

# Characterizing the Male Urogenital Tract Microbiome using 16S rRNA Gene Analysis

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## 1. BIOLOGICAL CONTEXT

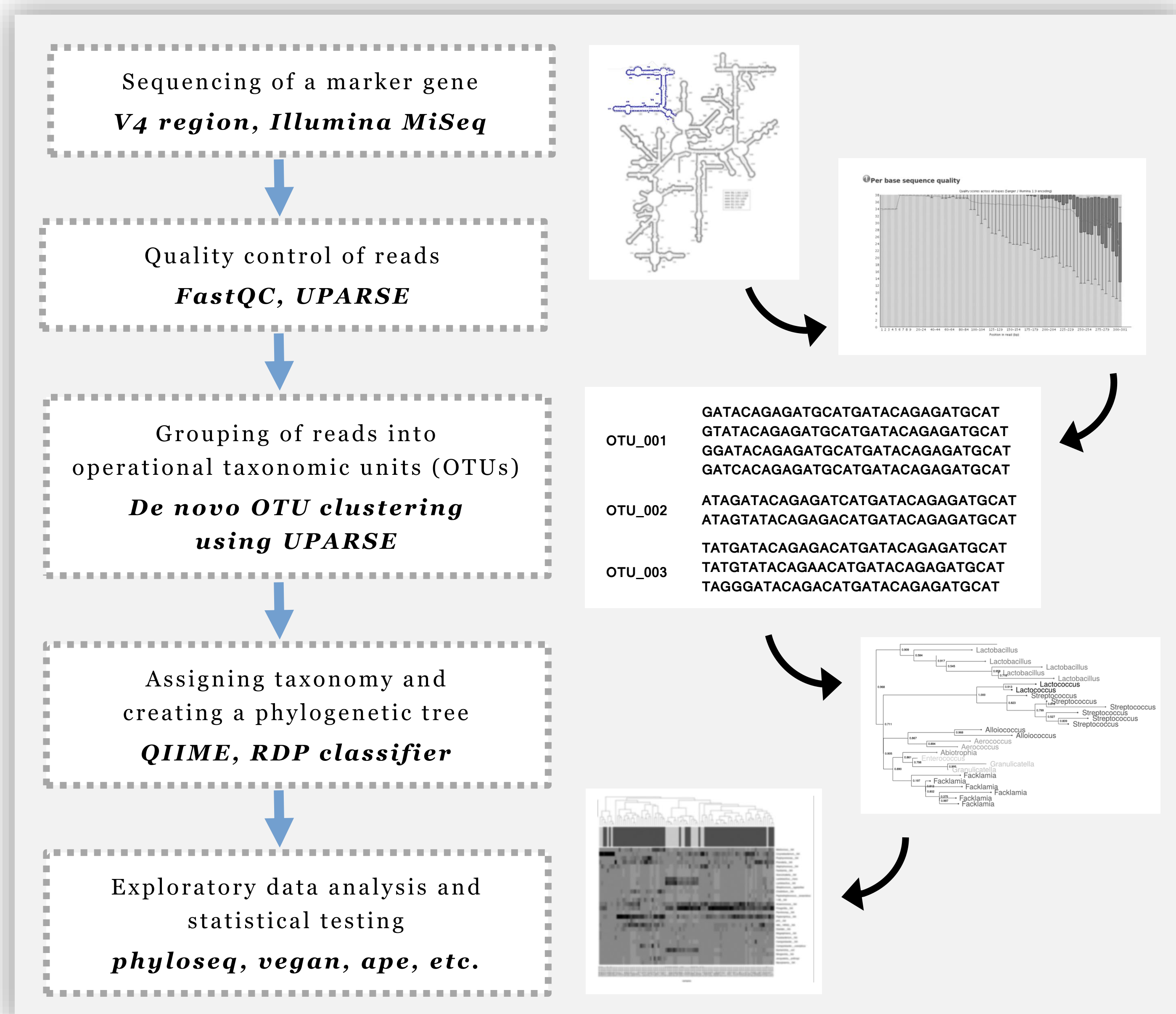
The male urogenital tract is the site of interactions between the microbiome, the immune system and various sexually-transmitted pathogens. A better understanding of these interactions may enable the development of interventions which decrease susceptibility to sexually transmitted infections (STIs), such as HIV.

A number of randomized, controlled trials have found that medical male circumcision reduces susceptibility to HIV.

