Addressing Maternal Mortality: Using GIS for Evaluating Access to EmOC in the SMGL Project in 4 Districts of Western Uganda

Stephen McCracken George Acire, Frank Kaharuza

Background:
The use of Geographical Information Systems (GIS) as a decision support tool is applicable in public health; planners can make use of analysis, modeling and hypothetical situations to inform decisions about interventions to increase access to emergency care.

The Saving Mothers – Giving Life (SMGL) initiative is a comprehensive health strengthening program aimed at reducing the number of maternal deaths by half in one year in its pilot area of four districts in Western Uganda. We aim to assess the utility of GIS in evaluating Emergency Obstetric Care within the project area.

Objectives:
1. Compare Approaches to Geographic Accessibility
   - Standard approach (15 km radius) vs.
   - Modeled Travel-Time using a “Cost-Surface”
2. Evaluate potential of Transportation Programs
   - Walking-time VS Walking/Motorized transportation
3. Assess pre- and post-intervention access to EmOC
   - Modeled Travel-Time using a “Cost-Surface”
4. Target underserved populations for CEmOC (Pre-intervention) and identify areas (and existing facilities) for targeting EmOC improvements (Evaluate Intervention Strategy)

Methods:
There are many approaches to determining geographic accessibility and catchment areas for health services. Simplistic “Euclidean” approaches are unrealistic in rugged rural areas, such as Western Uganda. For the purposes of this analysis, a time-cost surface was created using ArcView 3.2 and a WHO tool (AccessSoft tool version 3 extension). This was used to model road networks, landcover, slope and 111 geocoded health facilities with delivery services to produce a cost-time surface and barriers affecting travel to these facilities. “Travel-time” contour-like boundaries are overlaid population density maps (derived from population projections and satellite imagery) to assess women’s travel-time accessibility to pre- and post-intervention health services (delivery, BEmOC, and CEmOC).

Modeling Accessibility to EmOC with Travel-Time based on a Cost-Surface

Potential for Transportation Programs

Comparison II: Modeled Walking versus Walking-Motorized Travel-Time

Comparison III: Access to “Almost-CEmOC” facilities pre-intervention and to 10 Existing Facilities being Improved to CEmOC (Walking/Motorized)

Some considerations

Base GIS inputs
- Population density maps (High Spatial Resolution)
- Slope Elevation (Appropriate Spatial Resolution)
- Land Cover (Appropriate Spatial Resolution)
- Road Network (Major roads; lacking minor roads and trails)

Modeling
- Could consider facilities (Hospitals, HC IV) in neighboring districts in targeting exercise and discussion (borders are porous)
- Resolution of underserved-population density maps might be improved (e.g. spatial filter – population weighted) for “targeting” exercise and discussion
- “Delivery-capacity” of health facilities by level are known or targeted more could be done with targeting location of BEmOC and CEmOC facilities separately (and the number and levels of facilities being recommended)

Benefits of GIS Analysis and Modeling

- Improve measurement of geographic accessibility
- Current approach of 15-km distance is a crude measurement particularly in rugged terrain with physical barriers and poor transportation networks
- Improve discussions around targeting of interventions
- Northwest region of Kibale District & Southwest Kabarole may be underserved given population distribution
- Some existing facilities may be redundant given close proximity to others
- Other facilities may not be appropriate for full CEmOC upgrade given population of catchment area
- In discussions of regional and/or national scale-up GIS analysis and modeling can be incorporated to foster a more effective strategic plan, reducing redundancies, and targeting interventions.