Georgia Tech Health & Humanitarian Systems
Interdisciplinary Research Center

# Covid-19, Airlines, Society

**Flying in the COVID-19 Era--Science-based Risk Assessments and Mitigation Strategies on the Ground and in the Air: A Workshop**

Education
Collaboration
Sustainable Health & Well-Being
Projects
Disease Modeling
Research
Medical Decision-Making
Outreach
Resource Allocation
Center for Health & Humanitarian Systems
A Georgia Tech Interdisciplinary Research Center

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By formulanone from Huntsville, United States - Atlanta Airport Aerial Angle, CC BY-SA 2.0
https://commons.wikimedia.org/w/index.php?curid=61801195

**Uncertainty**

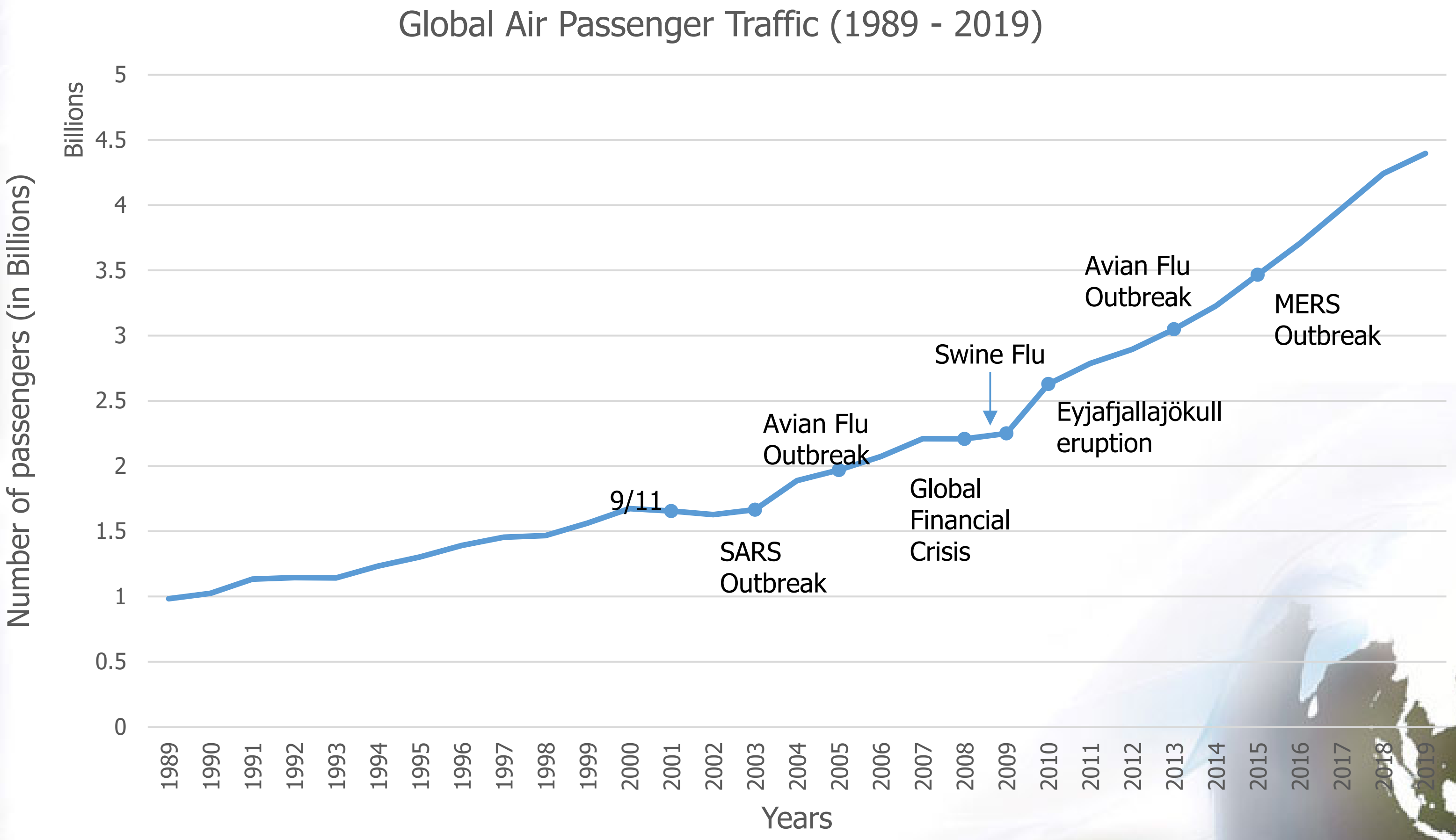
**Variability**

**Disruptions**

**Complexity**

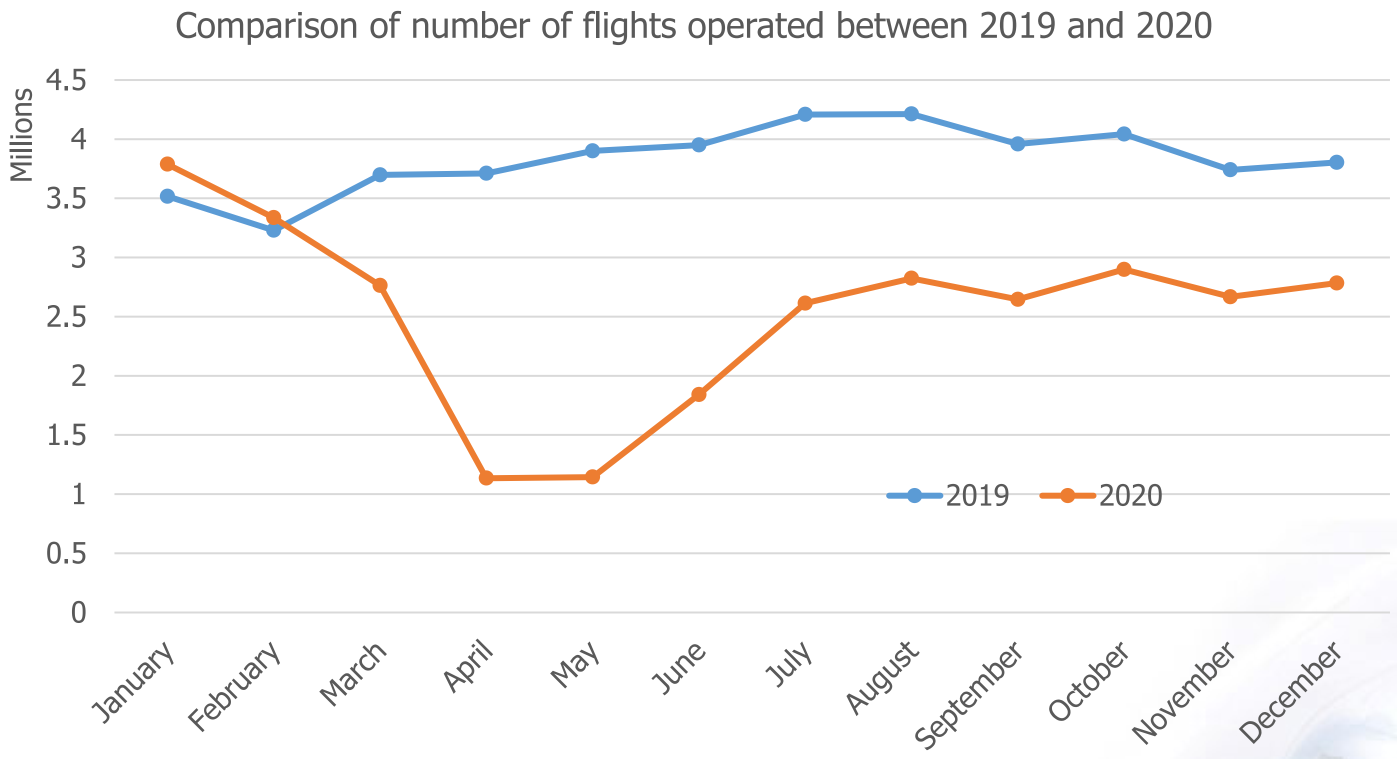
**Data, analytics, systems engineering** in decision-making

- Fleet planning, Maintenance, Ground operations, Flight & Crew scheduling, Price and revenue management, Disruption management, …



Global Air Passenger Traffic (1989 - 2019)

*Source: World Bank Data*

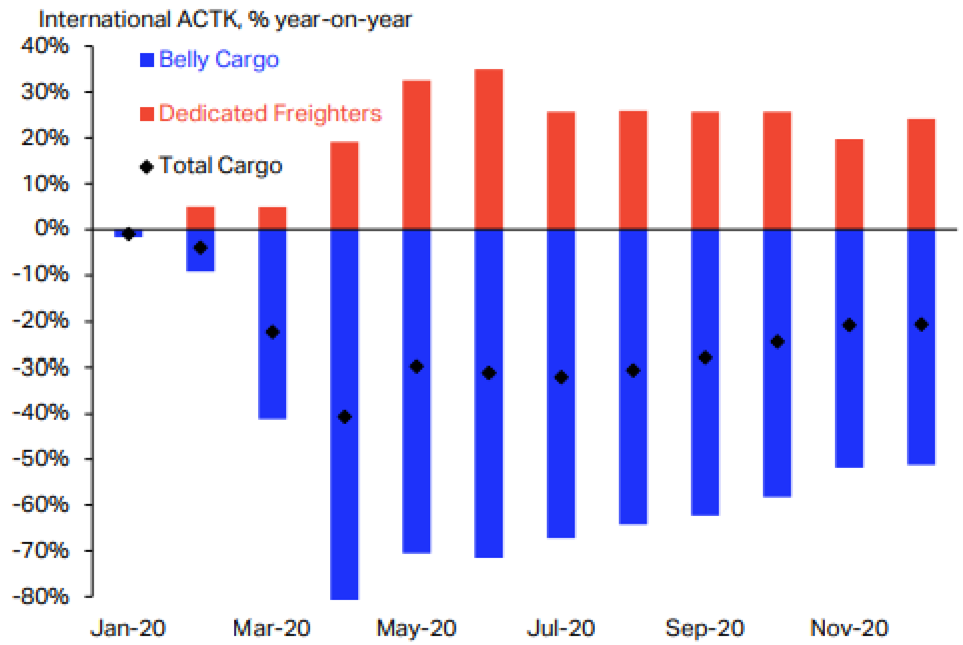


Snapshot of Aug 2020 air-passenger volume compared to Aug 2019:

- Global travel ↓64%
- Domestic travel ↓51%; International travel ↓81%
- Connecting flights ↓81%; Non-stop flights ↓61%

