

**Event: Navigating Logistics Disruption and Uncertainty: Logistics SIG Open Forum,  
(Aug 29<sup>th</sup>, 2025)**

**Case Study Summary – Epidemic Disruption and Smart Freight Fleet Management in  
Colombia (2020–2022)**

During the COVID-19 pandemic, a hardware products distributor (name not to be disclosed) in Barranquilla, Colombia, faced severe operational disruptions. Truck drivers, essential for deliveries to 50 hardware stores across the city, were at high risk of contagion due to constant external exposure. Traditional fleet management models did not account for driver health conditions, leading to increased absenteeism, safety concerns, and operational inefficiencies.

**Task**

The Company needed to continue deliveries while safeguarding drivers' health. The challenge was to minimize contagion risks and absenteeism costs, while ensuring product availability and customer service continuity.

**Action**

We designed a data-driven smart fleet management framework integrating:

- **Geospatial epidemic risk analysis:** Using COVID-19 case forecasts across five city zones.
- **Driver health profiling:** Categorizing drivers into four risk levels (low, moderate, severe, critical). Data privacy had to be managed.
- **Risk-informed routing optimization:** Assigning low-risk drivers to higher-risk areas and shielding vulnerable drivers with safer routes.
- **Simulation modeling:** Simulation software tested outcomes for intelligent versus random driver-route allocations – then Driver-risk constrained optimization was implemented on the scenarios with given probabilities of occurrence.

**Results**

Simulation results showed:

- Estimated absenteeism costs reduced by  $\approx$  \$25,000/month.
- Estimated (socio-economic) fatality-related costs reduced by  $\approx$  \$195,000/month.
- Probability of driver death or long-term absence nearly eliminated (approaching zero).
- Deliveries continued with higher efficiency and reduced exposure risks.

**Lessons Learned and Industry Implications:** The case highlights that health must be treated as a logistics variable. During epidemic disruptions, fleet managers cannot separate workforce safety from operational planning; instead, driver health conditions must be integrated directly into routing and allocation decisions. The study also demonstrates that data-driven allocation delivers tangible benefits, as intelligent driver-route matching both lowers operational costs and reduces exposure risks. Moreover, scenario simulation emerges as a critical tool, providing decision support by modeling trade-offs and testing alternatives under uncertainty. Finally, the findings emphasize that social responsibility is inseparable from resilience: protecting vulnerable drivers not only upholds ethical standards but also strengthens the overall continuity of the supply chain.

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## **Benchmarks & Metrics**

- **Economics:** Days of Driver Absenteeism (with associated cost), measured in lost workdays compared to a baseline scenario (e.g., average number of driver days lost per month due to illness). Operational Cost Reduction, measured in financial savings from intelligent allocation versus random assignment (e.g., monthly reduction in absenteeism and fatality-related costs, measured in USD).
- **Socio-economic:** The cost of fatalities avoided (e.g., estimated monetary value of prevented deaths through health-aware driver allocation and safer routing).
- **Health related:** better (from the operational side) **epidemic** management during COVID-19 – using ML/AI estimates and projections of contagion probability, i.e., the ability to reallocate drivers based on health risk (e.g., the percentage of deliveries completed using safe driver-route assignments that minimize contagion exposure).
- **Operational resilience:** Proportion of routes successfully reassigned to protect high-risk drivers without compromising service levels (e.g., % of vulnerable drivers allocated to low-risk routes while maintaining on-time delivery).

## Key Takeaways from the Epidemic Fleet Management Case

### 1. Health is now a logistics variable, not just an HR issue

- Driver health conditions directly impacted the ability to maintain operations.
- Integrating health risk data into routing decisions reduced contagion exposure and absenteeism.

### 2. Continuity depends on health-aware contingency planning

- Random driver allocation left vulnerable drivers exposed and raised operational risks.
- Intelligent health-based assignment ensured deliveries while protecting at-risk workers.

### 3. Cost avoidance is the real benchmark

- The critical KPI wasn't just deliveries made, but the reduction of absenteeism and fatality-related costs.
- Intelligent allocation saved Company X over COP 885 million per month in projected costs.

### 4. Data-driven decision support is essential

- GIS, forecasting, and simulation allowed managers to anticipate outbreaks and reallocate drivers dynamically.
- Scenario modeling revealed trade-offs between efficiency and safety under epidemic disruptions.

### 5. Protecting vulnerable workers builds resilience and trust

- Shielding high-risk drivers improved workforce morale and ensured ethical operations.
- Companies that protected employees strengthened long-term resilience and stakeholder confidence.

## Summary Table

Case	Success Defined By	Key Learnings / Best Practices	Benchmarks & Indicators
<b>Epidemic Fleet Disruption (2020–2022)</b>	Safe and continuous deliveries; reduced absenteeism and fatalities; operational cost savings	Health-aware driver allocation; epidemic risk-informed routing; simulation-driven decision support	Absenteeism days, contagion probability per route, cost avoidance (USD), socio-economic cost of fatalities avoided

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### ? Key Questions for Discussion

1. How should logistics managers balance workforce health with operational efficiency during epidemics?
2. What indicators best measure resilience in epidemic-driven disruptions (absenteeism, cost reduction, driver safety)?
3. Should health-risk-aware routing become part of standard fleet management practices?
4. How can simulation modeling be institutionalized in logistics contingency planning?
5. What role should policymakers play in mandating health-based fleet allocation strategies?

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### Source:

Carlos D. Paternina-Arboleda, Ambar Palacio and James Cochran. Data-driven Smart Freight Fleet Management amid epidemic disruptions: a framework, and case study. Under Review (Third Stage): HealthCare Management Science.

Please contact the speaker for more information.