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Factors associated with sexually transmitted infection literacy among men who have sex with men and transgender people in Soweto: A machine learning approach

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Sexually transmitted infections (STIs) remain a significant public health challenge in Sub-Saharan Africa (SSA), particularly among key populations such as men who have sex with men (MSM) and transgender individuals. This study aimed to assess the level of STI literacy within this population, identify its demographic, behavioral, and structural predictors, and explore its influence on knowledge, attitudes, behaviors, and healthcare-seeking. A retrospective observational mixed-methods approach was employed, combining logistic regression, structural equation modeling (SEM), and explainable machine learning (SHAP) to analyze data collected from 1,240 MSM and transgender individuals in Soweto, South Africa. The main outcome variable, STI literacy, was operationalized both as a composite score (binary: high and low) and as a categorical label (1 and 0), enabling both inferential and predictive modeling. Results revealed that 28.1% of participants demonstrated adequate STI literacy. Key positive predictors included younger age, prior STI testing, higher education, being single or married, female gender identity, and personal STI history. In contrast, older age, unemployment, lower education, substance use, and frequent sexual activity were associated with lower literacy. Structural equation modeling illuminated how STI testing experience acts as a cue to action, while stigma, cost, and fear serve as barriers. SHAP analysis confirmed these insights, highlighting modifiable predictors such as information-seeking, communication confidence, and testing accessibility. The study's findings were interpreted through Nutbeam's Health Literacy Framework, the Health Belief Model (HBM), and the Theory of Planned Behavior (TPB). These frameworks helped contextualize the behavioral pathways linking sociodemographic factors to STI literacy and preventive actions. Notably, TPB constructs such as subjective norms and perceived behavioral control were particularly influential. This study contributes to the STI prevention literature by quantifying literacy gaps, modeling predictive pathways, and demonstrating how behavioral theory and machine learning can inform targeted interventions. It recommends multi-level approaches that go beyond awareness to address stigma, build self-efficacy, and enhance access to sexual health services. These insights are vital for designing inclusive, theory-driven public health strategies in SSA.

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