THE HEALTH CARE WORKER SUPPLY CHAIN: ALLOCATING HUMAN RESOURCES FOR HEALTH IN SUB-SAHARAN AFRICA

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Task Force for Global Health

- 130 Dedicated Employees
- 157 Countries
- 2nd Largest U.S. Non-Profit
- $1.6 Billion USD
- 2016 Hilton Humanitarian Prize Winner
- 3 Sectors
Context
Supply Chain Context

1. **Scare resources:** Shortage of health care workers in sub-Saharan Africa

2. **Inefficient processes:** Current allocation processes are manual and not data driven

3. **Autonomous resources:** Current allocation processes do not take into account location preferences from health care workers
Workforce Allocation Optimization Tool

1. Allocate scarce resource of health care workers across the country
2. Optimize the allocation processes and health care worker supply chain via a data
3. Include worker preferences in the allocation model to improve worker satisfaction, retention, and decrease bureaucratic tasks
Workforce Allocation Optimization (WAO) Tool
WAO Tool Optimization Model

MAXIMIZE

Total rewards (preference scores or weights) coming from assigning workers to their preferred location

MINIMIZE

minus the penalties that result from not fulfilling a percentage of the locations’ demand, for each worker type.

CONSTRAINTS

1. Each worker can be assigned to at most one location
2. Cannot assign more workers than the demanded by the location
3. Fixed workers must be assigned to their fixed location
4. Workers may only be assigned to one of their choices or not be assigned at all
5. Cannot violate budget constraints
WAO Tool Optimization Logic Example

Worker 1, Type: Blue

<table>
<thead>
<tr>
<th>Location Preference</th>
<th>Opt. Reward</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 2</td>
<td>3</td>
</tr>
<tr>
<td>Location 1</td>
<td>2</td>
</tr>
<tr>
<td>Location 4</td>
<td>1</td>
</tr>
</tbody>
</table>

Locations:
- Location 1
- Location 2
- Location 3
- Location 4
WAO Tool Optimization Logic Example

- 2 clinics with different demands:
  - Clinic 1 needs 2 workers
  - Clinic 2 needs 1 worker

- 2 Workers with same preferences
  - Workers prefer Clinic 1 with preference weight 2
  - Workers prefer Clinic 2 with preference weight 3

- Penalty for unfulfilled demand percentage = 40

\[-40(0.5) + 2\]  
\[-40(0) + 3\]
## WAO Tool Optimization Logic Example

<table>
<thead>
<tr>
<th>Feasible Solution</th>
<th>$W_1$</th>
<th>$W_2$</th>
<th>Objective Function (OF) Calculation</th>
<th>OF Value</th>
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<tbody>
<tr>
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<td>X</td>
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Increased Complexity
Workforce Allocation Optimization (WAO) Tool

Low cost + user friendly + easily implemented
Successes

**MOZAMBIQUE**
- Used semi-annually in Mozambique since Dec. 2015
- 85% of workers allocated to one of their top three preferences, 62% to first preference
- Significant decrease in transfer requests
- Improved morale and retention

**TANZANIA, ZAMBIA**
- Development of Web Portal
- Building capacity in HITRAC, informatics organization in Harare, Zimbabwe
- Tool training and hand off in Q2 2018 for integration with existing information systems
Questions?
Thank you!
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<thead>
<tr>
<th>Num</th>
<th>UID</th>
<th>Name</th>
<th>Assigned Location</th>
<th>Assignment Preference</th>
<th>Gender</th>
<th>Study Location</th>
<th>Adjusted Distance (km)</th>
<th>Worker Type</th>
<th>Worker Level</th>
<th>Salary (Allocated)</th>
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