*Source: International Civil Aviation Organization data*

## **Chart 4**: Int'l belly cargo and freighter capacity growth

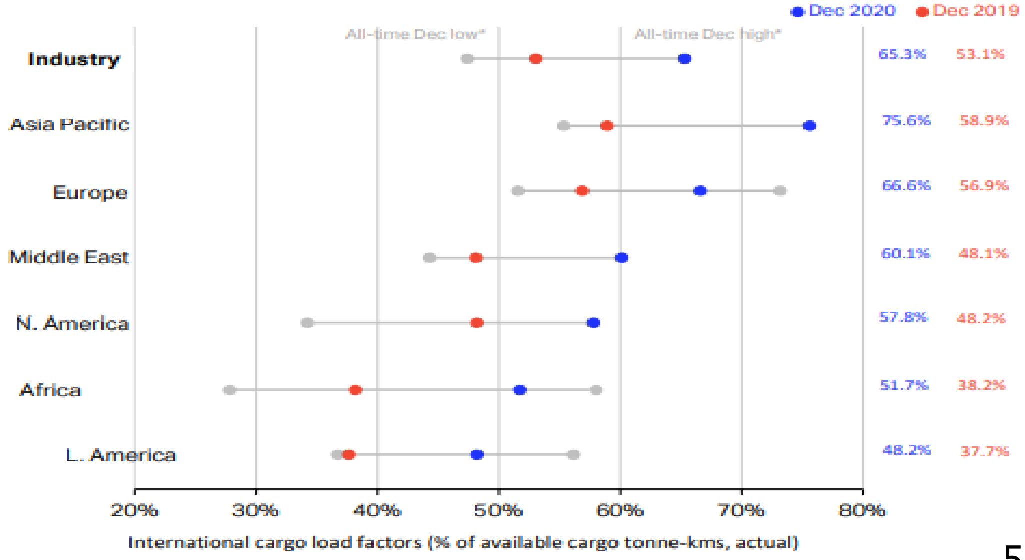


Source: IATA Monthly Statistics

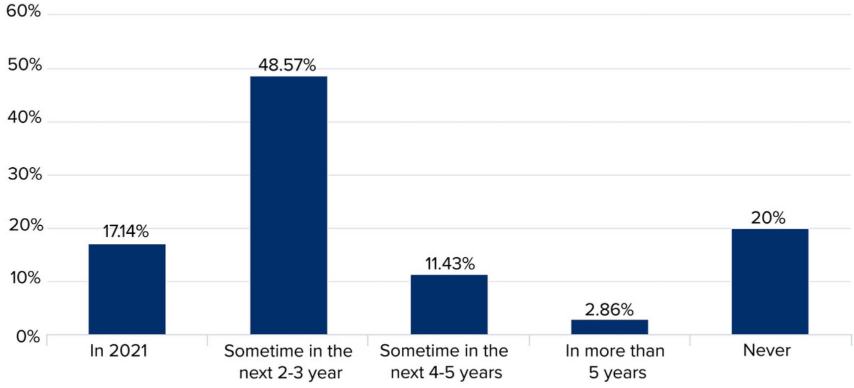
https://www.ajc.com/business/with-few-passengers-delta-gets-faa-approval-carry-cargo-cabin/txiJbJJV3srGFc0c1mkU8H/

https://scmwiki2012.wordpress.com/b/belly-cargo/

## **Chart 5**: International cargo load factors by region

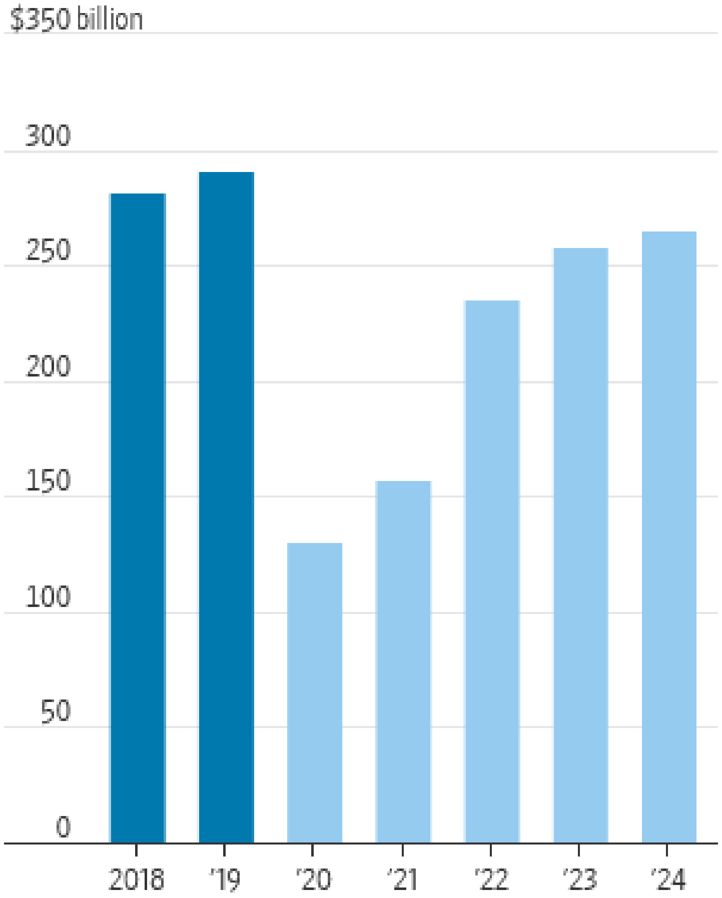


Sources: IATA Economics, IATA Monthly Statistics



When do you expect your company's budget for employee travel to return to pre-pandemic levels?

Source: CNBC Q4 2020 Technology Executive Council Survey

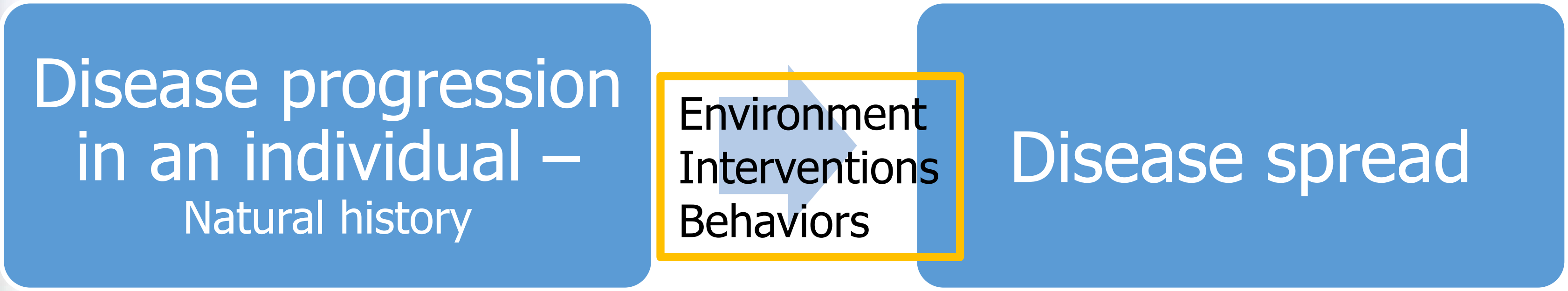


**Travel Budget**

Direct business travel spending in U.S., by U.S. residents

Note: 2020-2024 figures reflect Nov. 2020 forecast
Source: U.S. Travel Association

