

## **Setting**

The Ngorongoro District in Tanzania has a population of 129,774 (the lowest of the five districts in Arusha), consisting predominantly of Maasai ethnic groups and a large minority of Watemi. [1] Located in the southern part of the Ngorongoro District, the Ngorongoro Crater and surrounding Conservation Area serve as popular tourist attractions, and play host to a large annual wildebeest migration. Collectively, these areas comprise a designated UNESCO World Heritage site. This area is semi-arid with a propensity for drought and irregular seasonal rain patterns.

The Maasai and Watemi, traditionally pastoral societies, have been steadily introducing agriculture as part of their subsistence strategies. Perceived threats on wildlife conservation efforts caused the current Ngorongoro Crater grazing ban and a past ban on all agriculture in the entire Ngorongoro Conservation Area from 1975 to 1992. In recent years, agriculture has been complemented with labor migration to the urban areas of Arusha and Mwanza. The migration of Maasai men to urban areas has been attributed to escalating poverty, droughts, and livestock herds reduced by disease resulting in family separation, exposure to more urban-based pathogens, and the decay of the traditional elder-based leadership structure. [2] Young men who migrate to urban areas tend to work as low-paid guards with minimal or no job security in the cities in situations that result in negligible savings. Their wives (plural, in these polygynous societies) stay near their homesteads to tend to agricultural, pastoral, and childcare responsibilities. Women will intermittently work as petty traders for cash necessary for school fees, store-bought goods (i.e. soap, tea, sugar, etc.), and supplemental food.

## **Study Data**

The 2002-2004 'Maternal morbidity and mortality in Ngorongoro District, Tanzania' collaborative health research and intervention effort (hereafter referred to as the Ngorongoro Health Survey, or NHS) trained the staff of a team of mobile health outreach clinics to survey 2500 pregnant women over three different points in time (prenatal, postpartum, and 9 months postpartum) concerning socio-demographic characteristics, reproductive topics, HIV/AIDS awareness, maternal morality, and other health-related topics. The women were also screened for syphilis and HIV (Johnson, et al. manuscript in preparation). The rate of HIV seroprevalence among the surveyed pregnant women is still relatively low (2%) but there was a steady increase in the rate of infection over the year-long survey period and a preliminary analysis based on an adjunct physical grouping of women divided by their partner's migration status at the clinic sites (during the administration of the first wave of the survey) suggested that the likelihood of HIV serum conversion was greater for women with migrating partners. [3] Mother-to-child transmission of HIV may occur during pregnancy, at birth, or via breastfeeding. The current, relatively modest infection rate of the women in the Ngorongoro district may be multiplied several times over as the mothers continue their usual cycle of breastfeeding, pregnancy, and breastfeeding until they begin to show significant evidence of the infection.

## **Research Topic**

Human mobility has been marked as a neglected central issue in explaining the spread of HIV/AIDS over the last decade in the African countries with the most

pronounced rates of infection. [4] This trend in Tanzania has been exacerbated by unsustainable land use patterns often resulting from land appropriation for parks and agricultural interests reducing traditional pastoral lands and thereby concentrating land use practices. [5-6] The loss of pastoral land and increasing landscape degradation contribute to nutritional inadequacy, labor migration, multileveled socio-economic change, and conditions favoring an increase in HIV infections within a remote population.

The negative impact of migration on HIV prevalence in rural communities has been documented in recent public health literature. [7-10] The unique and insular characteristics of the Maasai population may contribute to the avoidance of or reduction of the risk of increased prevalence due to rural to urban labor migration (i.e. Maasai labor migrants are not having sex in town). [11-12] While the preliminary manuscript based on the NHS data suggests that there is an increased likelihood for HIV positive status of pregnant women with partners who migrate, it is unclear whether this would hold within an analysis using the actual survey data and whether there is significant spatial patterns or migratory-related characteristics that have varying impacts on the community HIV prevalence.

### **Analysis Plan**

Statistical analysis will be conducted using STATA10. Migration characteristics and their impact on HIV will be assessed using an aggregate focus across all village sites using the first and third surveys in the NHS dataset as cross-sectional analyses. Descriptive statistics will include basic demographic characteristics and the impact of migration on household labor, wealth, source of household support and cash income, perceptions of the benefit of migration, sufficiency of livestock/land for farming to support household, use of contraceptives, child classification of weight for age, and spousal abuse. A binary logistic regression will be applied to the HIV outcome (HIV status) with covariates for migration characteristics. A second logistic regression will be applied to a binary migration measure (ever/never migrated) with covariates encompassing measures for the quality of life of the women and families left behind. Both main effects and interactions between the covariates will be tested. If interaction terms are found to have a significance level  $\alpha < 0.10$ , models will be re-run stratified by the significant variable.

Spatial descriptive analysis will be conducted using ESRI ArcMap v9.2 and ERDAS Imagine 8.6. A spatial analysis will delineate patterns of HIV prevalence and labor migration patterns across clinic sites. The clinic sites used for the NHS study will be geocoded onto a map of the Ngorongoro area with a “catchment area” delineated based on an assessment of the distance walked by study participants. Spatial raster layers of local transportation routes, elevation data, and land cover data will be overlaid over a 2002 LANDSAT image of the study area. Variables based on distances to urban areas will be compared with HIV prevalence labor migration data for each catchment area to further explore the possibly spatial patterns of the route of infection and trends in labor migration.

## **Expected Findings**

Labor migration is becoming an important part of Maasai and Watemi livelihood diversification. Its impacts on subsistence patterns, social dynamics, and disease prevalence within communities will have increasing negative impacts on maternal and child health suggested by the odds ratios for positive HIV status of women with partners participating in labor migration. The frequency and duration of labor migration and the household labor effects of labor migration will have an impact on the structure of the HIV prevalence and social factors across clinic catchment areas. The clinic catchment area labor migration rates areas will have a significant pattern based on proximity to urban areas, transportation routes, elevation patterns, and land use patterns.

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