

A Systems Approach: New Methods and Technologies to Predict and Manage Food Supply Threats

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Bruce Y. Lee, MD, MBA

Executive Director, Global Obesity Prevention Center (GOPC) at Johns Hopkins University

Associate Professor of International Health

Johns Hopkins Bloomberg School of Public Health and Carey Business School

Email: Brucelee@jhu.edu | Twitter: @bruce_y_lee

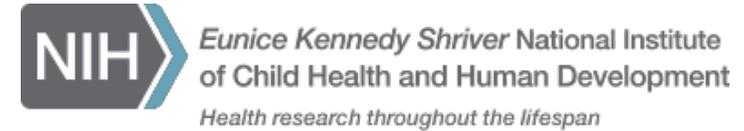


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Disclosures

- Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) and Office of Behavioral and Social Sciences Research (OBSSR) via U54 HD070725
- NICHD via U01HD086861 and R01HD086013
- United States Agency for International Development (USAID)
- Bill and Melinda Gates Foundation



Forbes



Contributor

Bruce Y. Lee

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Following



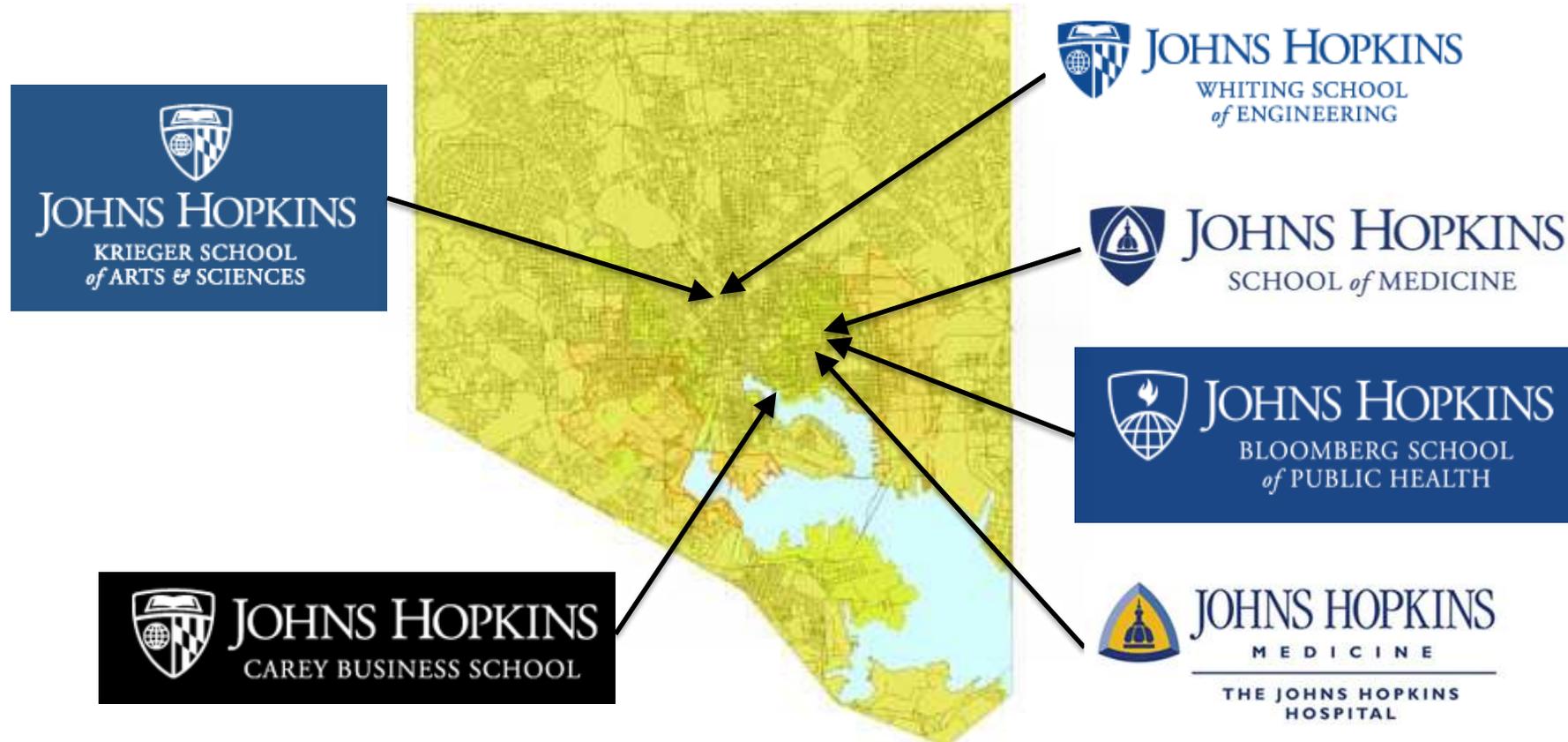
Content

- **GOPC overview**
- Food supplies are complex systems
- Systems approaches are needed to manage and protect food supplies
- An example of systems modeling of food supplies
- Summary and discussion

