THE STOCK–OUT SEVERITY INDEX: A NEW TOOL TO EVALUATE A PERSISTENT PROBLEM

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I. DRUG STOCK-OUTS: A DRIVER OF GLOBAL HEALTH INEQUTIES

Imagine a sick child in a remote village who is diagnosed with a diarrheal disease. Her medical provider prescribes over-the-counter oral rehydration salts and a common antibiotic. At the village's only pharmacy, her parent is told that they have run out of both medications. The pharmacist adds that because of seasonal mudslides blocking access to the village, it's difficult to know when their supplies will be replenished. This predicament – a "drug stock-out" – could have a profound impact on the child's health. Leading to treatment with inappropriate, alternative medications, prolonged illness, antibiotic resistance, and even death, drug stock-outs are a serious problem in low- and middle-income countries (LMICs), where they amplify structural inequities and exacerbate existing public health challenges.

Pharmaceutical supply chains are intrinsically complicated in LMICs, where governments

implement public health policies and interventions alongside international donors. In some cases, drug availability is less an issue at the regional level than it is at the "last mile": the final destination of goods in supply chain management and planning. Solutions to last mile drug stock-outs in LMICs have, to date, been hobbled by siloed framing of the problem: for example, public-health interventions that do not take into account why stock-outs occur, and management and engineering interventions that neglect equity or fairness in problem-solving.

An equity-based solution to the problem of LMIC drug stock-outs would require some mechanism for quantifying their impact on specific communities (relative to others). This documentation would, in turn, enable government and NGO planners, logistics specialists, and policy experts, as well as commercial companies, to craft interventions without presupposing that all drug stock-outs have the same impact on diverse communities.

Researchers at the University at Buffalo (UB) have developed a decision-making tool to address this particular knowledge gap. To quantify the severity of the impact that drug stock-outs have on particular communities, they developed a "stock-out severity index" (SSI) that utilizes risk factors and determinants of health from a combination of data sources. The SSI is a high-impact innovation aligned with the United Nations' Sustainable Development Goals (SDGs), which call for an increased focus on addressing equity challenges in human health and wellbeing. Making possible the definition of priority levels of different population groups, the SSI enables supply chain improvements based on equity considerations—rather than the false assumption that populations experience equivalent challenges in the face of drug stock-outs.

In sum, the SSI integrates supply, demand, and demographic data from the Demographic and Health Surveys Program (DHS), World Bank and Global Health Observatory (GHO), as well as in-country entities (Ministries of Health, etc.) and NGOs. To integrate datasets that have been compiled for divergent purposes, with different methodologies and data collection instruments, the SSI proposes that each dataset be categorized into one of three vertical categories:

> (a) Demographic data specific to diseases and location or population settlement – typically disease prevalence and burden data;
> (b) Demographic data specific to location— typically population data; or
> (c) Stock-out history specific to diseases— typically supply level data.

The traditional "equality" approach to drug stock-out assessment utilizes supply and demand data for a particular drug. However, two locations with the same product stock-out in the same quantity are not always affected identically. The SSI's improvement over the traditional equality analysis is in combining supply and demand data for a particular drug with demographic and community-level information to provide an index of inequity that is connected to the unique challenges of specific population settlements. It is a valuable tool for measuring the inequity impact experienced within a given village or defined geographic zone due to drug stock outs.

The richness and diversity of the data considered in the SSI means that the inequity score for a given drug stock-out is influenced by factors beyond specific medical shortages. For example, the SSI score for a given drug shortage would be higher

(worse) for a location with fewer clinics per 1000 people than another location with more clinics.

Thus, the SSI can be used as a prioritization metric to show which districts within a given region are most severely affected by a drug stock-out, and enable regional managers or policymakers to prioritize the dispatch of limited resources in low-income settings. However, it is important to note that the SSI does not provide a method for comparing two different systems, such as villages in different districts or states, or two states at different points of times. For this type of comparison, the creators of the SSI recommend that the it be used in combination with the modified GINI-coefficient.

II. PRACTICAL TAKEAWAYS

1 The implications of drug stockouts vary from community to community. Efforts to address last mile drug stock-outs must take equity considerations into account to identify and implement the best long-term solutions.

2 Conventional drug stock-out analysis uses supply and demand data. Rather than tallying days of shortage, the SSI has the potential to quantify equity as a function of various inter-dependent factors and therefore inform pharmaceutical distribution decisions based on actual need.

3 The SSI highlights which communities are the most vulnerable within a given country. By using the SSI, decision makers can see changes in supply (e.g., drug shortages) or changes in demand (e.g., an outbreak of cholera that increases demand for oral rehydration

salts) through an equity lens and respond accordingly. In essence, this index builds capacity of a country to plan for ordinary circumstances, and also to respond equitably to climate change events, natural disasters, and medical crises.

4 The SSI can be used in conjunction with other prioritization metrics such as operational cost or time required for implementation. If the most equitable solutions were also the most expensive, decision-makers could use the SSI in conjunction with cost metrics. This would identify the most equitable solutions within a given price range, or the least-costly solution while maintaining a minimum level of equity.

5 The SSI can be used to make decisions regarding capital/infrastructure investment as well as addressing how to remedy the last-mile supply-chain issue at hand.

6 The SSI has been tested from a theoretical perspective. Next, pilot testing in a country – or sub-region – may support efficient and equitable decision making about deployment of scarce pharmaceuticals.

Biplab Bhattacharya testing a survey tool with a drug shop owner in Uganda | University at Buffalo

III. POLICY TAKEAWAYS

1 Policymakers who wish to respond to drug stock-outs in both efficient and equitable ways can use the SSI to inform their decisions.

2 Countries and sub-regions that wish to utilize emerging technologies can also incorporate the SSI as a decision-making tool. For example, the use of drones to deliver medical supplies in rural Africa could use the SSI to identify geographies that ought to be served for reasons of efficiency and equity.

3 As the present COVID 19 experience has highlighted, delayed decision making about how and where limited resources, such as respirators, are deployed takes a toll on human life, especially among those who are already vulnerable in society. The SSI has the potential to aid policy makers in making rapid and equitable decision-making.

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