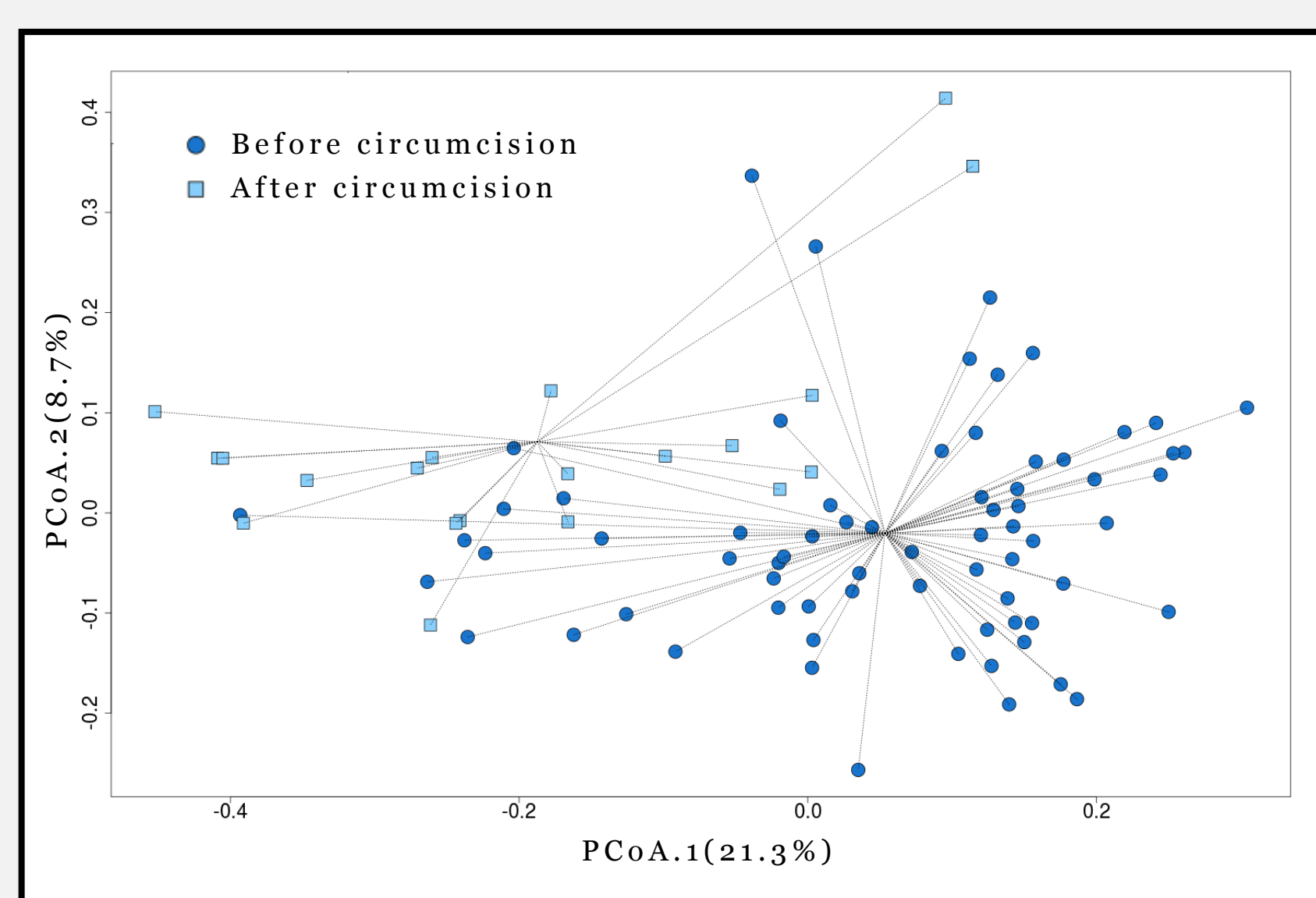
- How does circumcision influence the composition of the male urogenital tract microbiome?
- What effect does circumcision have on the specific taxa (genera/species) which have been associated with increased/decreased HIV susceptibility?

To address these questions, young males scheduled to undergo circumcision were recruited into a longitudinal study. Penile swabs were collected at various time points pre- and post-circumcision for microbiome analysis.