# Infectious Disease Modeling



Disease progression in an individual – Natural history

Environment
Interventions
Behaviors

Disease spread

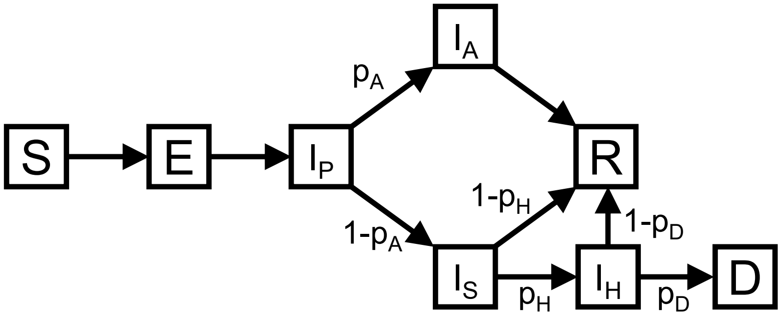
- Model the spread of the disease
- Project spread & metrics/outcomes of interest
- Evaluate the impact of interventions on outcomes
- Estimate resource needs
- Resource planning and allocation

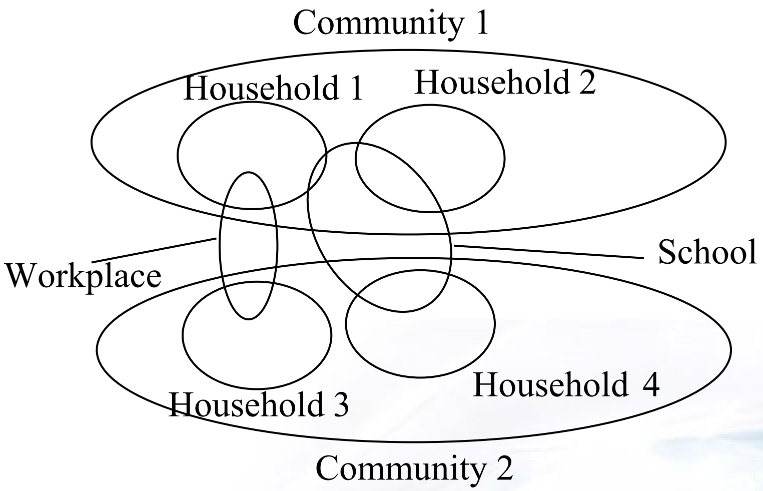
**Data:** Various data sources, including

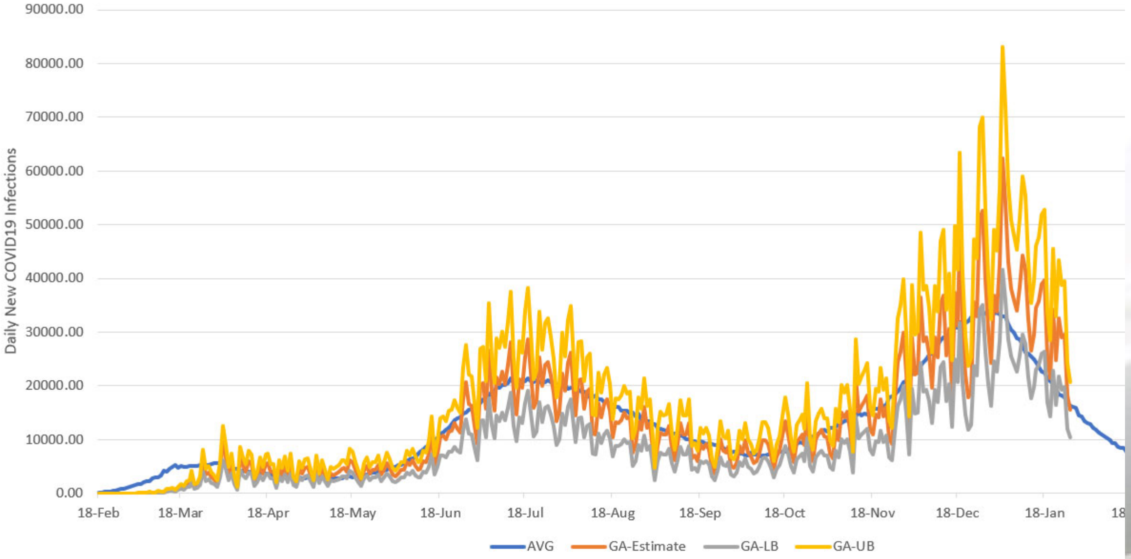
- Household statistics, workflow data, classroom sizes, age statistics