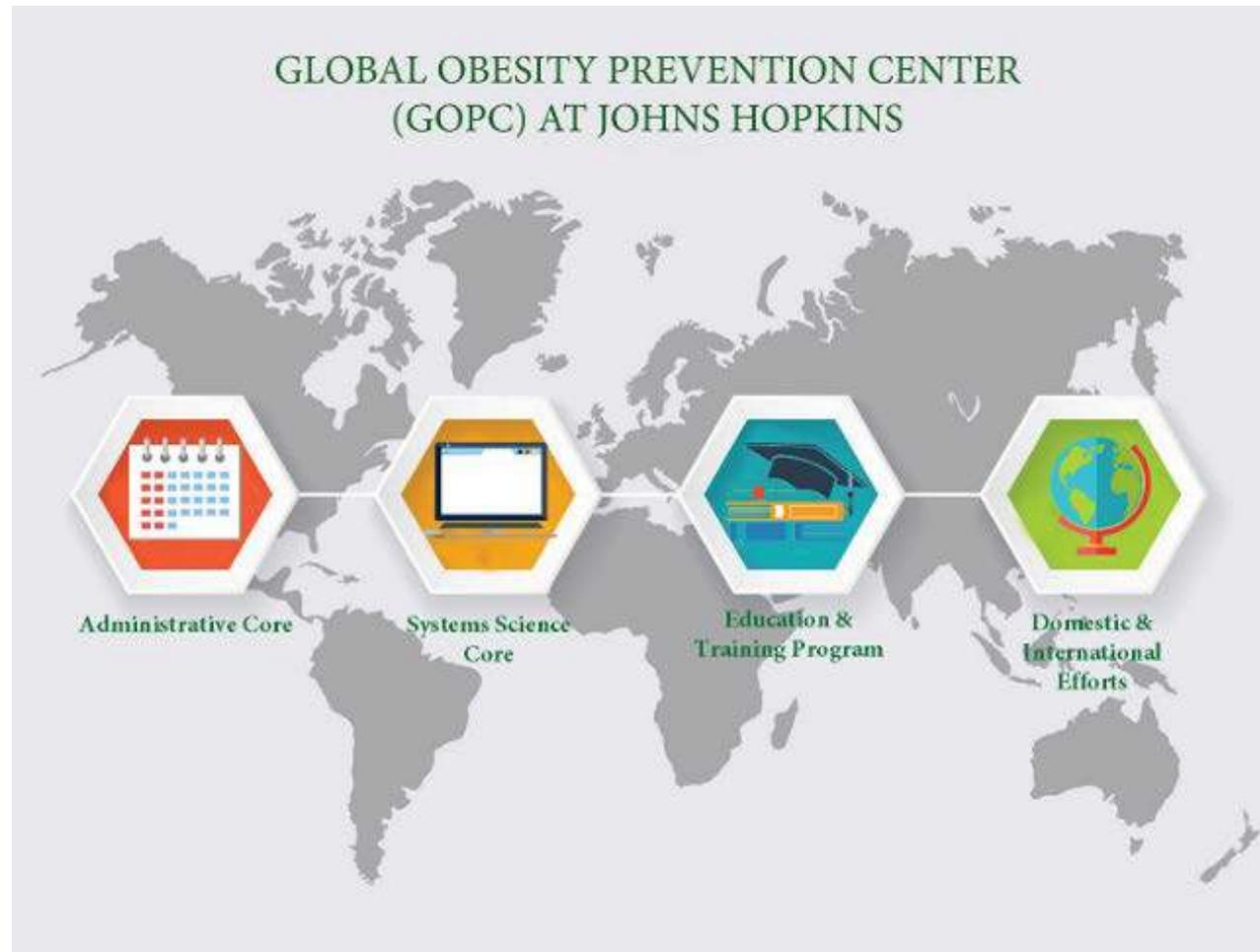


The GOPC is a university-wide Center

The Center includes experts across Johns Hopkins University



Organization of the GOPC

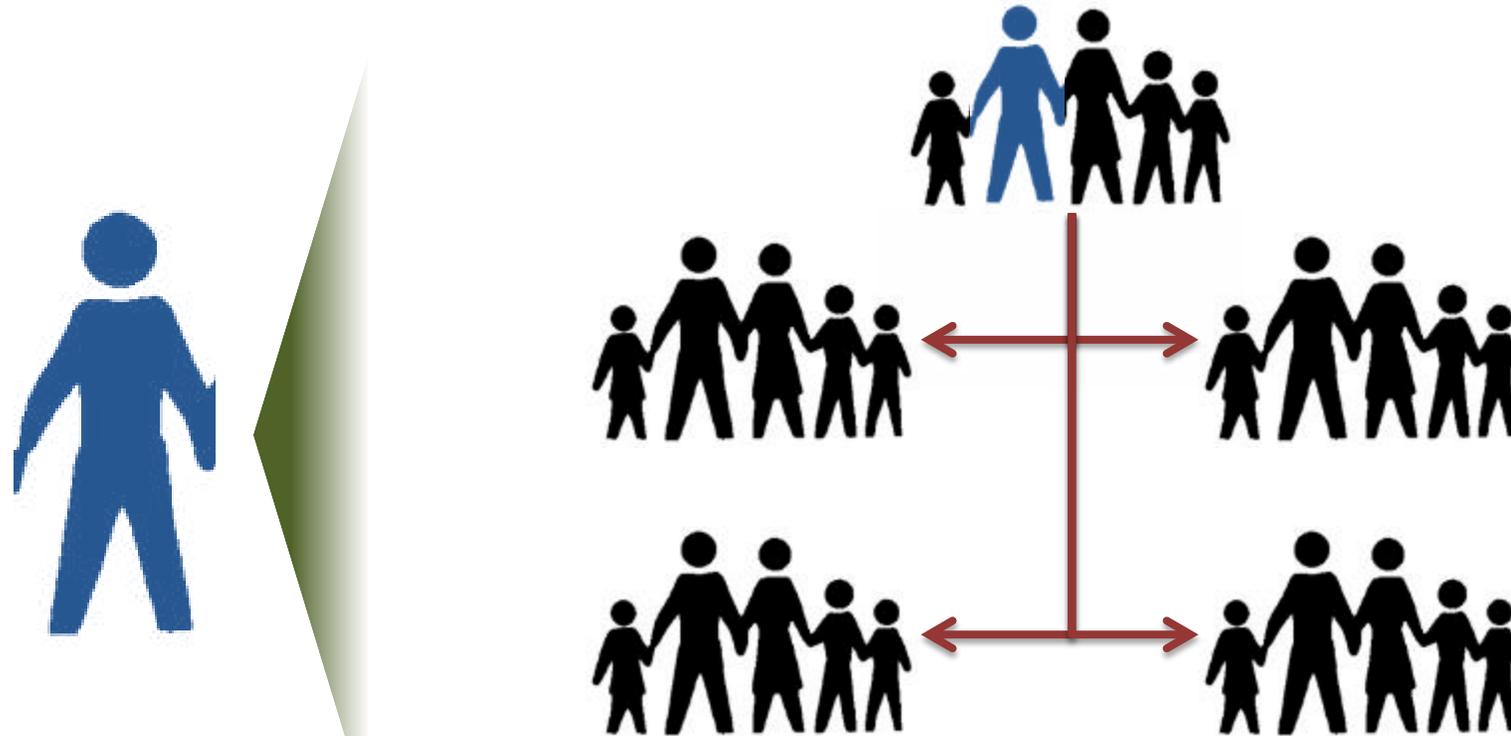


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What is a system?



*Individuals do not exist in isolation; they are all part of many different systems, such as **social, political, environment, and economic systems***

