Health and Humanitarian Logistics 2015 Conference
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2015 Research Poster and Project Listing

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Poster Abstracts

1. **Map of Primary Healthcare**
   York Zucchi (Hello Healthcare)

   This is a map to illustrate the various components of the PHC services and infrastructure spectrum. It is a useful map to get a visual idea of what the primary healthcare landscape looks like and understand how the parts fit together

2. **HR Leadership for Supply Chain Managers**
   Kevin Etter (UPS/Gavi, the Vaccine Alliance), Hamadou Dicko (Gavi, the Vaccine Alliance), Moz Siddiqui (Gavi, the Vaccine Alliance), Andrew Brown (People that Deliver)

   Strategic Training Executive Programme (STEP) - HR Leadership for Supply Chain Managers: A Gavi, the Vaccine Alliance, and UPS Public Private Partnership Initiative (with People that Deliver). Through leveraging private sector expertise and direct country involvement, UPS and Gavi, the Vaccine Alliance, are developing a short course training workshop, similar to an Executive MBA programme, that will provide Health Supply Chain Management professionals and decision makers with core leadership and management skills.

   We are anticipating the audience will be people who determine strategy, set policy and oversee supply chain networks, this executive level training is for senior supply chain managers and directors from Ministries of Health as well as other officials that have oversight and impact on the supply chain system. Instruction will be provided in people management, problem solving, communication, project management and professional development competencies. The course content will be built around general leadership competencies detailed in People that Deliver's PtD Health Supply Chain Competency Framework for Managers and Leaders (published April 2015). It is anticipated that the course will be delivered in alignment with other technical competency courses currently in place or currently in development in various regions of the globe. The course will include a combination of instructor-led, distance learning and an additional mentorship program.

3. **Access-To-Medicines Supply Chain Design: A Stakeholder Framework**
   Catherine Decouttere (Katholieke Universiteit Leuven), Nico Vandaele (Katholieke Universiteit Leuven), Stef Lemmens (Katholieke Universiteit Leuven)

Many rigorous models have been developed to support the design of humanitarian supply chains. Supply chains supportive of Access-To-Medicines (ATM), like vaccine supply chains impose considerable additional challenges on this design process. We embed these models in a broader stakeholder based framework. This will substantially enhance the societal and human impact of the ATM supply chain service delivery. This broader base of stakeholders will bring along a balanced set of Key Performance Indicators, against which the new design options and scenarios will be evaluated. These scenarios will be the outcome of an iterative design and modelling process moderated by a group of key stakeholders. Subsequently, a multi-criteria ranking method will reveal a shortlist of championing scenarios. Finally, a group decision process will decide on the final supply chain design choice. Moreover, the acceptance and buy-in of the (re)designed supply chain will be much more evident for all stakeholders involved. The main purpose of this paper is to present a general framework for ATM supply chain design which constitutes a stakeholder's framework encapsulating a rigorous modelling approach. We build upon our own experience within a vaccine supply chain.

4. **Enhancing Country-based Change in Human Resources for Health Supply Chains and Humanitarian Logistics – A Stepped Approach for Strengthening Health Systems by People that Deliver**

Andrew Brown (People that Deliver Initiative), Sara Khan (People that Deliver Initiative)

The health supply chain is often the weakest link in achieving global health equity, with all health programs dependent on a functional system for maximum results (eg. improving maternal health, reducing child mortality, combating HIV/AIDS, malaria) The status of the supply chain workforce in resource constrained countries is in marked contrast to their status in high income environments, where supply chain management is recognized as a key strategic function, instrumental to institutional success. The People that Deliver (PtD) Initiative is a global partnership of organisations established in 2011, with a strong interest in health supply chain management. Over recent years the Initiative has been using a coordinated multi-organizational approach to address HR for SCM issues and has developed extensive experience in the process.