**Modeling:** Agent-based simulation

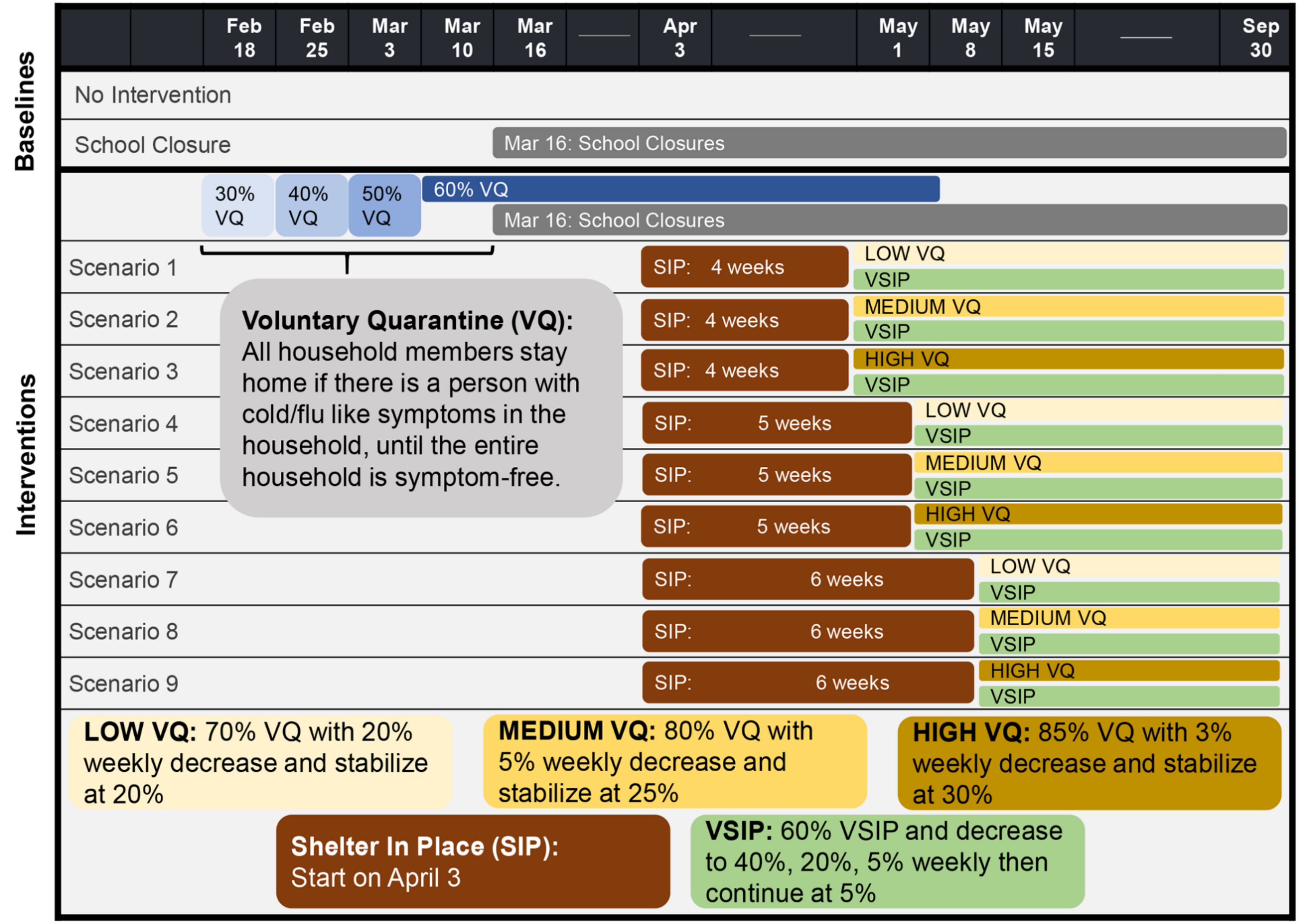
S: Susceptible
E: Exposed
$I_P$: Presymptomatic
$I_A$: Asymptomatic
$I_S$: Symptomatic
R: Recovered
$I_H$: Hospitalized
D: Dead


S
E
$I_P$
$p_A$
$I_A$
R
$1-p_A$
$1-p_H$
$1-p_D$
$I_S$
$p_H$
$I_H$
$p_D$
D


Community 1
Household 1
Household 2
Workplace
School
Household 3
Household 4
Community 2



# Scenarios for Non-Pharmaceutical Interventions



Feb 18 | Feb 25 | Mar 3 | Mar 10 | Mar 16 | ____ | Apr 3 | ____ | May 1 | May 8 | May 15 | ____ | Sep 30

**Baselines**

No Intervention

School Closure: Mar 16: School Closures

**Interventions**

30% VQ | 40% VQ | 50% VQ | 60% VQ

Mar 16: School Closures

**Voluntary Quarantine (VQ):** All household members stay home if there is a person with cold/flu like symptoms in the household, until the entire household is symptom-free.