Examples of complex systems



Transportation systems



Ecological systems



Manufacturing systems



Meteorological systems

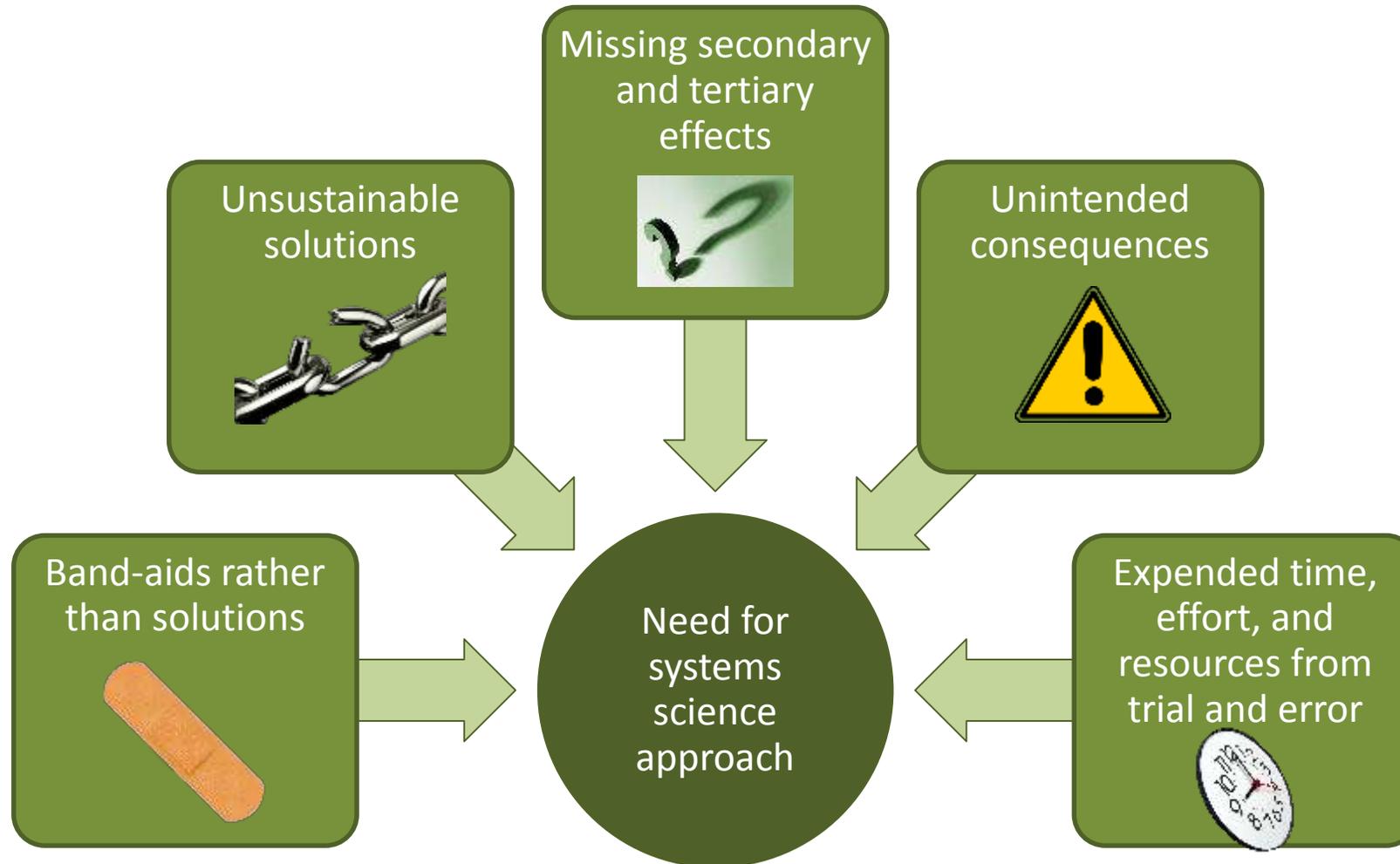


Financial systems



Aerospace systems

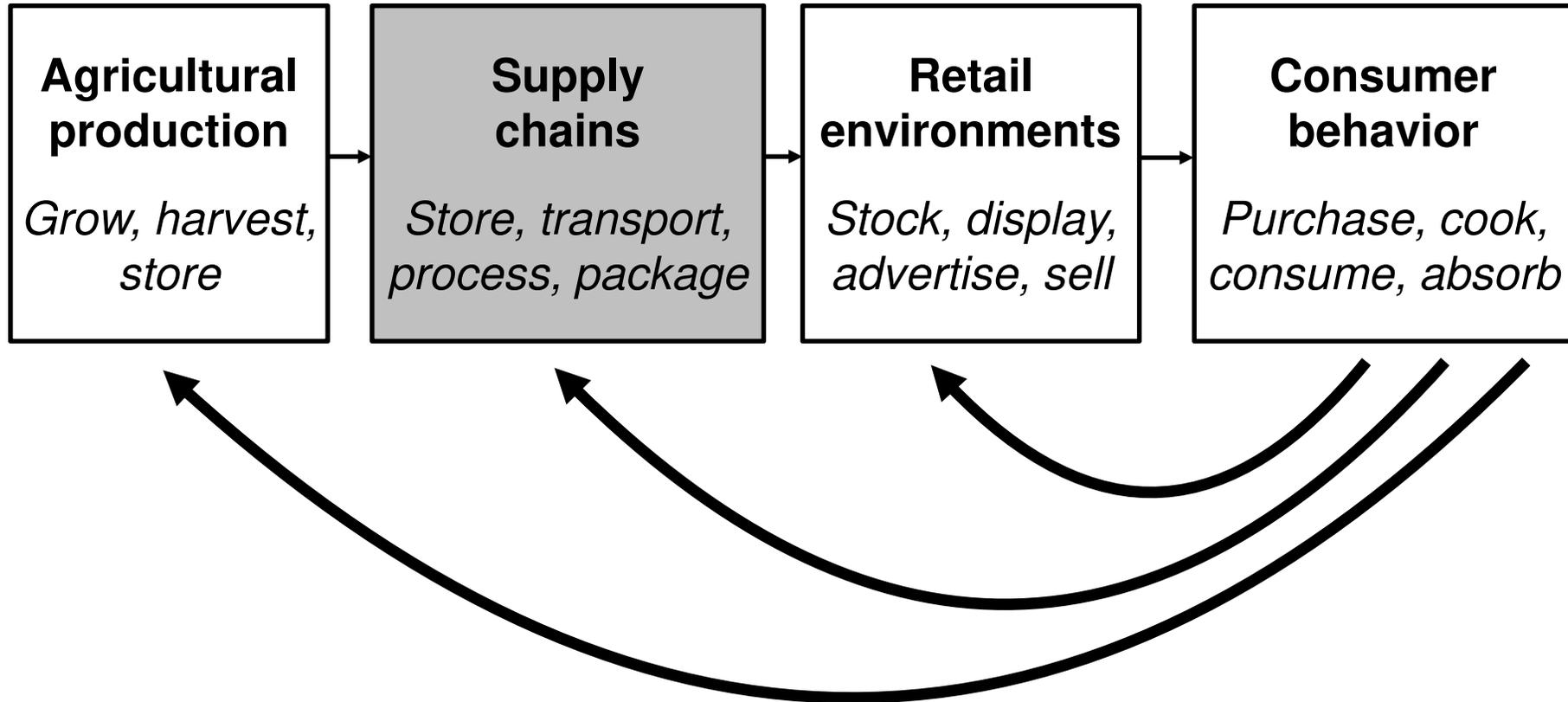
Dangers of not using a systems approach



Content

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 - VPOP Laboratories
 - HERMES Agri-food
- Summary and discussion

In a complex system, where to intervene?



Computational modeling can help understand and address complex systems

Not this type of modeling...

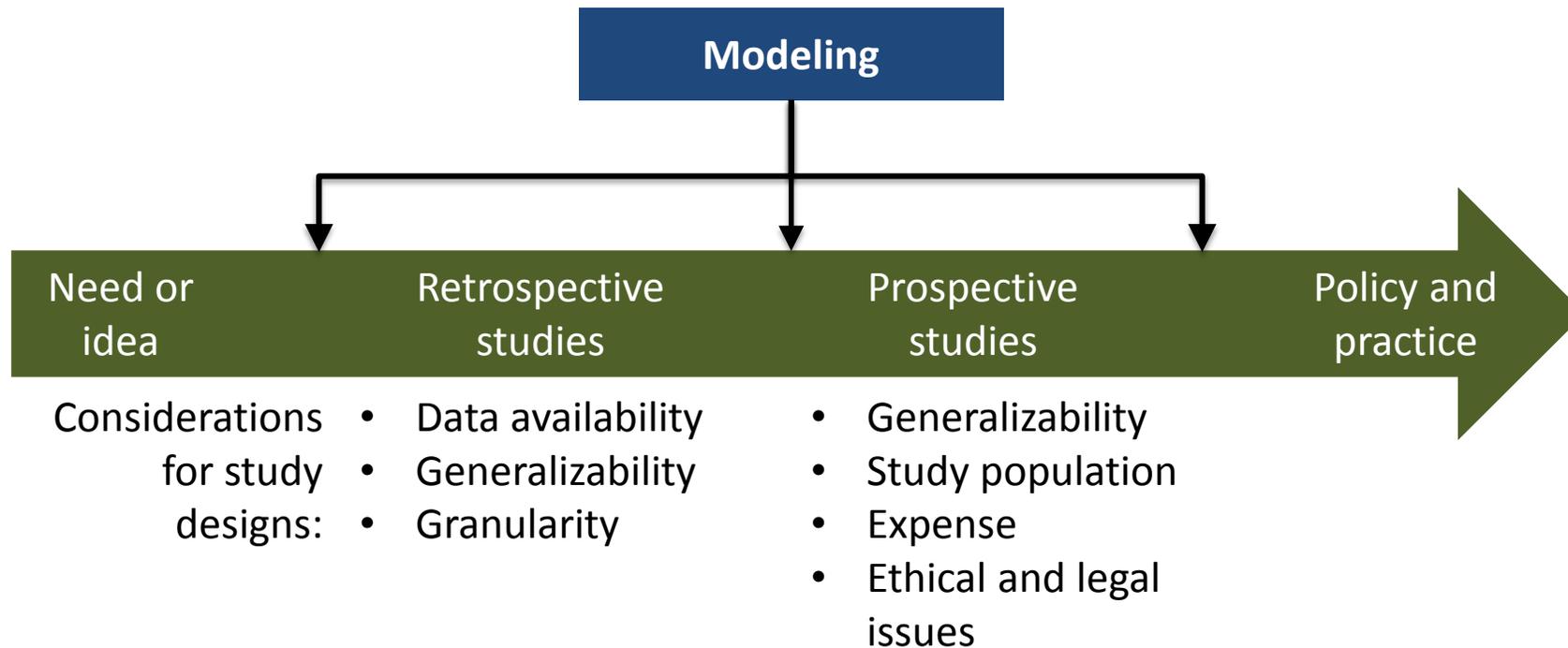


This type of modeling...

