain. While some of these exist already, a technological harmonization will be required to add it into the data-lake, and other analytics will need to be produced. Also, the identification and characterization of evidence depicting the dynamics of infrastructure interactions of U.S. domestic and international health supply chains, from procurement, manufacturing, warehousing, to transportation processes, will serve as the basis for the data-lake platform, where available and emerging sources of evidence will be arranged following the proposed risk framework.

II. Project Status & Lessons Learned

Completed Milestone 1: Kick-Off Meeting on 8.26.20

Completed Milestone 2: Data Acquisition and Management Plan

- The data management plan has been carefully designed to allow for new protocols and sources of information to be included later into the development stage.
  - Data points will be ingested daily for our analysis and analytics from data sources through the application of data-gathering techniques and statistical methods to provide value to the public and stakeholders. *We learned that the literature review process is predominately 'manual'; however, the team is exploring different ways to automate this process on a periodical basis to publish on the dashboard platform once the data lake system becomes operational.*
  - *The team required more time than anticipated to contract and procure services, licensing, and other processes with external entities and vendors, even when a preexisting licensing agreement with the university existed in some cases.* For instance, securing access to Panjiva, Bloomberg Terminal, etc., has proved to be very time-consuming, even though there is a licensing contract with the university libraries; a similar sentiment applies to securing access to other academic services. *The key lesson learned is to expect a considerable amount of time to secure purchasing and legal agreements with established large institutions, as internal processes and contracting agreements already in place exist that must be followed before the product or service in question can be accessed by the team.*
  - *To overcome these kinds of delays, we have found other information aggregation services that are already accessible to most of the researchers involved in this project, which had a significant and positive impact to keep the project on schedule (e.g IBISWorld, ProQuest).*

Contributing to Milestone 4: Data-Lake System

- Met and reviewed the Data-Lake design, implementation, and operation plan with:
  - Contractors
  - TAMU Data Centers
  - TAMU Information Technology Risk Management
  - TAMU High-Performance Research Computing (HPRC)
  - IT Engineering – Server Services
  - IT Engineering – Cloud Services
  - IT Engineering – Unix Services

  It has been a pleasant surprise to learn about the number of internal structures in place to guarantee information technology security, access to vital systems, and data protection. Several discussions have taken place to allow for complaint access to IT systems for all collaborators. The process has taken more time than initially planned as the number of internal departments required to collaborate for this magnitude project is much larger than initially anticipated.

- Finished conceptual design of the Data-Lake System shown in Figure 1, is composed of two interconnected components:
  - 1. An on-premise system
  - 2. A cloud-based system (see Figure 5)
  - Completed installation of on-premise Data-Lake System (Hardware)
  - Completed acquisition of cloud services for the Data-Lake System

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Due to university security protocols, it was decided to modify our original system's architecture, resulting a clear division, servers located on-premise will be hosted and managed by TAMU IT with restricted access to public resources outside the internal firewall while a separate cloud-based hosted by Amazon's Web Services will act as the public-facing element of our project. The Data-Lake System will reside in the on-premise servers and will only be accessible thought the internal university network following the security protocols in place. The cloud-based system will host the public dashboards of synthetized data, and analytics with limited communication with the on-premise system.
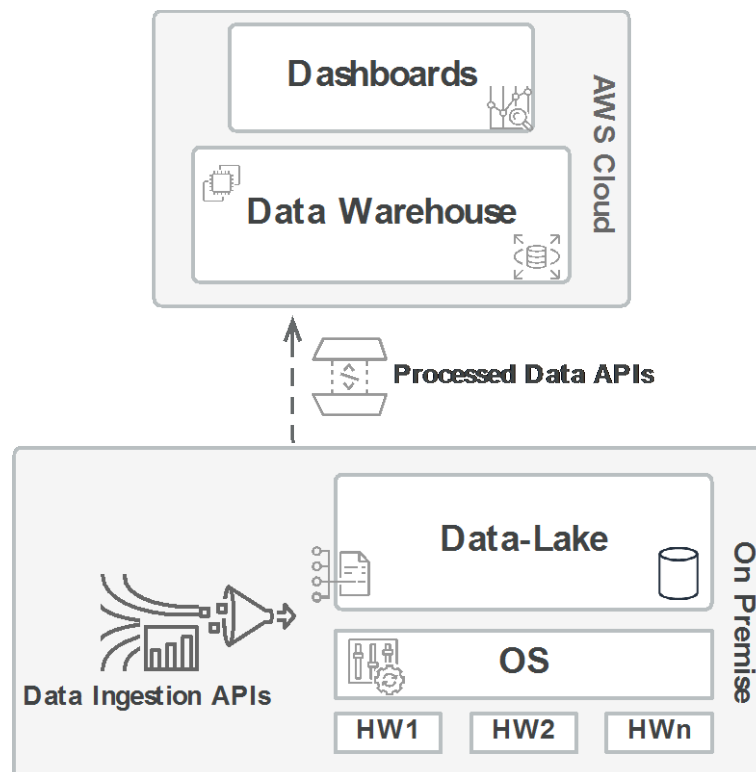