This poster highlights the importance of a strong workforce in health logistics and supply chain and explains a systematic approach to HR for SCM through the five HR Building Blocks; 1) Engaged Stakeholders, 2) Optimise Policies & plans, 3) Workforce Development, 4) Increase Performance and Staff Retention and 5) Professionalization of SCM . PtD (www.peoplethatdeliver.org) will present their stepped approach to systematically assess HR for SCM capacity development in country contexts and provides supporting tools and guidance that may aid interventions. This stepped approach to country-based change will particularly benefit managers and leaders responsible for the development of health supply chains and humanitarian logistics in low and middle income environments.

5. **Project Last Mile: Applying Coca-Cola's Expertise to Improve Delivery of Life-Saving Medicines**

Adrian Ristow (The Coca-Cola Company, Director of Project Last Mile); authored by Erika Linnander (Yale Global Health Leadership Institute), Shirin Ahmed (Yale Global Health Leadership Institute), and Leslie Curry (Yale Global Health Leadership Institute)

Background: The global health and development community is beginning to leverage the knowledge and expertise of industries outside of healthcare to address complex global health challenges, but little is known about factors that drive successful efforts across industries and sectors. Project Last Mile (PLM) is a unique public-private partnership that aims to transfer Coca-Cola's logistic, supply chain and marketing expertise to improve public health systems across Africa. By bringing together partners from across sectors, including Coca-Cola, USAID, Global Fund, and the Gates Foundation, the project aims to help get medicines and supplies out to the communities that need them most.

Method: The Yale Global Health Leadership Institute (GHLI) used qualitative research methods to conduct a process evaluation of PLM, systematically documenting how the partnership came together, tracking implementation activities and identifying key challenges and factors for success. From 2011 to 2014, GHLI conducted, analyzed, and synthesized a series of 70 semi-structured qualitative interviews with key informants in Tanzania and Ghana, where the project has been implemented.

Results: Expertise from Coca-Cola has not only helped improve distribution and availability of medicines but also contributed to important shifts in the business culture of public health entities. The following themes were found to be essential for partnership success: 1) Flexible approach to partnership design, 2) Adequate engagement from global and national development partners, 3) Adapting Coca-Cola approaches to public and private environments, 4) Engagement of boundary spanners to translate across industries and sectors, 5) Investment in local management and implementation capacity, 6) Close interactions between local bottlers and public health staff, 7) Accommodating competing demands of bottlers and public health staff, and 8) Alignment with complex funding environments. Conclusion: These findings can inform development and implementation of PLM in other settings as well as other partnerships seeking to drive improvements in global health.

6. **The Role of Integrated Scenario Experimentation in Improving Humanitarian Response Outcomes**

Scott Appling (Georgia Tech Research Institute), Leigh McCook (Georgia Tech Research Institute); co- authors Erica Briscoe (Georgia Tech Research Institute), Gerald Scott (Naval Postgraduate School), Tristan Allen (Naval Postgraduate School), Todd Fruehauf (Naval Postgraduate School)

GTRI in support of the Naval Postgraduate School's Joint Interagency Field Experimentation JIFX event carries out quarterly Integrated Scenario Experimentation. Integrated scenario experimentation brings technologists together to collaborate on shared humanitarian response scenario to gain working knowledge outside of the laboratory. Scaffolding scenarios are offered to experimenters in a series of pre-planning calls that happen before the week of JIFX. Through discussion with experimenters, the scenarios are expanded to allow for in situ experimentation that is beneficial to individuals experimenters outside of their traditionally isolated and laboratory settings. The qualitative knowledge and empirical data

gathered through integrated scenario experimentation is invaluable to evolving experimenters' technology.

7. **Public Transportation Planning For Mass-Scale Evacuation Prior To A Hurricane**
Rajan Batta (University at Buffalo (SUNY)), Rahul Swamy (University at Buffalo (SUNY)), Jee Eun Kang (University at Buffalo (SUNY))

Before a mass-scale disaster strikes a populated region, large sets of population groups evacuate from evacuation zones to safety regions. This research aims to provide a public transportation based evacuation strategy using road infrastructure to maximize the number of people evacuated with limited vehicle resources to cater to a time-varying demand. The nature of the disaster is assumed to be such that the evacuation zones and safety regions, as well as the time of strike can be pre-inferred, like in the case of most hurricanes. The evacuation operations are to be conducted within a time-frame which starts when the warnings are issued and ends when the disaster strike is expected.