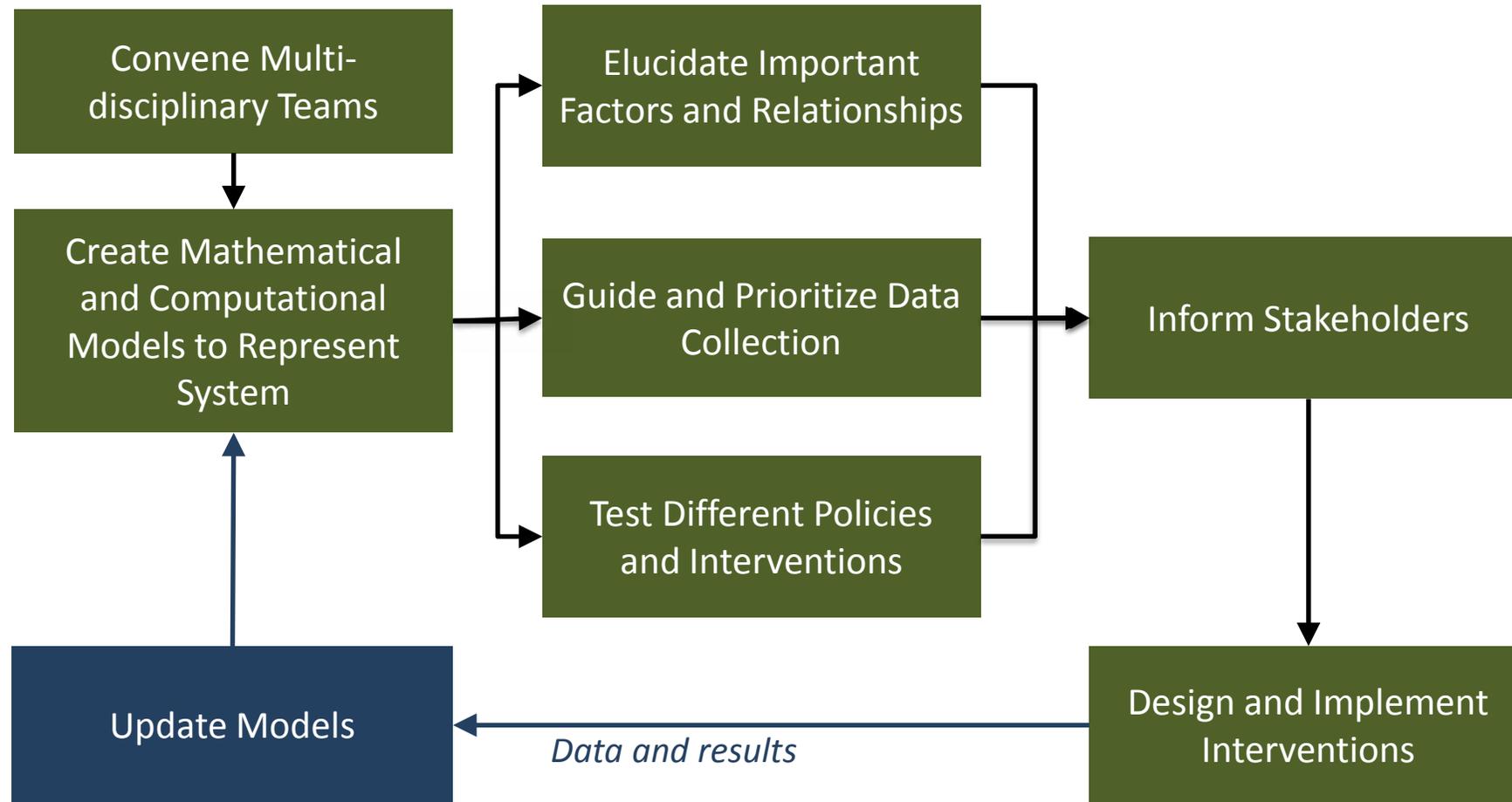


Modeling is the bridge to translation

Modeling can and does occur at different time points along the research path from idea inception to policy implementation



A systems approach iteratively brings together various disciplines, stakeholders, and methods



Content

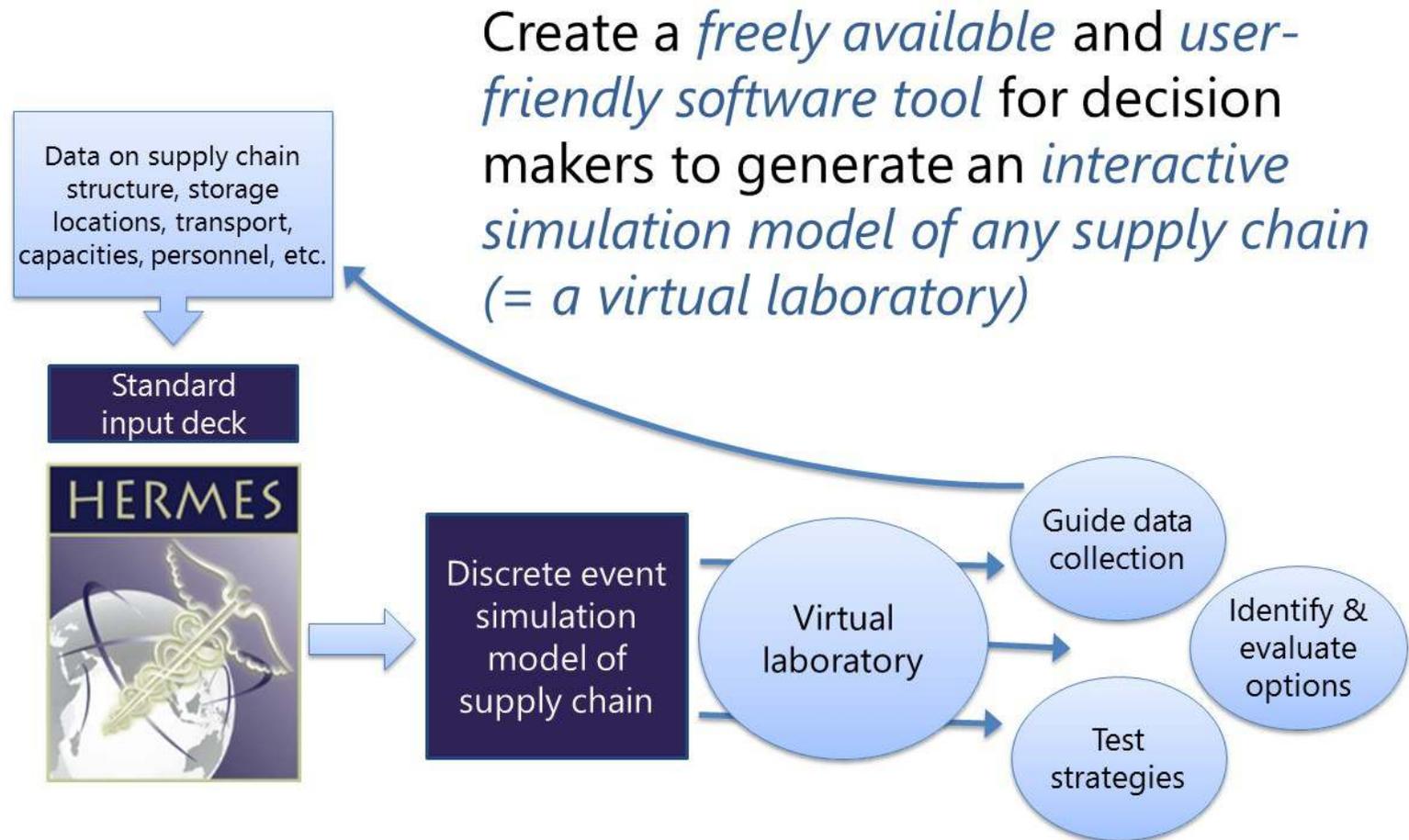
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Food Supplies Have Similarities To Other Supply Systems

The screenshot shows the Guardian website interface. At the top, there are navigation links for 'become a supporter', 'sign in', 'subscribe', and 'search'. The main header features the Guardian logo and a navigation menu with categories like 'election 2016', 'US', 'world', 'opinion', 'sports', 'soccer', 'tech', 'arts', 'lifestyle', 'fashion', 'business', 'travel', and 'environment'. Below this, a breadcrumb trail reads 'home > world > africa > australia > cities > development > UK > europe > americas > asia > middle east'. The article title is 'Why transporting vegetables is not so different from delivering vaccines' by Bruce Y. Lee, dated Wednesday 8 July 2015 05:24 EDT. The article text states: 'Unhealthy packaged food is much easier to transport to remote communities than fresh produce. Bruce Y. Lee explains what vaccines can teach us about improving supply chains'. A photograph shows a man carrying two large woven baskets of green fruit on his shoulders. A caption below the photo reads: 'Fruit is more vulnerable to damage during transportation than sugary drinks. Photograph: Gideon Mendel/Gideon Mendel/CORBIS'. The article continues: 'Every day in low-income countries throughout the world, tons of fresh fruit and vegetables fail to reach their destinations or become damaged and inedible along the way. By contrast, highly processed foods - likely to include large amounts of fat, sugar or preservatives - reach these same destinations, ready to be eaten by people in need of food. This simultaneous availability of less healthy processed'.

What is HERMES?