Figure 1. Data-Lake System Overview

Working on Milestone 5: Bulletin

- Researching and identifying:
  - Systems Subjected to Threats
    - Workforce's Health
    - Healthcare Supply Chain
    - Emerging threats such as hurricanes, flooding, and tangential systems
  - Metrics of Damage or Performance of Systems Subjected to Threats
    - E.g., Time, cost, quality, supporting, reliability, etc.
    - E.g., Confirmed, recovered, and deceased cases.
  - State of Risk of the Systems mentioned above
    - E.g., Mexican epidemiology report with four states of Risk (low, moderate, high, very high), shortage of medical equipment, intensive care units, etc.
  - Management - Mitigation Actions

- Predominant risk mitigating actions across local and regional government and communities such as the implementation of workplace control, safe work practices.
- Defining the selection criteria for data readily available in the US and Mexico:
  - Coverage, granularity, and periodicity of databases.
  - Transversally related components of supply chains that are related to the workforce's health in all economic sectors.
- Translating the official Mexican COVID19 dashboard into English for easier access and understanding by the US public and stakeholders.
- Defining the mechanisms and involvement of the taskforce members with the development of the risk-bulletins reports, including representatives from academia.

One important lesson learned during this time period has been attending CBTS seminars that provided a better understanding of the current status of the pandemic, its impact on the Homeland's main supply chains, and rising threat vectors.

The dashboard and public-facing components of the risk bulletin milestone will be composed several distinct versions when completed online. One version of the dashboard will be exclusively focused on the US, another version will focus only on Mexico, and a third one in data that is harmonized for both (binational). Finally, other views will provide analytics using incompatible data between both countries. Thus, it is envisioned to have at least three main dashboard versions.

One important component of our risk bulletin is to provide a snapshot of the current state of risk through the utilization of an easy and quickly understandable communication mechanism. *To this end, it has been decided to use a risk-score-card-type that employs familiar colors associated with risky everyday objects and situations such as an operating oven or a stoplight. The definition will follow the key elements of our adopted risk framework, which is primarily composed of threats, systems, and risk buustatus.* Moreover, the scorecard will be interactive and updated periodically in our public-facing dashboard. A preliminary "Scorecard Risk Communication Mechanism" is shown in Figure 3.

Finally, *having some members of the R13 project working directly on milestones focused on the risk model assessment development has proved to be very valuable as the amount of overlap between both projects is significant. This has accelerated the adoption and implementation of key elements.*

III. Risk Communication Mechanism - Scorecard

One objective of the project is to provide a communication system and platform to facilitate the restoration of broken supply chains impacted by COVID-19 while fostering the creation of new ones to reactivate trade between the U.S. and Mexico.

As mentioned on the previous risk-bulletin, this risk-bulletin report will include a report card-type to define the status of threats, system vulnerabilities and impacts as these relate to each component of the health supply chain systems. The team is currently working on the initial definition of the proposed risk-score card shown in Figure 2, and Figure 3, respectively.

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First, a definition of our threats, systems, and the metrics, state of risk and mitigating actions associated with them. R13 is aligned with the fundamental pillars of SGL's risk framework (R7's). However, the R7 risk framework can be used to decompose other threats and system, yet R13 will be focused in the ongoing current threat, COVID-19, and two important systems, the health infrastructure and workforce's health.

Figure 3 shows a visual mockup of a preliminary risk scorecard-type that expands the definitions to include more details about metrics related to each threat. The objective is to have this score card on the website with updated values on a periodical basis. Essentially, a score will be assigned to each fundamental component of the risk framework using several parameters, on this example we have expanded some scores to a series of variables related to each component, followed by a weighted sum or other function to arrive at the final index.

