A population-based deterministic mathematical model was developed to investigate the impact of a PrEP intervention in Cotonou, Benin and Kisumu, Kenya. The model reveals that prioritising a PrEP intervention with respect to different levels of prioritisation by behavioural risk is greater in Cotonou, as the HIV epidemic is more focussed within identifiable at-risk groups. However, the overall epidemiological impact of the PrEP intervention is greater in Kisumu, which has higher HIV incidence than Cotonou. Assuming an estimated cost range for PrEP of $160–$240 per-person per-year, the estimated cost per infection averted in Kisumu, Kenya ranges from $15,578 to $20,368, if 50% of high risk individuals receive PrEP and the remaining PrEP is distributed among low and medium risk individuals. These costs should be considered in light of future averted costs of ART provision.