Example topics HERMES can address

Introducing new products and technology

e.g. food and beverages, storage, vehicles

Monitoring the health and status of the supply chain

e.g. augment imperfect surveillance

Altering characteristics of products and other technologies

e.g. product size and vulnerability/stability

Changing configuration and operations of the supply chain

e.g. storage, shipping frequency, personnel, ordering policy

Differing conditions/circumstances

e.g. infectious disease outbreaks, contamination, delays, and inclement weather

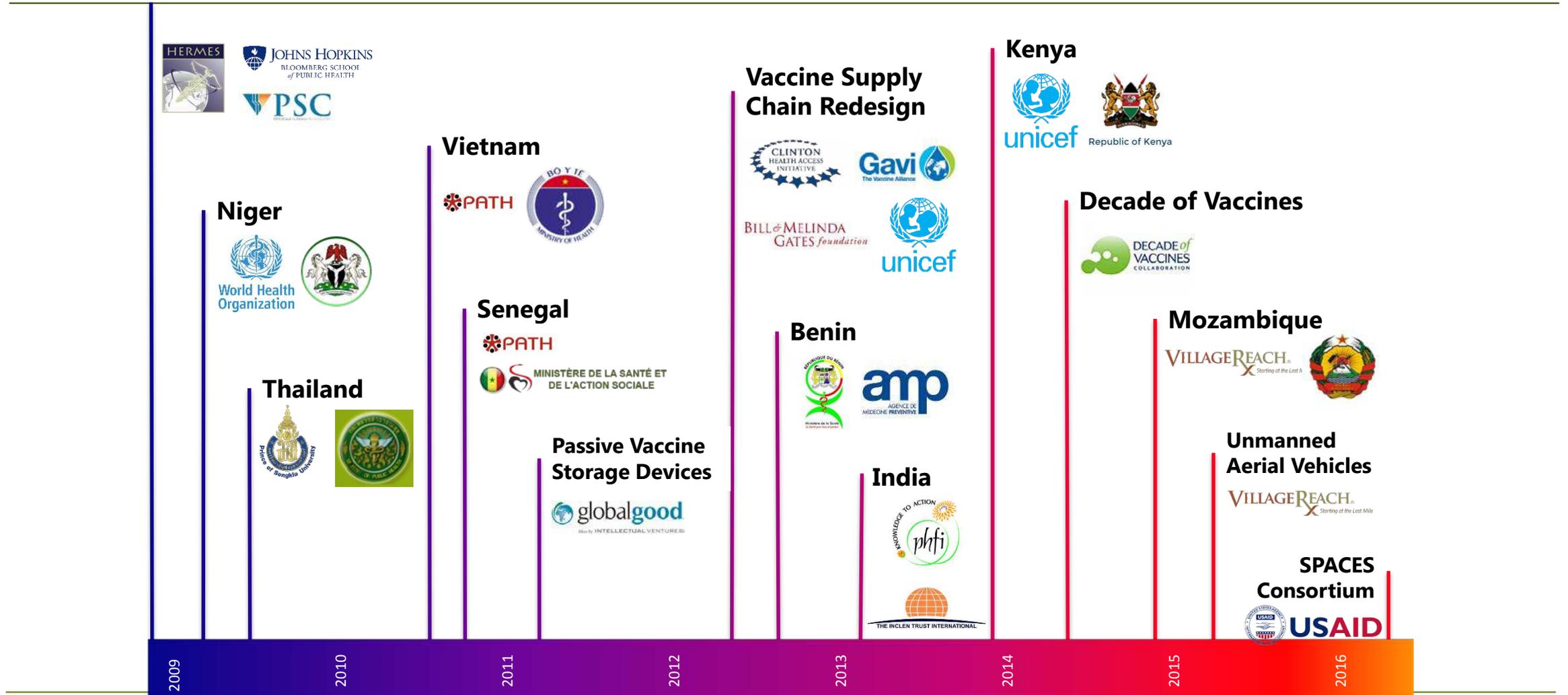
Investing or allocating resources

e.g. adding refrigerators vs. increasing transport frequency

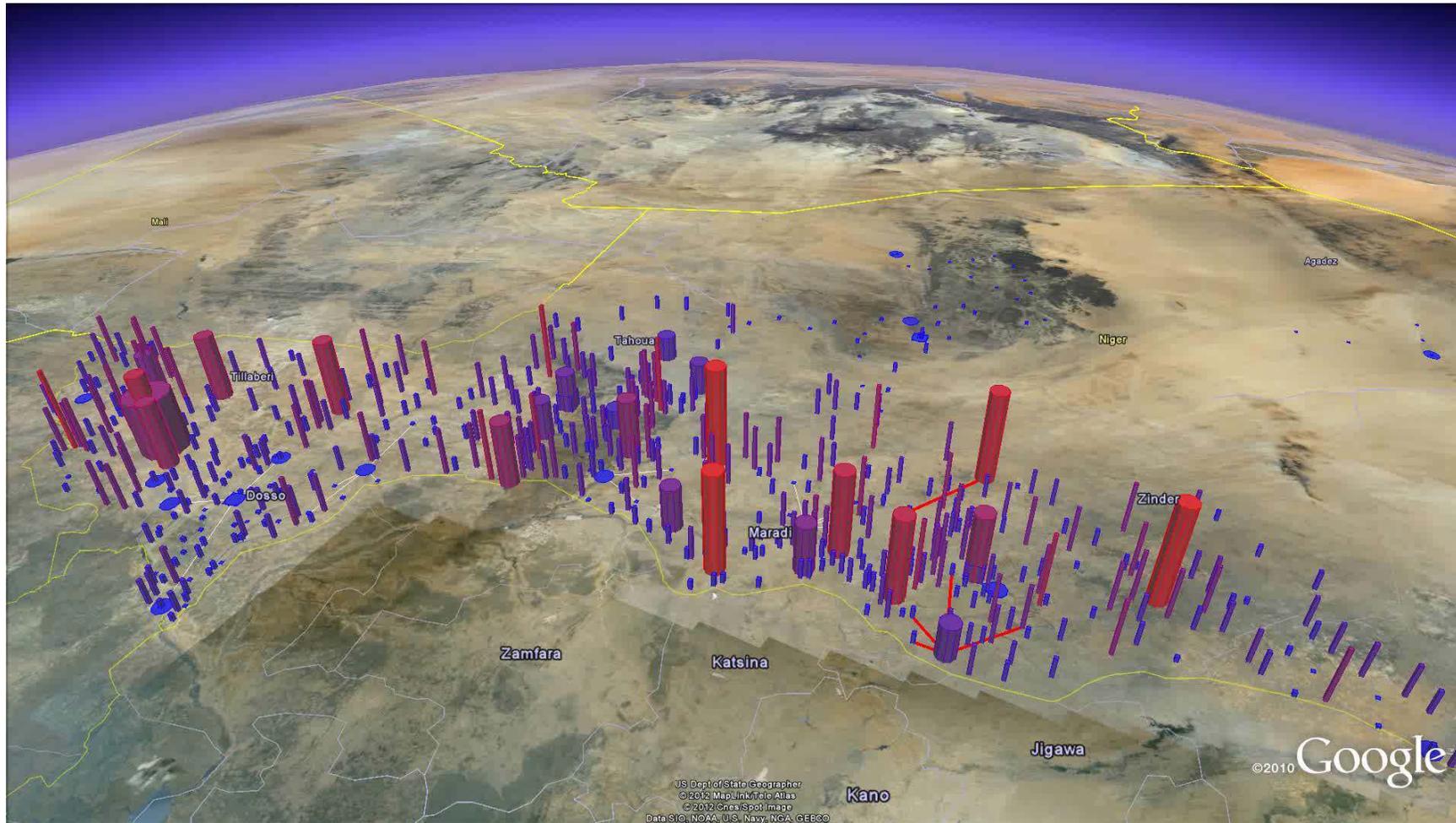
Optimizing product delivery and safety

e.g. minimize negative health outcomes and cost

Examples of HERMES collaborations



Visualization of Supply Chain

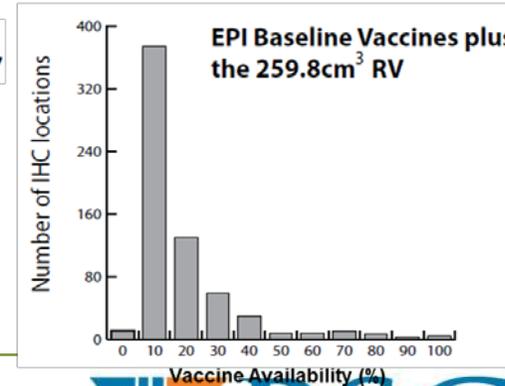
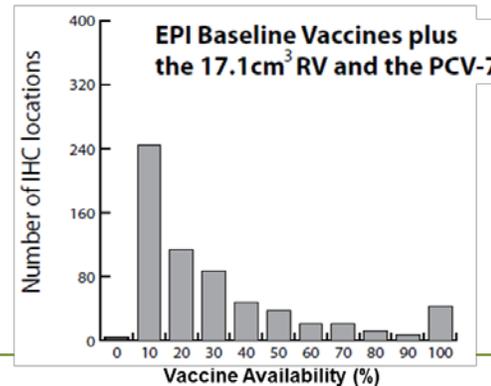
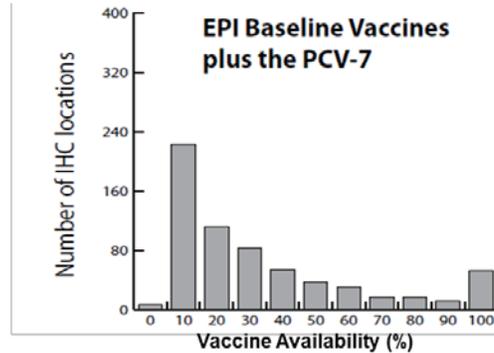
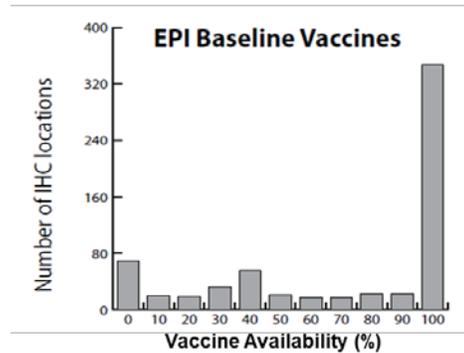