Scenario 1: SIP: 4 weeks — LOW VQ, VSIP

Scenario 2: SIP: 4 weeks — MEDIUM VQ, VSIP

Scenario 3: SIP: 4 weeks — HIGH VQ, VSIP

Scenario 4: SIP: 5 weeks — LOW VQ, VSIP

Scenario 5: SIP: 5 weeks — MEDIUM VQ, VSIP

Scenario 6: SIP: 5 weeks — HIGH VQ, VSIP

Scenario 7: SIP: 6 weeks — LOW VQ, VSIP

Scenario 8: SIP: 6 weeks — MEDIUM VQ, VSIP

Scenario 9: SIP: 6 weeks — HIGH VQ, VSIP

**LOW VQ:** 70% VQ with 20% weekly decrease and stabilize at 20%

**MEDIUM VQ:** 80% VQ with 5% weekly decrease and stabilize at 25%

**HIGH VQ:** 85% VQ with 3% weekly decrease and stabilize at 30%

**Shelter In Place (SIP):** Start on April 3

**VSIP:** 60% VSIP and decrease to 40%, 20%, 5% weekly then continue at 5%

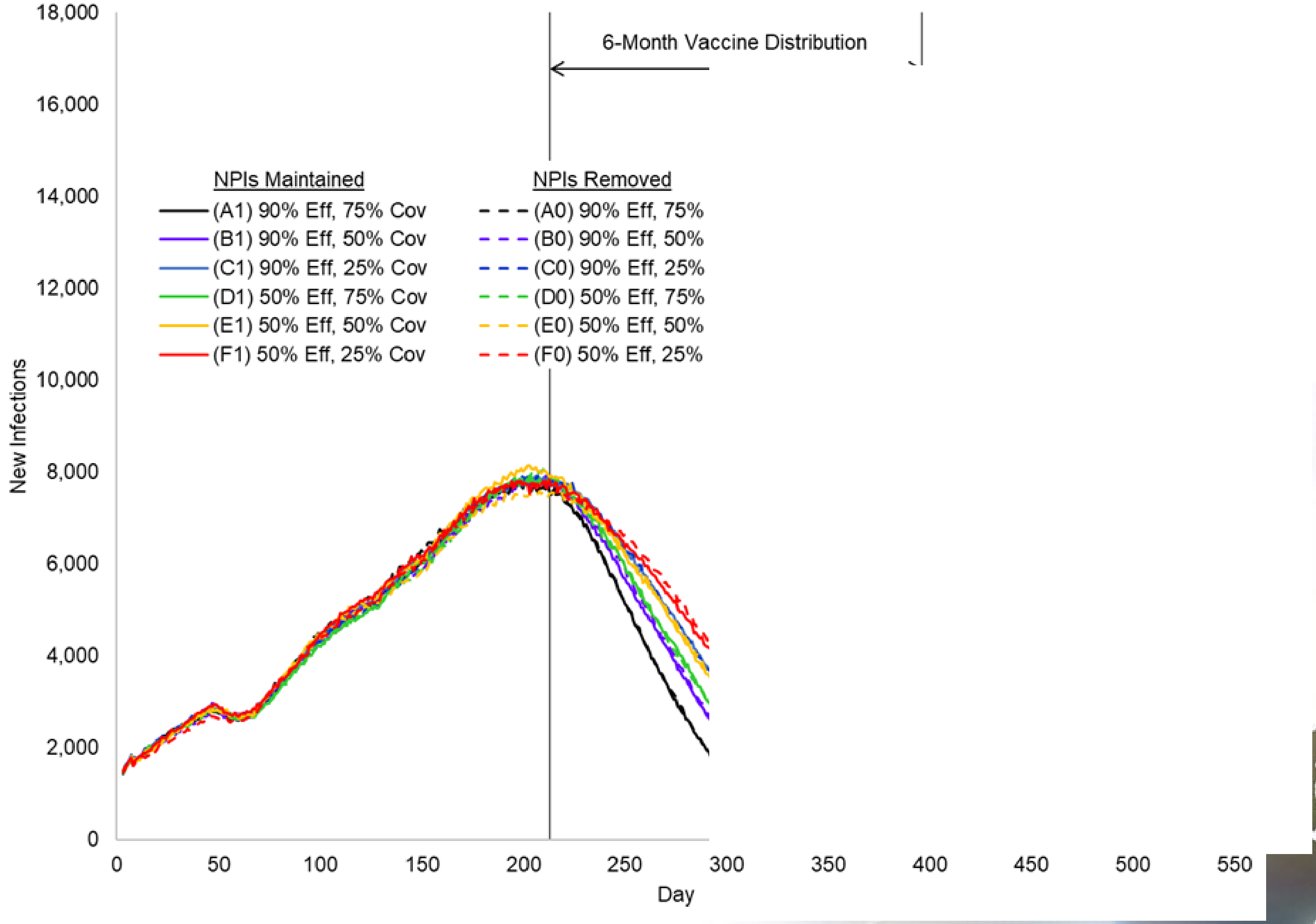
# A few takeaways from our research

- *Shelter-in place* effects are temporary
- *School closures* buy time, but disruptive; alternating school day schedules are effective
- *Voluntary quarantine* at high compliance levels significantly reduces infections, while limiting ‘homebound days’
- Predictions about resource (hospital bed, ICU bed, ventilator) needs and shortages in various geographic regions

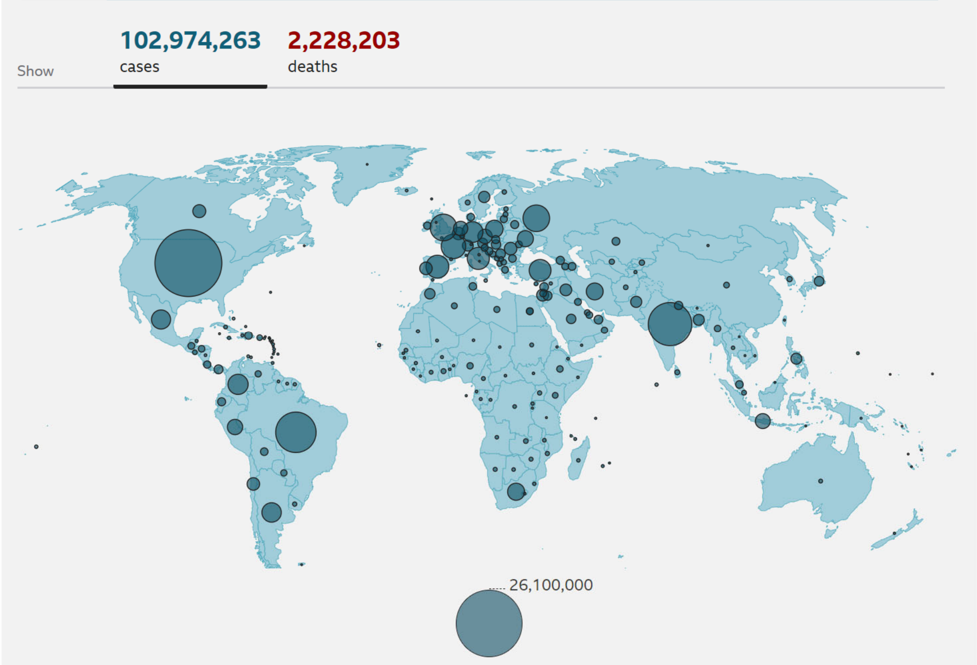
Significance of SARS-CoV-2 Specific Antibody Testing during COVID-19 Vac
Resource Allocation for Different Types of Vaccines against COVID-19: Tra
High-Quality Masks Reduce COVID-19 Infections and Deaths in the US | m
Evaluating Scenarios for School Reopening under COVID19 | medRxiv
Homebound by COVID19: The Benefits and Consequences of Non-Pharma
The Impact of Social Distancing on COVID19 Spread: State of Georgia Case