Again, this is just a preliminary version and it might change as we move through the taskforce meetings and other developments of the project.
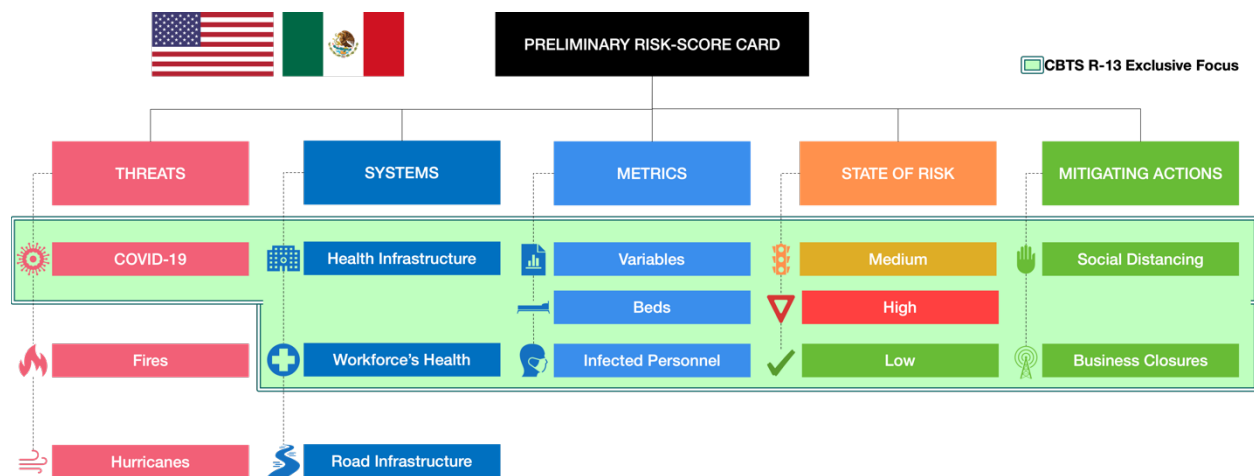

Figure 2.- Simplified proposed scorecard definition to use in a future risk-bulletin
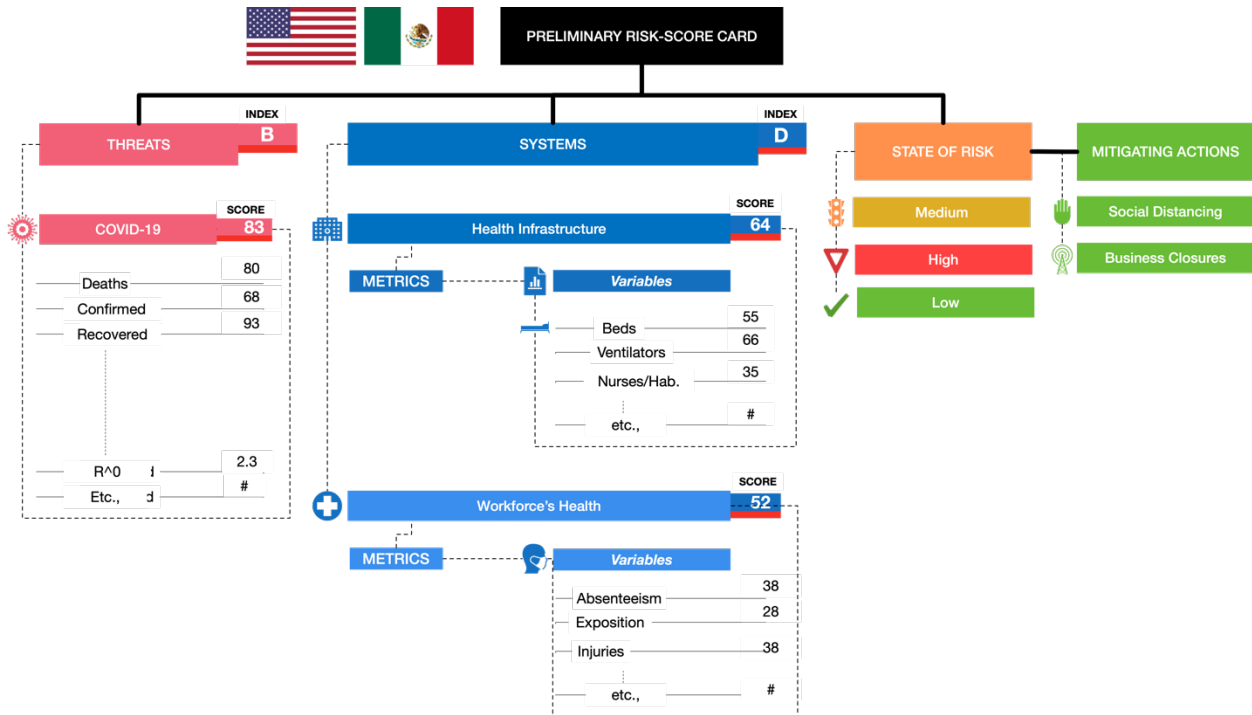
Figure 3.- Simplified proposed scorecard definition to use in for future risk-bulletin

