Background: HIV remains a major barrier to reducing child mortality in sub-Saharan Africa. Although mother-to-child transmission of HIV declined substantially in the region over the past decade, the prevalence of HIV among pregnant women remains high. Like HIV-infected children, HIV-exposed uninfected children are at higher risk of infections and death than the children of HIV-negative mothers. Most of this excess mortality occurs during infancy and results from pneumonia. Most fatal cases of pneumonia are caused by bacterial pathogens, and colonization of the upper respiratory tract precedes pneumonia caused by these bacteria. The nasopharyngeal microbiome serves as a barrier to colonization and invasion by pneumonia pathogens through competition for nutrients, production of antimicrobial peptides, or modulation of the local immune response. Our research program recently demonstrated that the nasopharyngeal microbiome is altered in HIV-infected and HIV-exposed, uninfected children. We hypothesize that the altered nasopharyngeal microbiome of these groups of children is the result of exposure to an altered maternal microbiome and contributes to their increased risk of pneumonia.

Impact: Understanding the extent to which the maternal respiratory microbiome is transmitted to infants will further knowledge of early-life colonization of the respiratory tract and elucidate a novel mechanism by which maternal HIV infection influences child health. Knowledge of the effect of HIV exposure on the respiratory microbiome could lead to interventions that reduce child mortality in high HIV prevalence settings. In particular, modification of the upper respiratory microbiome through oral or intranasal probiotics may be a novel pneumonia prevention strategy.

Objectives and Milestones:

This project will make use of clinical data and samples from a prospective cohort study of 300 mother-infant dyads in Botswana. Mothers and infants were enrolled at birth and were followed monthly (0-6 months) or every month (6-12 months). At all study visits, a nasopharyngeal sample was obtained from the infant and mother for characterization of the respiratory microbiome using 16S ribosomal RNA gene sequencing.

Weeks 1-2: Review and summarize literature on the respiratory microbiome of HIV-infected/exposed children and mother-to-infant microbiome transmission
Weeks 3-4: Evaluate for associations between HIV exposure and the diversity and composition of the nasopharyngeal microbiome throughout infancy
Weeks 5-6: Characterize patterns of transmission of bacteria from the respiratory microbiomes of mothers to infants.
Weeks 7-10: Report project findings to mentor, perform secondary analyses, draft abstract for submission to national or international conference.

The intern will be expected to:
- Participate in weekly 1:1 meetings with the HIV/AIDS mentor;
- Present the analysis findings at a biweekly research group meeting after receiving mentor feedback;
- Be a co-author on a manuscript arising from the project