- Number of contacts
- Frequency of contacts
- Proximity of contacts
- Duration of contacts

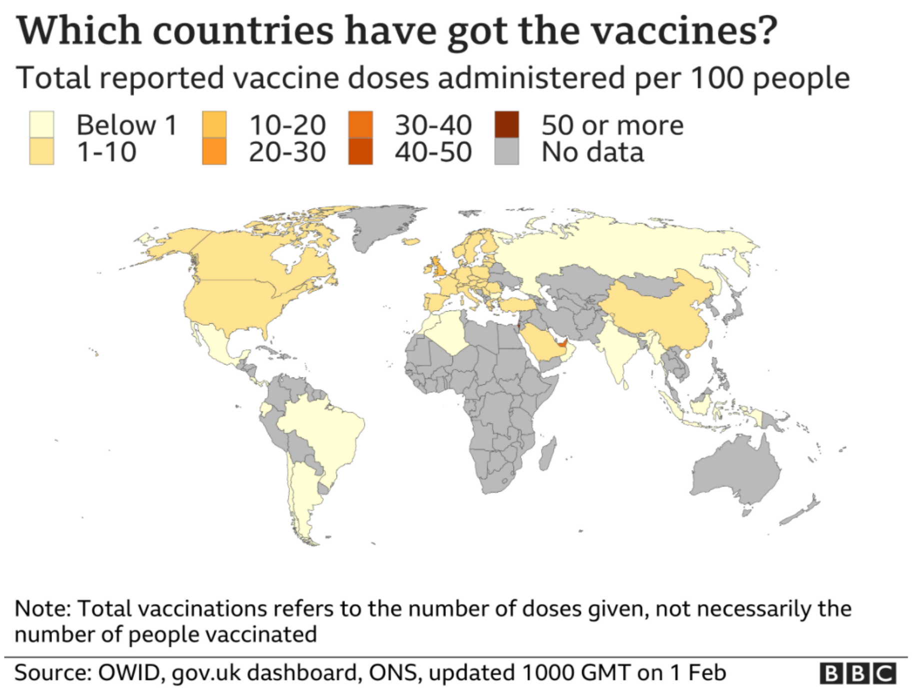
# Back to “normal”?



The Joint Impact of COVID-19 Vaccination and Non-Pharmaceutical Interventions on Infections, Hospitalizations, and Mortality: An Agent-Based Simulation | medRxiv


Show
102,974,263
cases
2,228,203
deaths
26,100,000

https://www.bbc.com/news/world-51235105



## Which countries have got the vaccines?

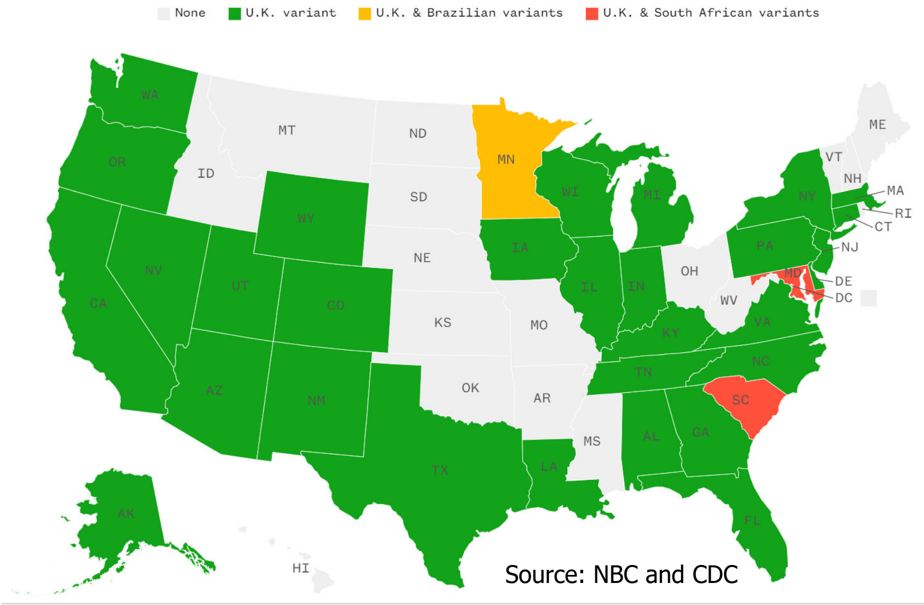
Total reported vaccine doses administered per 100 people

Below 1
1-10
10-20
20-30
30-40
40-50
50 or more
No data

Note: Total vaccinations refers to the number of doses given, not necessarily the number of people vaccinated

Source: OWID, gov.uk dashboard, ONS, updated 1000 GMT on 1 Feb

BBC


None
U.K. variant
U.K. & Brazilian variants
U.K. & South African variants
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
GA
FL
WV
VA
NC
SC
PA
NY
MD
DE
DC
NJ
CT
RI
MA
NH
VT
ME
AK
HI