1. Mexico's Epidemiological Report

The team identified variables being reported and available in the Mexican COVID19 dashboard discussed in the previous risk-bulletin, these variables are listed on Table 2.

Space	Time	COVID-19 Cases	Demographics	Co-Morbidity
State of Residence Municipality/town of residence	Admission date Death date	Ambulatory Hospitalized Positive Pending	Gender Age	Diabetes Chronic Obstructive Pulmonary Disease (COPD) Asthma Immunosuppression Hypertension Other co-morbidities Cardiovascular diseases Obesity Chronic Kidney Disease

Table 1.- Readily available variables from the Mexican COVID19 dashboard

A daily monitoring report of all the variables and parameters that allow for the identification and magnitude of the risk is carried out daily and communicated weekly at the status nation-wide COVID19 report

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conference so that the general public can quickly identify at what level of epidemiological risk their communities are currently at and modify their activities accordingly.

Healthy distance interventions must be strictly followed, depending on the color of the traffic light in which the public is located. Failure to do so will increase the risk of an increased abruptly rate of contagion where the epidemic contagion is currently relatively under control. In such a scenario, local and state authorities will need to impose more restrictive measures that may not be appropriate for a healthy public life and economy.

Mexico invites the general public to be aware of the light traffic epidemiology report in their community or locality and to comply with the federal and local health authorities' indications.

Space	Time	COVID-19 Cases	Demographics	Co-Morbidityarchive
State of Residence Municipality/town of residence	Admission date Death date	Ambulatory Hospitalized Positive Pending	Gender Age	Diabetes Chronic Obstructive Pulmonary Disease (COPD) Asthma Immunosuppression Hypertension Other co-morbidities Cardiovascular diseases Obesity Chronic Kidney Disease

Table 2.- Readily available variables from the Mexican COVID19 dashboard

IV.   Restoration and Creation of Supply Chains

One objective of the project is to provide a communication system and platform to facilitate the restoration of broken supply chains impacted by COVID-19 while fostering the creation of new ones to reactivate trade between the U.S. and Mexico.

We have continued with the identification of several potential mechanisms of engagement to achieve this goal. The following list introduces some broad methods and ideas to gather more tangible evidential information about the state of risk and impact of COVID-19 on the bilateral trade supply chains.

1. A public-facing section of the dashboard exclusively dedicated to highlighting essential binational supply chain markets disrupted by the ongoing threat
2. The site will be available in both English and Spanish to ease information access and flow from both countries
3. The risk scorecard will be compatible and aligned with the objectives of this milestone
4. Online-based quick surveys send to industry stakeholders, academics, government officials, and

subject matter experts involved in key aspects of the most impacted bilateral trade supply chains

5. A semi-automated matching of needs and supply products related to Healthcare infrastructure and the workforce's health
6. An automated analysis and interactive presentation of public news in Spanish and English from the most important news outlets of both countries
7. Automated evolutionary analysis of premium information aggregators and other news sources such as periodic government agencies report, e.g., U.S. & Mexican Census, Labor, Securities and Exchanges Commission (SEC), or other government agencies and websites.
8. Engagement and collaboration with important trade associations relevant to impacted supply chains by distributing important newsletters and information internally by emails, phone calls, or advertisements, or surveys.

