

# Aging among persons with HIV: developing numerical and data-driven tools for a growing health concern

*Alex Viguerie, Elisa Iacomini*

## Abstract

The development of effective antiretroviral therapy (ART) has transformed HIV from a fatal diagnosis to a manageable chronic condition, extending lifespans among persons with HIV (PWH) in developed countries to near-general population levels. Consequently, the PWH demographic has shifted dramatically, with those over 55 increasing from 16% in 2008 to 45% in 2022 in the United States, with similar shifts observed throughout the developed world. HIV care now involves not only managing the virus itself but also addressing age-related comorbidities, which present at higher rates and earlier ages in PWH. Additionally, long-term ART use introduces its own set of health complications.

This talk will present new mathematical tools to project the evolving age structure of PWH and the burden of age-related comorbidities, based on a hyperbolic model of the PWH population age structure. We introduce a novel Inverse Ensemble Kalman Filter (InvEnKF) workflow to reconstruct the evolution of age-dependent mortality among PWH over the past two decades. For future mortality forecasts, we develop and apply a variant of Dynamic Mode Decomposition (DMD), specifically non-negative DMD (nnDMD), and explore its mathematical properties. Unlike other methods, nnDMD generates forecasts solely from data without additional assumptions. These tools are integrated into a broader modeling framework to forecast the demographic evolution of the U.S. PWH population in the coming years.