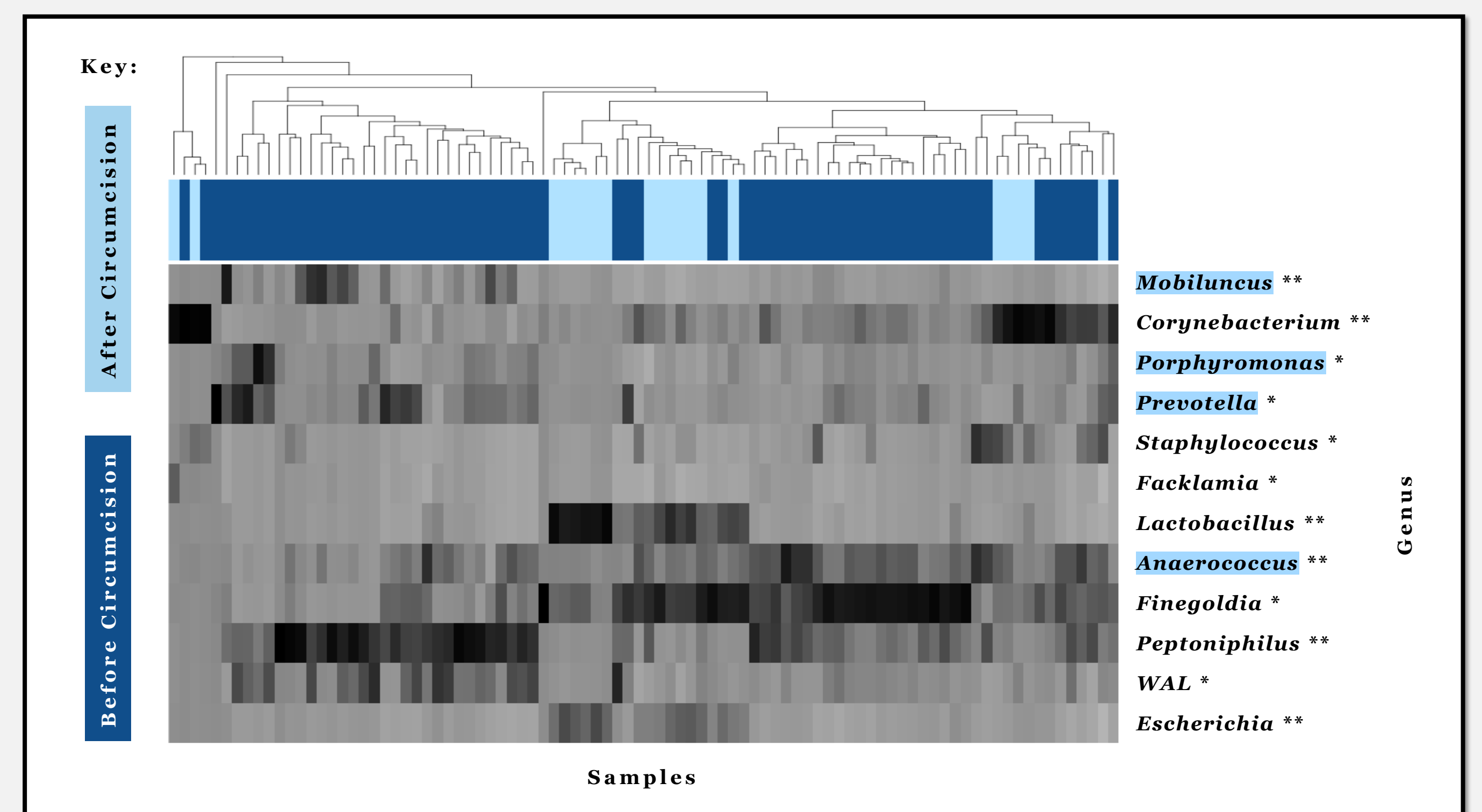
## 2. OVERVIEW OF THE ANALYSIS



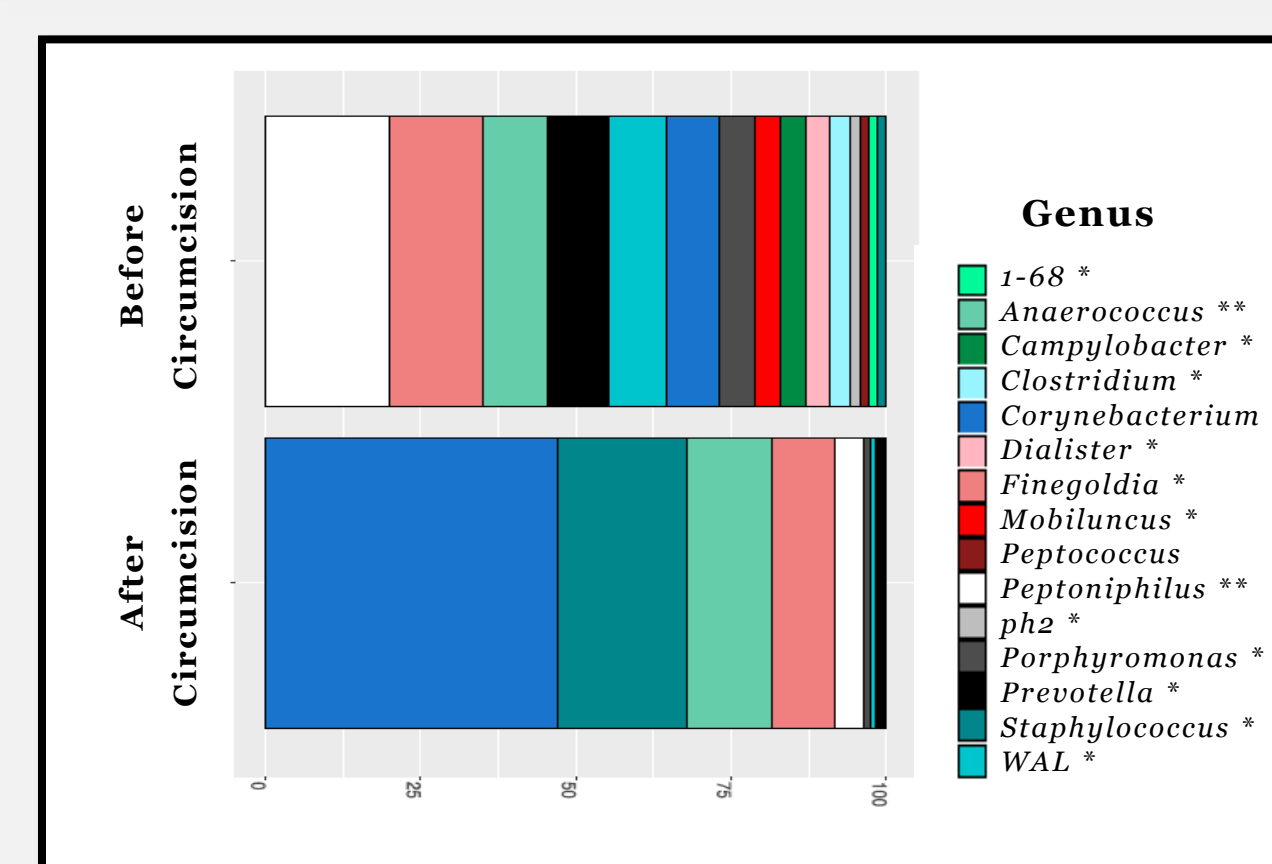
## 3. RESULTS OF THE ANALYSIS



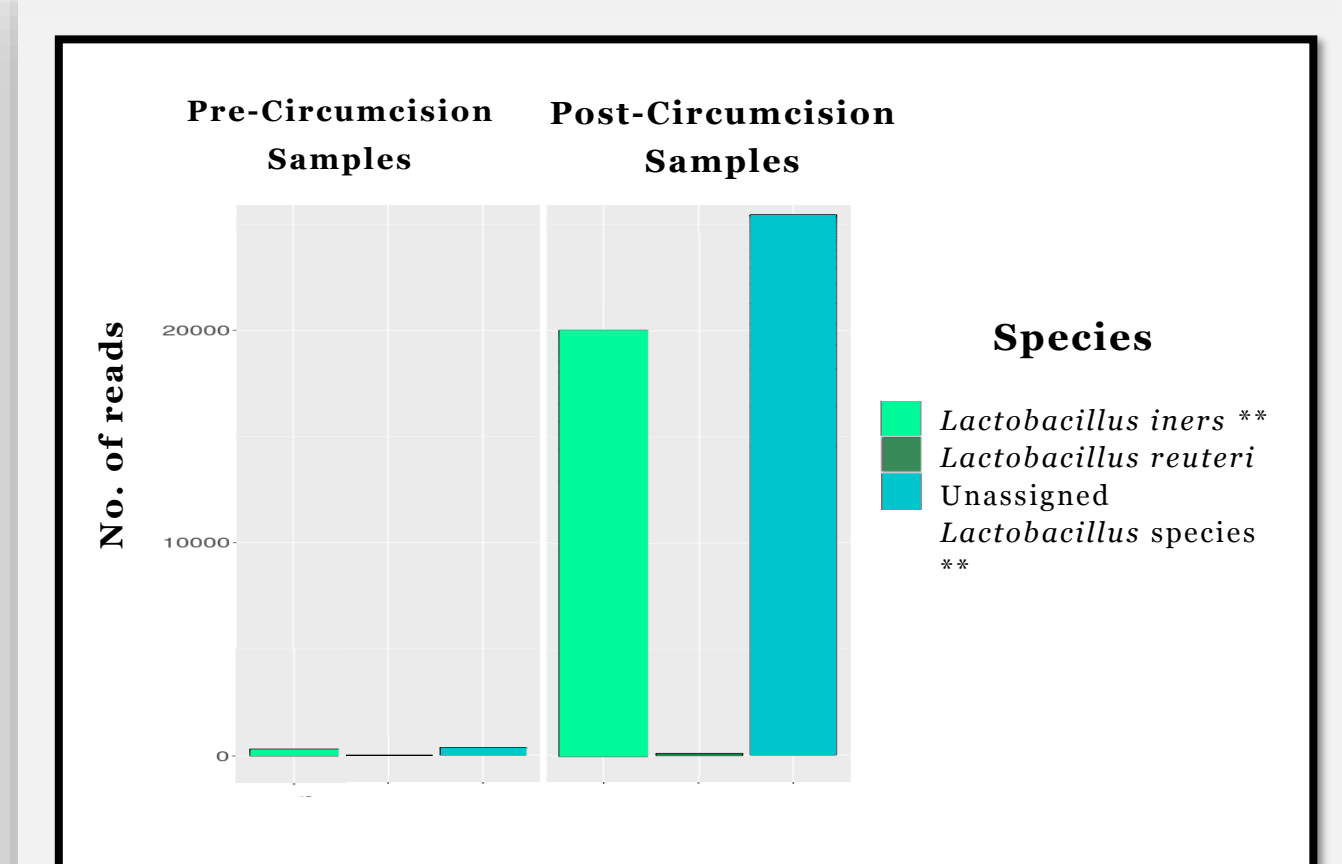
**Figure 1: Principle coordinates analysis (PCoA) of samples by circumcision status. Each sample is represented by a single point, with the distances between points indicating their degree of similarity. A Permutation Multivariate Analysis Of Variance (PerMANOVA) confirmed that the composition of the two sets of samples were distinct ( $p = 0.001$ ).**



**Figure 2: Average-linkage hierarchical clustering revealed patterns in the relative abundance of specific genera before and after