Introducing new vaccines in a country

Impact of Introducing the Pneumococcal and Rotavirus Vaccines Into the Routine Immunization Program in Niger



Bruce Y. Lee, MD, MBA, Tina-Marie Assi, PhD, MPH, Jayant Rajgopal, PhD, Bryan A. Norman, PhD, Sheng-I Chen, PhD, Shawn T. Brown, PhD, Rachel B. Slayton, PhD, Souleymane Kone, MS, Hailu Kenea, MS, Joel S. Welling, PhD, Diana L. Connor, MPH, Angela R. Wateska, MPH, Anirban Jana, PhD, Ann E. Wiringa, MPH, Willem G. Van Panhuis, MD, PhD, and Donald S. Burke, MD



Implementing a system to forecast demand for vaccines

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

ELSEVIER

The impact of implementing a demand forecasting system into a low-income country's supply chain

Leslie E. Mueller^{a,d}, Leila A. Haidari^{a,c}, Angela R. Wateska^a, Roslyn J. Phillips^a, Michelle M. Schmitz^a, Diana L. Connor^a, Bryan A. Norman^b, Shawn T. Brown^c, Joel S. Welling^c, Bruce Y. Lee^{a,d,*}

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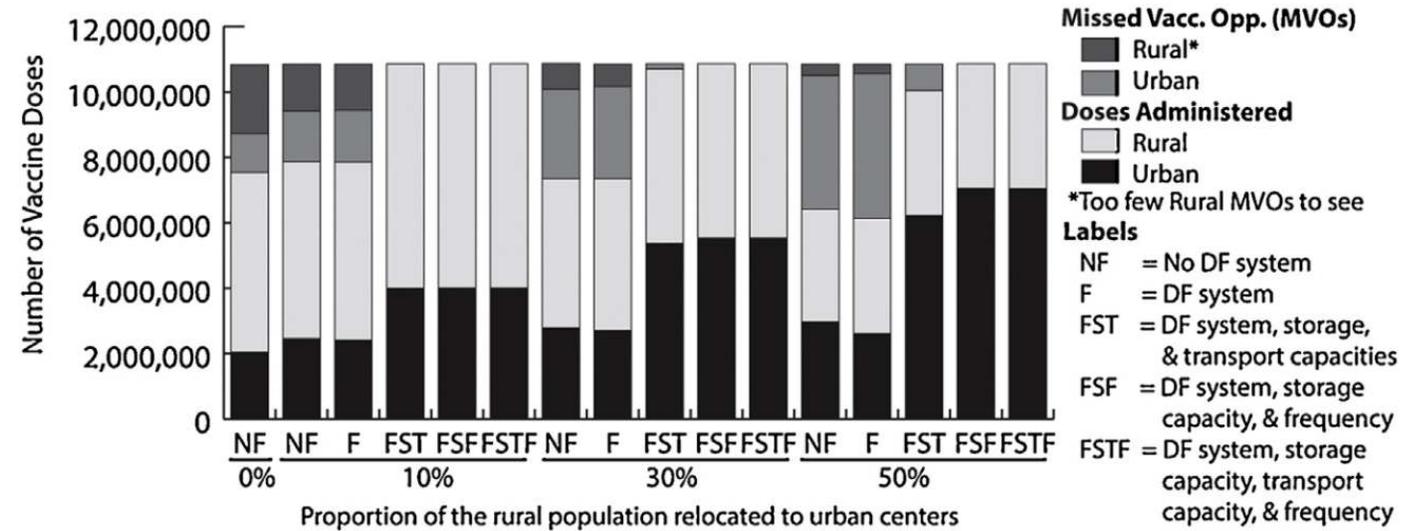


Fig. 2. Vaccinations administered with demand forecasting (DF) system.

Utilizing drones for vaccine transport

The Next New Frontier For Drones: Saving Lives



Forbes

Lee, CONTRIBUTOR

Intersection of business, health and public health. [FULL BIO](#) ▾

Views expressed by Forbes Contributors are their own.



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The economic and operational value of using drones to transport vaccines



Leila A. Haidari ^{a,b}, Shawn T. Brown ^{a,b}, Marie Ferguson ^{c,d}, Emily Bancroft ^e, Marie Spiker ^{c,d}, Allen Wilcox ^e, Ramya Ambikapathi ^{c,d}, Vidya Sampath ^e, Diana L. Connor ^{a,d}, Bruce Y. Lee ^{a,c,d,*}



Making vaccines thermostable



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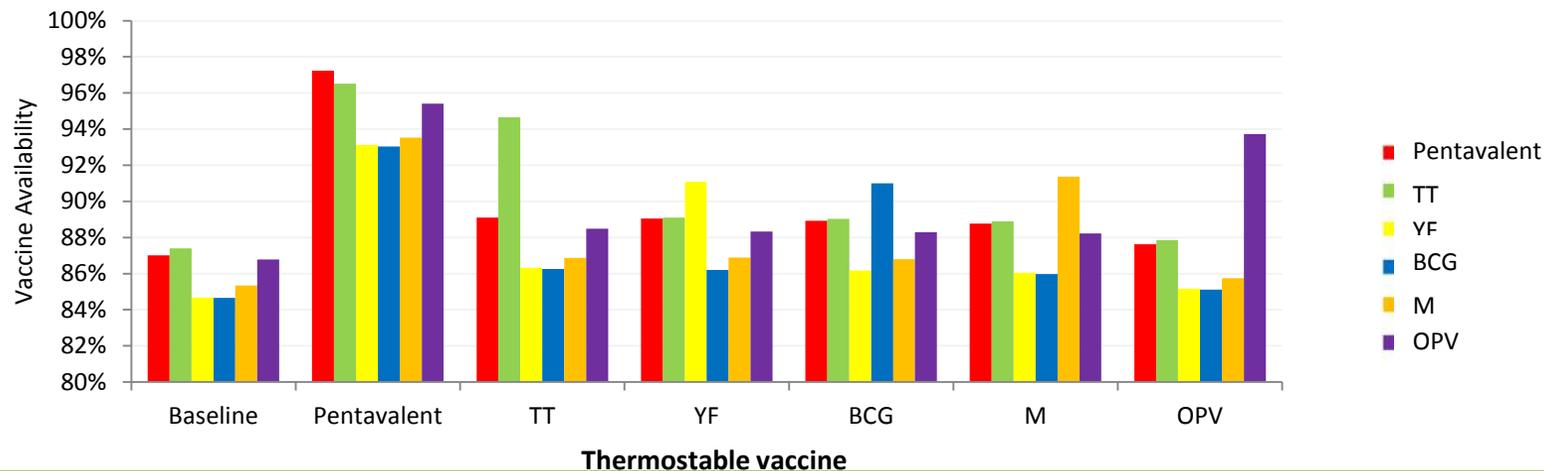
Vaccine

journal homepage: www.elsevier.com/locate/vaccine



The impact of making vaccines thermostable in Niger's vaccine supply chain

Bruce Y. Lee^{a,*}, Brigid E. Cakouros^a, Tina-Marie Assi^a, Diana L. Connor^a, Joel Welling^b, Souleymane Kone^c, Ali Djibo^d, Angela R. Wateska^a, Lionel Pierre^e, Shawn T. Brown^{b,f}