(Coyle et al., 2016; Govindan et al., 2020; Ivanov, 2020; Scott Stern, 2020))

V.   Appendix:

Moving on to the vulnerabilities, the system at risk in this project is the Supply Chain System. The definition formal definition accounts for several flows, including channels of information, finance, and materials.

The following supply chain definitions were selected to base our proposed risk framework.

•   "In healthcare, <u>supply chain</u> (global) refers to the **information, supplies** and **finances** involved with the **acquisition** and **movement** of **goods** and **services** from the **supplier** to the **end-user** to enhance **clinical outcomes** while **controlling costs**" (Luke et al., 2003).

•   "The primary objective of the <u>supply chain</u> (global) in the context of public health is to ensure a responsive health service **delivery** customized to serve a variety of **patient** groups. This includes considerations of **geographic** and **needs** diversity (Serbout, 2016)".
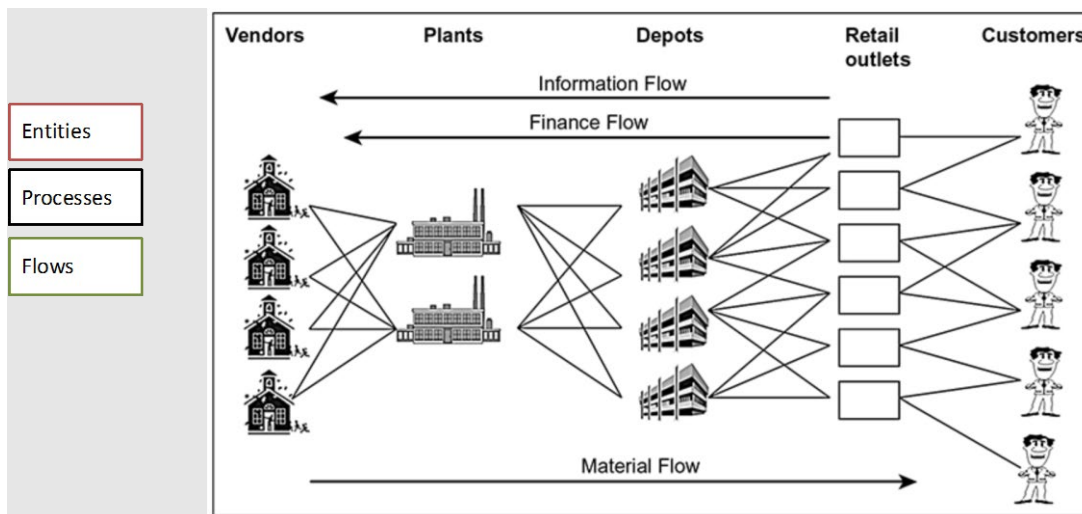
•

Figure 5.- Healthcare Supply Chain definition used in this project (Adapted from (Shah, 2016))

The project focus is also to facilitate the assessment of social, economic and environmental impacts that may be produced by a likely combination of threats and states of vulnerability of the health supply chain

systems (e.g. fatalities, disabilities, hospitalizations, social sentiment, migration, crime, GDP, unemployment, poverty, pollution, etc.).

A literature review was conducted to define the main impact metrics for Health Supplies and Services, and the Health of the Workforce.

Time	Cost	Quality	Supporting
• On-time delivery • Order cycle time	• Cost to serve • Days sales outstanding	• Overall customer satisfaction • Perfect order fulfillment	• Availability of information

Reliability	Agility	Costs	Asset Management
• Perfect order fulfillment	• Delivery cycle time • Order fulfillment cycle time	• Cost to deliver • Order management costs	• Cash-to-cash cycle time • Return on working capital

Figure 6.- Health Supplies and Services Impact Metrics (Adapted from(Coyle et al., 2016) and APICS, 2014)

Time	Disease Transmission	Wellbeing	Health
• Absenteeism • Recovery	• Exposition • Contagion	• Fear of contagion • Working under pressure	• Injuries. • Loss of lives. • Diseases.