circumcision (\*  $p < 0.05$ , \*\*  $p < 0.01$ ). Taxa highlighted in blue have been linked to increased HIV susceptibility<sup>1</sup>.**



**Figure 3: A comparison of the average composition of samples collected pre- and post-circumcision (\*  $p < 0.05$ , \*\*  $p < 0.01$ ).**



**Figure 4: No. of reads assigned to the Lactobacillus genus, which has been linked to decreased HIV susceptibility. (\*\*  $p < 0.01$ ).**

The analysis of samples taken before and after circumcision revealed distinct bacterial community composition (Figure 1). Several taxa that have been linked to increased HIV susceptibility<sup>1</sup>, were decreased post-circumcision (Figure 2, Figure 3).

In contrast, *Lactobacillus* species, which are considered to be protective in the female genital tract<sup>2</sup>, were increased substantially after circumcision (Figure 4). These findings have implications for the development of potential methods to reduce HIV susceptibility by modulating the (uro)genital tract microbiome.

<sup>1</sup>Liu CM et al. *Penile anaerobic dysbiosis as a risk factor for HIV infection*. mBio 8:4, 2017.

<sup>2</sup>Petrova MI et al. *Lactobacillus species as biomarkers and agents that can promote aspects of vaginal health*. Front. Physiol. 6:81, 2015.

## 4. ACKNOWLEDGEMENTS

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