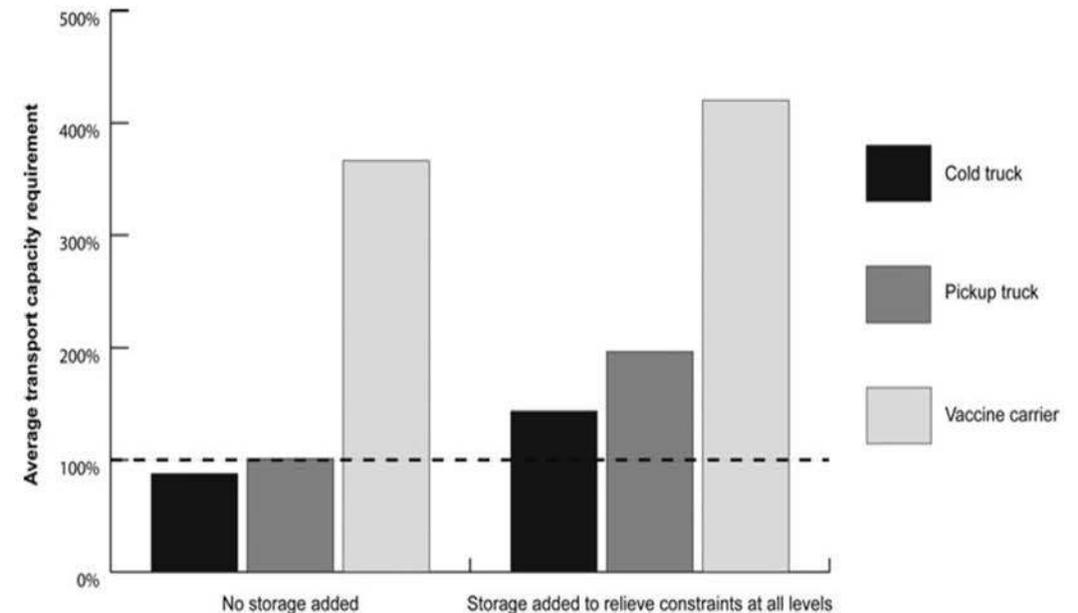
Investing resources to improve supply chain performance

Only Adding Stationary Storage to Vaccine Supply Chains May Create and Worsen Transport Bottlenecks

Leila A. Haidari, MPH; Diana L. Connor, MPH; Angela R. Wateska, MPH; Shawn T. Brown, PhD; Leslie E. Mueller, MPH; Bryan A. Norman, PhD; Michelle M. Schmitz, BA; Proma Paul, MHS; Jayant Rajgopal, PhD; Joel S. Welling, PhD; Jim Leonard; Erin G. Claypool, PhD; Yu-Ting Weng, MS; Sheng-I Chen, PhD; Bruce Y. Lee, MD, MBA



FIGURE ● Transport Capacity Requirement Before and After the Addition of Stationary Storage^a



^aA transport capacity requirement of more than 100% indicates a transport bottleneck.

Changing vaccine primary container sizes



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Vaccine

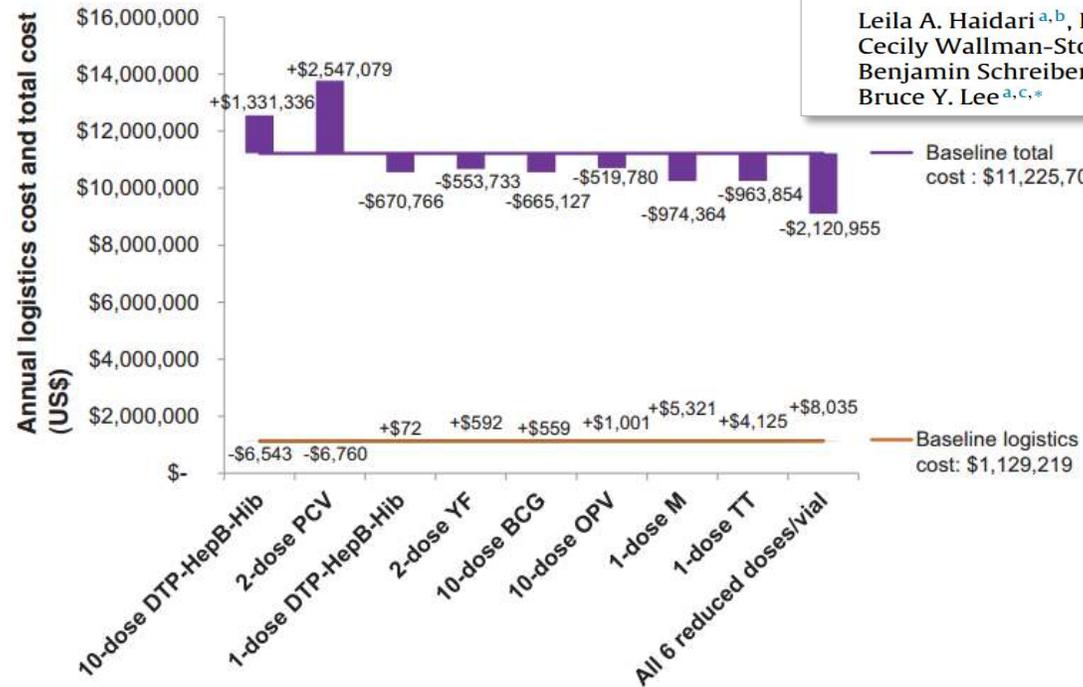
journal homepage: www.elsevier.com/locate/vaccine



One size does not fit all: The impact of primary vaccine container size on vaccine distribution and delivery

Leila A. Haidari^{a,b}, Brian Wahl^c, Shawn T. Brown^b, Lois Privor-Dumm^c, Cecily Wallman-Stokes^c, Katie Gorham^{a,c}, Diana L. Connor^a, Angela R. Wateska^a, Benjamin Schreiber^d, Hamadou Dicko^{e,f}, Philippe Jaillard^{e,f}, Melanie Avella^{e,f}, Bruce Y. Lee^{a,c,*}