Mobility	Social	Economic	
• Reduced or lack of transportation • Migration	• Social and cultural beliefs	• Access to resources • Income disparities	

Figure 7.- Health of the Workforce Impact Metrics

Furthermore, mitigation actions were identified in literature to facilitate Risk Management practices as shown in the following figure. The active countermeasures have a direct effect on COVID-19 threat, and the passive countermeasures influence the vulnerability for both Health Supplies and Services and Health of the Workforce.
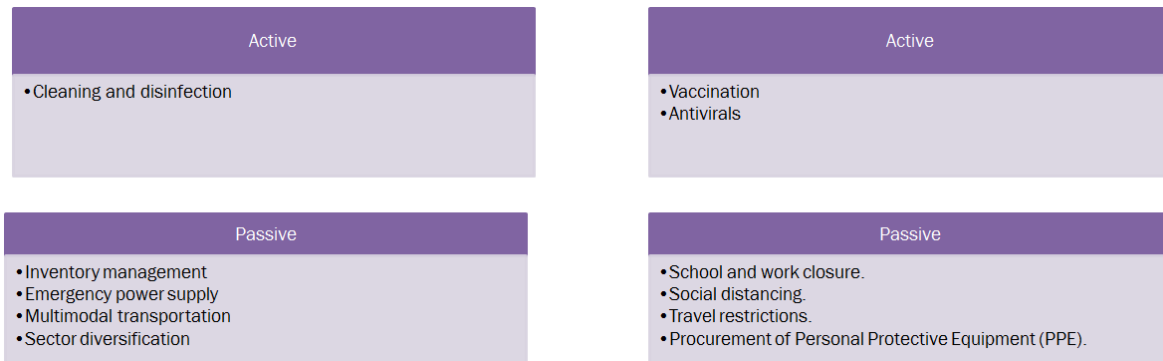
Active
• Cleaning and disinfection

Active
• Vaccination • Antivirals

Passive
• Inventory management • Emergency power supply • Multimodal transportation • Sector diversification

Passive
• School and work closure. • Social distancing. • Travel restrictions. • Procurement of Personal Protective Equipment (PPE).

Figure 8.- Example of risk mitigation actions identified

1. Critical supplies and services regarding health infrastructure

We have identified the most important healthcare products categories impacted by COVID19 according to previous literature and the WHO guidelines (Mirchandani, 2020).
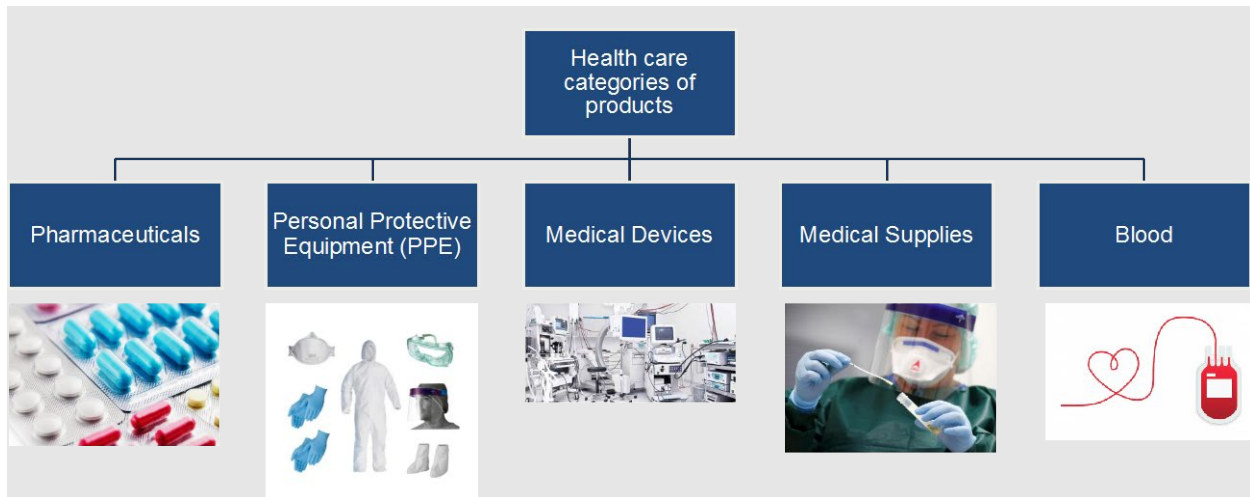

Figure 9.- Healthcare Products' Categories

Critical supplies and services regarding health infrastructure as defined by the World Health Organization's Coronavirus Disease Technical Guidance, which include:

1. a) Medical equipment to support Oxygen Therapy, Airway Management and Intubation, Mechanical Ventilation, Non-Invasive Ventilation, IV Infusion, Blood Chemistry, Imaging, Intensive Care Unit, Sterilization.
2. b) Accessories and consumables associated to medical equipment to support Oxygen Therapy, Mechanical Ventilation, Imaging and Intensive Care Unit.
3. c) Consumables (single use devices) for Oxygen Delivery Devices, Airway Management and Intubation, Blood Chemistry, Central Line, Gastro-enteral Feeding, Urine Collection, and for General Operations (e.g. Antiseptic, Wipes Compress, Tape, Drape, Gloves, etc.

