Abstract

Background: HIV/AIDS remains a major public health concern in Ghana. Despite progress in prevention and treatment, variations in prevalence across Ghana's 16 regions persist, driven by differences in healthcare access, urbanization, and socio-economic factors. This study aims to identify trends, hotspots, and clustering patterns that can guide more effective HIV surveillance and control strategies in Ghana.

Methods: A retrospective ecological study was conducted using secondary HIV data from the District Health Information Management System (DHIMS) of Ghana between 2020 and 2024. HIV Prevalence was computed and standardized per 100,000 population. Spatial analyses were performed using R programming software. Hotspot detection used the Getis-Ord Gi* statistics, while Global and Local Moran's I statistics were used to determine spatial autocorrelation and clustering. Choropleth maps and trend analyses were used to visualize regional distribution and spatio-temporal shifts in HIV prevalence across Ghana.

Results: HIV prevalence per 100,000 population increased nationally from 0.68 (0.13-1.93) in 2020 to 0.84 (0.15-2.95) in 2024 (+23.5%). Higher burden persisted in southern and middle-belt regions, led by Western North (1.80 to 2.95), alongside Bono East, Eastern, Ashanti, Greater Accra, and Volta, while northern regions consistently recorded low prevalence (<0.50). Hotspot and LISA analyses showed sustained high-high clustering in southern Ghana across the study period, with stable low-low clusters in the north. Global Moran's I indicated significant spatial dispersion in 2020 ($I = -0.43$, $p = 0.076$), largely random patterns in 2021-2023, and an emerging but weak clustering tendency in 2024 ($I = 0.22$, $p = 0.12$).

Conclusions: The study suggested growing regional disparities in HIV prevalence, with urbanized southern regions bearing a disproportionate burden. Data-driven, region-specific interventions, including improved surveillance systems and equitable allocation of health resources, are needed to reduce transmission and support Ghana's HIV/AIDS control efforts.

Keywords: HIV, AIDS, spatio-temporal, choropleth, Moran's I, Ghana.