Re-designing a country supply chain



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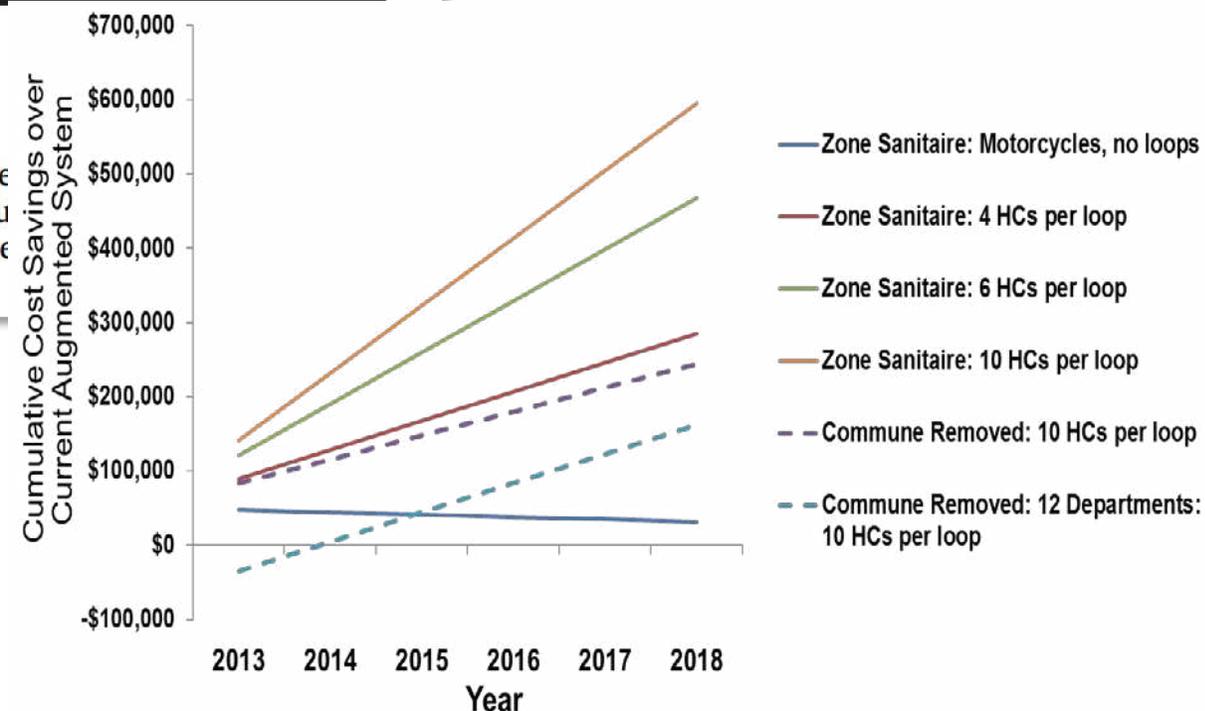
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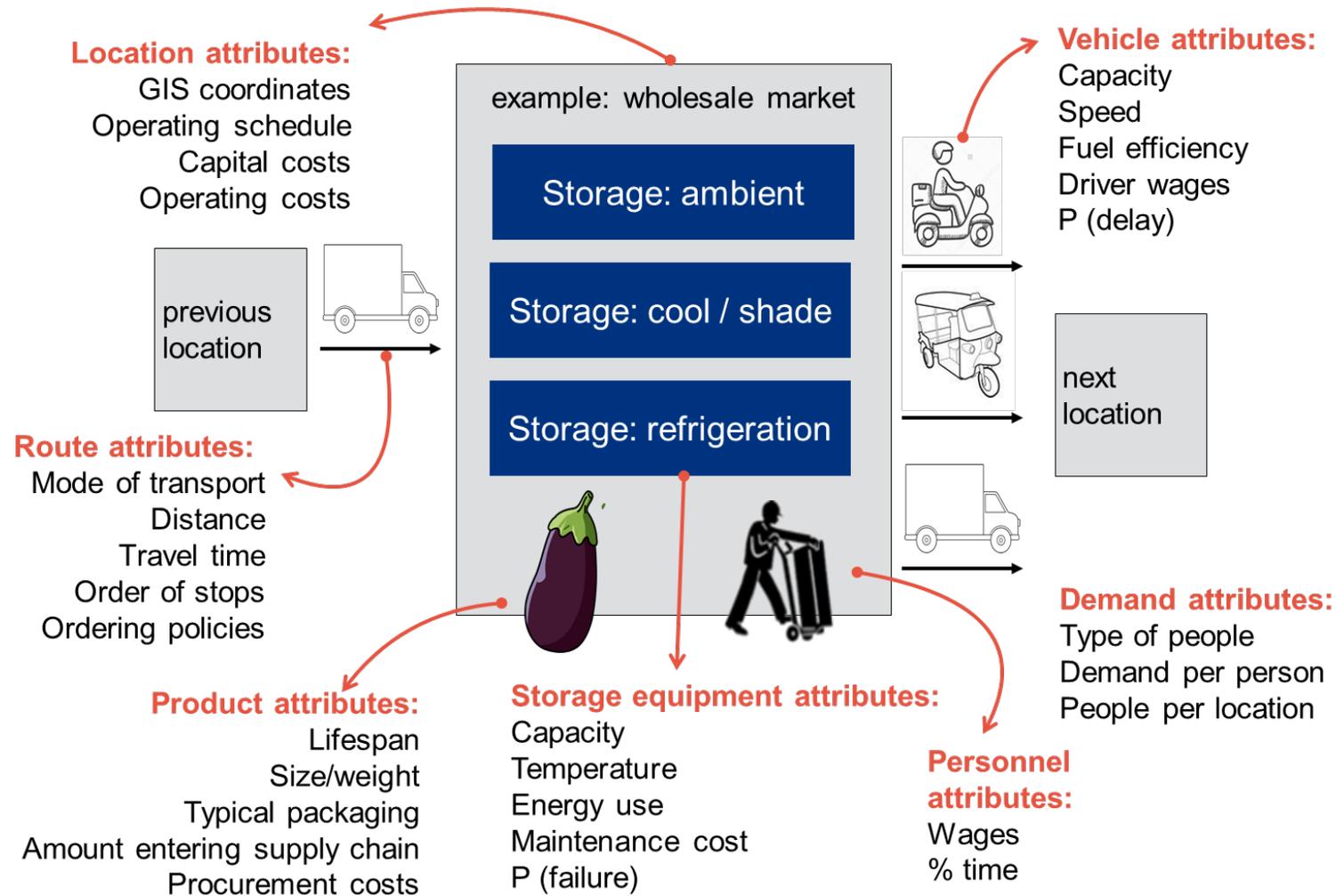


The benefits of redesigning Benin's vaccine supply chain

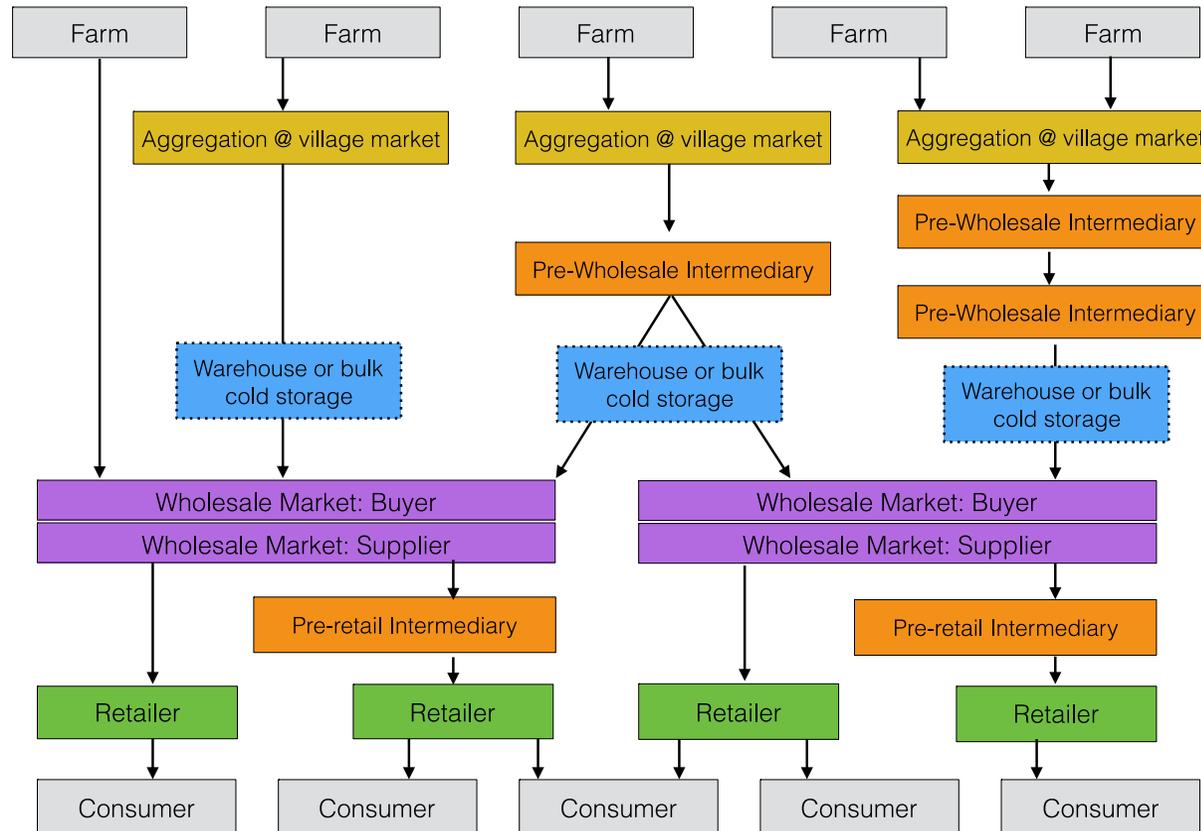
Shawn T. Brown^a, Benjamin Schreiber^b, Brigid E. Cakouros^{c,1}, Angela R. Wate^{c,1}, Hamadou M. Dicko^{d,e}, Diana L. Connor^{c,1}, Philippe Jaillard^{d,e}, Mercy Mvundu^{c,1}, Bryan A. Norman^g, Carol Levin^h, Jayant Rajgopal^g, Mélanie Avella^{d,e}, Caroline Erin Claypool^g, Prama Paul^g, Bruce Y. Lee^{c,i,*,1}



HERMES for Food Supply Chains



Example of HERMES Modeling: State of Odisha, India



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Systems Science Core Team



Atif Adam, MD



Cameron Avelis, MA



Molly Domino, BA



Marie Ferguson, MSPH



Daniel Hertenstein, BS



Mario Solano Gonzalez, BS



Marie Spiker, MSPH



Patrick Wedlock, MSPH



Bruce Y. Lee, MD, MBA



Lindsey Asti, MPH



Elizabeth Mitgang, MSc



Leslie Mueller, MPH



Sarah Bartsch, MPH



Saeideh Fallah-Fini, PhD



Sindiso Nyathi, BA

Questions and Discussion

Thank you!

www.globalobesity.org

globalobesity@jhu.edu | brucelee@jhu.edu

@globalobesity | @bruce_y_lee