## 2.	Critical supplies and services regarding the health of the workforce

Critical supplies and services regarding the health of the workforce as defined by the Guidance on Preparing Workplaces for COVID-19 by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA 3990-03 2020), include:
a) Development of an Infectious Disease Preparedness and Response Plan
b) Preparedness to Implement Basic Infection Prevention Measures
c) Development of Policies and Procedures for Prompt Identification and Isolation of Sick
d) People, if Appropriate
e) Development, Implementation, and Communication about Workplace Flexibilities and
f) Protections
g) Implementation of Workplace Controls
h) Engineering of Controls
i) Administration of Controls
j) Definition of Safe Work Practices
k) Procurement of Personal Protective Equipment (PPE)
l) Adherence to Existing OSHA Standards

A report card grading scheme will be used to define the status of threats, system vulnerabilities and impacts as these relate to each component of the health supply chain systems. The bulletin will include a summary of Lessons Learned on the U.S. and Mexico Health systems, to identify best practices that can support the regional economic development. In addition, the Bulletin will include a section to populate U.S. and Mexican academic, industrial and government agencies vested on each segment of the health supply chain, with the idea of foster collaborations and exchange information that can be established to support the continuous trade operations between U.S. and Mexico. As discussed previously, our team has been following closely the main DHS priorities and adjusting some of our project priorities accordingly. An example of this has been the discussion of key priorities from attended webinars and discussions.

Notice that content of the Bulletin will be primarily based on the analytics generated in the data- lake, which will be defined and prioritized by the taskforce. As the catalog of analytics is being developed and made available to CBTS' stakeholders via the data-lake, production of automated summary reports to integrate evidence collected up-to-date will be offered as an option. The automation of reports of available analytics will provide current evidence 'as needed' by the stakeholders. The goal is that by the end of each month analytics produced by the latest automated report will serve as the basis of the monthly bulletin content. Each automated report will include the latest commentaries, feedback and advice collected throughout the weekly meetings of the taskforce where the reports will be presented and discussed.

3.   Performance Metrics Planned (KPI)

Metric 1 – CBTS leadership will develop rubric to be fulfilled every time the Taskforce meets. This rubric will include three main sections: datasets, models and expert opinions, to reflect the quantity and quality of the evidence being collected to formulate the Risk model. Minutes from the Taskforce meetings will include the rubric and a list of action items indicating the partners involvement required to complete the identification of key processes involved in the supply chain for the health infrastructure and for the health of the workforce.

Metric 2 – CBTS leadership will develop a rubric to assess the development and operation of the data-lake. This rubric will include three main sections: volume of data being processed, volume of model predictions being processed, and volume of expert opinion's being processed, for the identification of the key processes involved in Risk model depicting the supply chain for the health infrastructure and for the health of the workforce.

Metric 3 – CBTS leadership will develop a rubric to assess the impact of the dissemination of the monthly Bulletin. This rubric will include three main sections: use of datasets, use of models and use of expert's opinions, as represented in the outcomes of the Risk analytics guided by the current Risk model.

The monthly Bulletin will be produced and submitted to DHS sponsor for review and clearance before dissemination to stakeholders and before this is published in the web. This to avoid any conflicts of interests between the U.S. and Mexico, since it has been established that this project must focus on scientific research and avoid any influence of political bias. The main purpose of producing risk analytics is to provide confidence to decision-makers involved in the supply chain of the health sector impacted by the COVID-19 pandemic, which is anticipated will have significant impact on all economic sectors.

Quarterly assessment reports (included under output 1) will be provided to DHS evaluating the scientific progress of this research. This evaluation will be integrated by the taskforce and complemented by Co-PIs of the project. This will include 1) progress of the operation of the taskforce, 2) progress on the design, implementation and operation of the data-lake, and 3) progress on the monthly publication of the bulletin.

VI.   References

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