8. **Transforming traditional public health supply chain through structural flexibility : Defeating Ebola in Sierra Leone**
Bram Dingemans (Crown Agents UK); Muchaneta Mwonzora (Crown Agents); Joey Shivanandan (Crown Agents)

This poster explores the drivers, functionality and performance of the Ebola Essential Health Care Supply Chain Platform operationalised by CAIPA, a Crown Agents and International Procurement Agency (IPA) joint venture, on behalf of DFID in Sierra Leone.

As the numbers of Ebola cases begin to dwindle in Sierra Leone, it is vital for organisations such as CAIPA to collate data and lessons learnt from in-country operations. The Ebola emergency response demands a supply chain that is rapidly responsive to the changing and relatively unpredictable needs that is characteristic of public health outbreaks of this nature. The supply chain operationalised by CAIPA exhibits both dynamic and structural flexibility needed to reduce loss of life and control the endemic disease. Flexibility was demonstrated through the ability to meet the changing demands of stock and preferences by our end-users. Additionally, flexibility was needed in order to meet the disease outbreak surges in different parts of Sierra Leone.

Through the course of the project, the CAIPA supply chain has operated a forward and reverse logistics base supplying life-saving drugs, medical supplies and crucial infrastructure equipment to 6 Ebola Treatment Centres (ETCs), 3 Ebola laboratories and other facilities providing Ebola related services. The CAIPA Ebola supply chain has transitioned with patterns of disease incidence and with the overarching nature of emergency responses. This presentation will explore the mechanism of CAIPA's responsiveness to move away from a traditional public health supply chain in order to utilise implementation strategies adaptable to the nature of the Ebola emergency.

9. **Evaluating the Impact and Behavior of a Global Health Supply Chain**
Ben Johnson (Georgia Institute of Technology), Julie Swann (Georgia Institute of Technology), Paul Griffin (Georgia Institute of Technology)

Using performance data from the USAID Malaria Supply Chain, both the impact of the supply chain on malaria mortality and the behavior observed in the supply chain are evaluated. A number of supply chain factors are evaluated alongside health specific factors to identify important factors in preventing Malaria mortality.

10. Locating Roadside Clinics in Sub-Saharan Africa

Harwin de Vries (Erasmus University Rotterdam), Joris van de Klundert (Erasmus University Rotterdam), Albert Wagelmans (Erasmus University Rotterdam)

Providing African truck drivers with adequate access to healthcare is an effective way to reduce the burden and the spread of HIV and other infectious diseases. Therefore, NGO North Star Alliance builds a network of healthcare facilities along major African trucking routes. Choosing the locations of new facilities presents novel and complex optimization problems. This paper considers a general design problem: the Roadside Healthcare Facility location Problem (RHFLP). The RFHLP entails to select locations for new facilities and to choose for each of these facilities whether or not to add specialized healthcare services for HIV, STIs, Tuberculosis, and/or Malaria to the standard health service package.

The objective combines the maximization of the truck driver patient volume at these facilities and the maximization of the effectiveness of the service delivery to the population served. The latter criterion is modeled through three novel access measures which capture the needs for effective health service provisioning to mobile patients. The resulting optimization problem is essentially different from previously studied healthcare facility location problems, because of the specific mobile nature of health service demand of truck drivers. We present a mixed-integer programming formulation for the RHFLP, and prove the problem to be strongly NP-hard.

Furthermore, based on theoretical and computational analyses, we show that the solutions found are highly robust with respect to data inaccuracy. Finally, we show how real life problem instances can be solved, presenting numerical experiments for the North-South corridor network (Southern and Eastern Africa), and discuss policy implications.

