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Paths of factors to hiv voluntary counselling and testing in association with population hiv incidence among Sub-saharan African adults: A multicountry multistage survey

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Background: As the global HIV/AIDS epicenter, sub-Saharan Africa (SSA) has been conducting national HIV voluntary counseling and testing (VCT) campaign to control HIV infection. To explore a practical puzzle about why high-level VCT is related inconsistently to low-level population HIV incidence, we performed an integrated path analysis to identify and characterize paths of the three main factors (HIV-related comprehensive knowledge, attitude towards people living with HIV/AIDS (PLWHA) and risky sexual behavior) to VCT uptake in association with population HIV incidence among SSA adults.

Methods and Findings: Adjusted by the demographic and socioeconomic covariates, complex sample logistic regression was employed to build the path models for VCT uptake in a nationally representative dataset from the Demographic and Health Survey of seven SSA countries. We identified a tight structure of path model present in the countries of lower population HIV incidence and a loose structure in those of higher population HIV incidence. Using a mediation analysis, we detected the strongest positive effect of highly risky sexual behavior directly on VCT uptake (the adjusted odds ratio ranged from 1.883 to 5.540, all p-values <0.001 in the sampled countries). But these direct and indirect paths of HIV-related knowledge and attitude towards PLWHA to VCT uptake did not have consistent significance within the SSA countries. Like partial correlation coefficient for two continuous variables, we developed partial contingency coefficient for two categorical variables to measure their associate degree by controlling the effect of covariates. The partial contingency coefficients for all direct and indirect paths to VCT uptake were adopted as partial least squares (PLS) regressors on 2013-2016 HIV incidence rates of the sampled countries. According to World's criterion, we determined two critical paths to VCT uptake, the direct path of risky sexual behavior and the indirect path of HIV-related comprehensive knowledge through risky sexual behavior, in affecting population HIV incidence. Population HIV incidence was associated positively with the former path, but negatively with the latter, since their standardized PLS coefficients range from 0.52 to 0.57 and from -0.61 to -0.60, respectively. Our study's limitations are that HIV testing status is subject to information bias, and thus further work is needed to validate these findings using a prospective study.

Conclusions: This work identified two critical paths to VCT uptake, the direct path of risky sexual behavior and the indirect path of HIV-related knowledge to VCT uptake, and their opposite association with population HIV incidence. It provides a heuristic resource for future studies of HIV/AIDS prevention system design based on optimizing and tightening the path structure of VCT on knowledge, attitude and behavior.

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