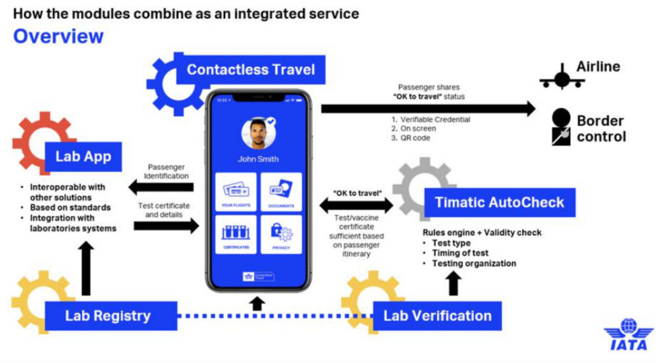
Source: NBC and CDC

# What is on the horizon?

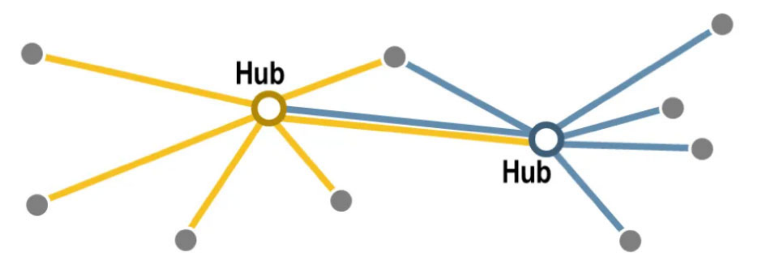
https://www.nationalgeographic.com/travel/2020/08/how-clean-is-the-air-on-your-airplane-coronavirus-cvd/

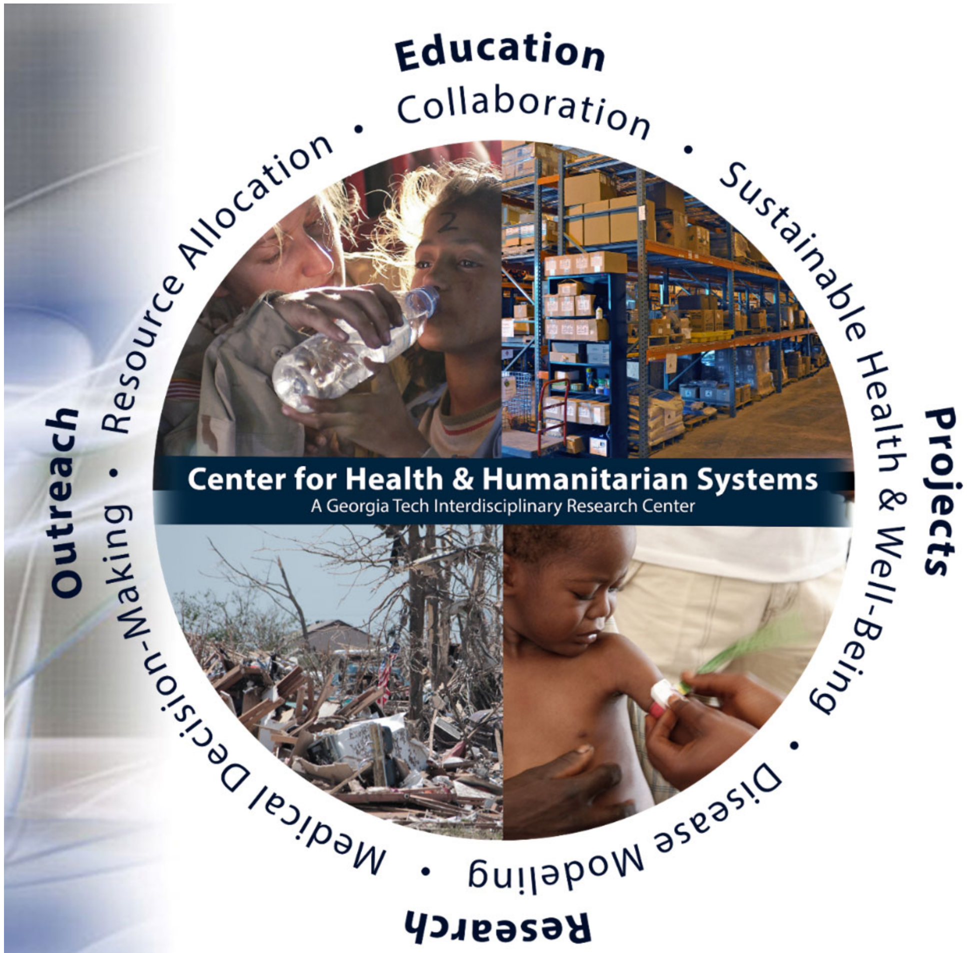
Credit: Alyssa Pointer / Alyssa.Pointer@ajc.com

ATLANTA AIRPORT BLOG | Updated Dec 21, 2020


How the modules combine as an integrated service
Overview
Contactless Travel
Airline
Passenger shares "OK to travel" status
1. Verifiable Credential
2. On screen
3. QR code
Border control
Lab App
Passenger Identification
Test certificate and details
John Smith
• Interoperable with other solutions
• Based on standards
• Integration with laboratories systems
"OK to travel"
Test/vaccine certificate sufficient based on passenger itinerary
Timatic AutoCheck
Rules engine + Validity check
• Test type
• Timing of test
• Testing organization
Lab Registry
Lab Verification
IATA

IATA lays out some of the complexity involved in pulling everything together. IATA

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teşekkür ederim
tapadh leat
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thank you
gracias
mauruuru
hvala
bedankt
dziękuję
mochchakkeram
go raibh maith agat
obrigado
sagolun
sukriya
kop khun krap
grazie
arigatō
takk
dakujem
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merci