11. Understanding host government impact on humanitarian logistics: Effects of interests and dependency in complex emergencies

Nonhlanhla Dube (University of Groningen), Taco van der Vaart (University of Groningen), Ruud Teunter (University of Groningen), Luk van Wassenhove (INSEAD)

International humanitarian non-governmental organisations are increasingly faced with the challenge of overcoming logistical hurdles caused by host governments to ensure good delivery performance. Host governments' openness to assistance often leads to timely delivery of aid whereas their reluctance to receive assistance can have devastating consequences. With almost 200 million deaths in just 25 of the violent events of the last century and millions in need humanitarian assistance in countries like Somalia and Syria, understanding how and why host governments impact humanitarian logistics in complex emergencies is an urgent matter.

This research is an in-depth multiple case study that explores these questions. Results show that host government actions are explained by their dependency on international humanitarian organisations on one hand, and tension in interests on the other hand. In

addition, regulatory and enforcement capabilities of a host government are crucial for ensuring that they can guard their interests. We derive four stances host governments predominantly adopt in terms of how they regulate/ control logistics related activities, namely: non-restrictive, indifferent, selectively accommodating, and uncompromising. Each of these stances carries different implications for logistics decisions and delivery performance. This paper further offers possible managerial approaches for addressing challenges arising from these aforementioned stances.

12. Gift In Kind Manager

Junior Kazadi Mulaji (World Vision DRC), Jonathan Kimonge Alama (World Vision DRC), Delphin Mwilambwe Ngoy (World Vision DRC)

DRC Country has complex situation, very rich in terms of resources but when you see the population, it's day and night. The public health systems are very poor due to corruption that has overtaken the conscience of leaders and spreading to the staff at the lower levels. Treatments are possible only for those with money while those without are left to die without help or awareness. When it comes to Humanitarian Emergencies, the lack of infrastructure and poor government systems lead to complex ongoing challenges.

13. Supply Chain Visibility and Control Through Cloud Computing Platform in Africa

Trevor Lambiotte, ONE Network, Resolve Solutions Partners

Explore the practical use of community based, cloud-computing platforms in improving efficiency and control in the supply chain. This presentation will be an informative look at the real solutions underlying the jargon and how they can be leveraged to drive true value. It will present the relevance and implication of these solutions to the South African and indeed African market, indicating the risks and opportunities facing our dynamic world in exploiting these solutions.

14. **Catch-up Scheduling for Childhood Vaccination**

Dr. Pinar Keskinocak (Georgia Institute of Technology); co-authors Dr. Hannah K. Smalley, Sheila D. Isbell (Georgia Tech Research Institute) , Dr. Faramroze Engineer, Dr. Larry K. Pickering (Emory University School of Medicine)

Recommended immunization schedules for children are published annually by the Advisory Committee on Immunization Practices. These schedules contain specific rules regarding the timing of each vaccine, rules which must be followed when constructing a catch-up immunization schedule for someone who has fallen behind on one or more vaccinations. Inappropriately constructed schedules may prevent timely vaccination, potentially increasing the risk for contracting a vaccine-preventable disease.

To help caregivers and providers construct catch-up immunization schedules, we developed a decision support tool which constructs optimized catch-up immunization schedules using a dynamic programming algorithm. Given an individual's vaccination history and vaccine-specific recommendations for that individual, the tool consistently constructs an optimized immunization schedule for remaining doses to be administered. Schedules constructed maximize the number of doses given, and minimize the total delay in administering doses.

This tool ensures timely vaccination rates, eliminates human error, expedites schedule generation, and alleviates missed opportunities. Originally available only as a downloadable program, this tool is now available online at vacscheduler.org. The current site features allow users to save, upload, and update their vaccination histories, and print their recommended immunization schedules. The site alerts users if a vaccination history is likely entered incorrectly and provides an option to create an accelerated schedule. Future work includes the development of online adolescent and adult immunization schedulers.

15. Optimized Oral Cholera Vaccine Distribution Strategies to Minimize Disease Incidence

Dr. Pinar Keskinocak (Georgia Institute of Technology), Dr. Julie Swann (Georgia Institute of Technology), Dr. Hannah K. Smalley (Georgia Institute of Technology), Dr. Alan Hinman (Task Force for Global Health)

In addition to improved sanitation, hygiene, and better access to safe water, oral cholera vaccines can help control the spread of cholera in the short term. However, there is currently no systematic method for determining the best allocation of oral cholera vaccines to minimize disease incidence in a population where the disease is endemic and resources are limited. We present a mathematical model for optimally allocating vaccines in a region under varying levels of demographic and incidence data availability.

The model addresses the questions of where, when, and how many doses of vaccines to send. Considering vaccine efficacies (which may vary based on age and the number of years since vaccination), we analyze distribution strategies which allocate vaccines over multiple years. Results indicate that, given appropriate surveillance data, targeting age groups and regions with the highest disease incidence should be the first priority, followed by other groups primarily in order of disease incidence, as this approach is the most life-saving and cost-effective. A lack of detailed incidence data results in distribution strategies which are not cost-effective and can lead to thousands more deaths from the disease. The mathematical model allows for what-if analysis for various vaccine distribution strategies by providing the ability to easily vary parameters such as numbers and sizes of regions and age groups, risk levels, vaccine price, vaccine efficacy, production capacity and budget.

16. Workforce Optimization Tool for Community Health Workers in Mozambique

Dr. Julie Swann (Georgia Institute of Technology); co-authored by Dr. Pinar Keskinocak, Emily Gooding, Colleen Gootee, Dr. Lori Houghtalen (all Georgia Institute of Technology); and Alan Hinman (Task Force for Global Health), Vivian Singletary (Task Force for Global Health)

The Workload Indicators of Staffing Need (WISN) is a methodology created by the World Health Organization and published in 2010 to determine how many health workers of each type are needed to fulfill the needs of a given healthcare facility and to assess the workload of the workers in that facility. These results are documented in two forms: (1) identifying overages and underages represented by an integer, and (2) representing the workload burden of each person through the calculation of a ratio. The WISN highlights existing imbalances at locations, but does not assist with planning or allocation.

This poster presents a Workforce Optimization Tool which accounts for employee availability and preference to work in a specified location. The decision-support tool includes an optimization model with a user interface and basic analysis capability. The tool recommends the optimal location to place each healthcare employee. The goal of the embedded model is to maximize employee satisfaction as represented by their preferred locations

subject to limitations defined by demand and other facility-specific information needed for successful operation. The inputs to the model include information about each employee, the demand in each province, and the available budget in each province.

17. Models and Decision-Support for Post-Disaster Debris Management

Dr. Pinar Keskinocak (Georgia Institute of Technology); co-authors Dr. Melih Celik (Middle East Technical University), Dr. Ozlem Ergun (Northeastern University), Dr. Alvaro Lorca (Georgia Institute of Technology), Dr. Kael Stilp (Georgia Institute of Technology)

Debris management is one of the most time consuming and complicated activities among post-disaster operations. Volume of post-disaster debris may be equivalent to multiple years of solid waste that would normally be generated. In the aftermath of a disaster, debris hampers effective search-and-rescue and relief distribution efforts by blocking roads and preventing access to disaster sites, highlighting the significance of timely debris clearance and removal. Debris also contributes significantly to disaster management costs.

In the first few days following the disaster (response phase), the resources are often extremely limited and the urgency of delivering aid to those in need is very high; hence, the main objective for the clearance activities is to unblock the roads by pushing the debris to the side so that search-and-rescue activities as well as relief transportation can proceed. In the recovery phase, debris collection activities consist of transportation of the debris from the disaster area to collection sites for further processing or disposal. Lastly, debris recycling/disposal consists of processing (e.g., burning, crushing, grinding) debris at predetermined facilities followed by further processing for recycling and/or disposal by transportation to landfills. In three related research studies, we develop models or decision-support tools to assist in decisions related to debris clearance, collection, and disposal.