

Tourism, Hotel Concentration and HIV in Jamaica: A Parish-Level Mathematical Comparison of HIV Burden in Tourism and Non-Tourism Belts

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ABSTRACT:

Background: Tourism is a major component of the Jamaican economy, with substantial hotel and visitor activity concentrated in Montego Bay, Ocho Rios and Negril and the surrounding north and north-western parishes. At the same time, Jamaica has experienced a geographically heterogeneous HIV epidemic, raising an important question concerning whether communities located in major tourism belts experience different HIV burdens from non-tourism areas.

Objective: This study examines the ecological association between tourism/hotel concentration and reported HIV burden across Jamaica and develops a mathematical framework for assessing the tourism–HIV relationship.

Methods: Secondary parish-level HIV surveillance data from Jamaica’s Ministry of Health were integrated conceptually with Jamaica Tourist Board accommodation statistics. The principal tourism belt comprised St Ann, Trelawny, St James, Hanover and Westmoreland, while the remaining reported parish units constituted the comparison group.

Results: Ministry of Health data for 1982–2015 showed cumulative reported HIV case rates of 1,403.5 per 100,000 in St Ann, 1,237.4 in Trelawny, 2,465.4 in St James, 1,264.2 in Hanover and 1,324.9 in Westmoreland. The unweighted mean was approximately 1,539.1 per 100,000 in the tourism belt compared with approximately 889.9 per 100,000 in the non-tourism group, representing an ecological rate ratio of approximately 1.73. St James exhibited the highest cumulative reported HIV rate nationally, while Kingston and St Andrew demonstrated that elevated HIV burden was not unique to tourism-intensive areas. The findings suggest a geographic association between tourism concentration and historical HIV burden but do not establish that hotels or tourism cause HIV infection.

Conclusion: Tourism intensity should be investigated as part of a broader system involving population mobility, sexual networks, urbanisation, transactional relationships, employment structures, testing intensity and socioeconomic conditions.

KEYWORDS: HIV; Jamaica; tourism; hotels; sexual health; parish inequality; tourism belt

1. INTRODUCTION

Tourism is one of Jamaica’s major internationally oriented industries and has produced geographically concentrated zones of hotels, entertainment facilities, transportation services and visitor-oriented employment. Montego Bay, Ocho Rios and Negril have historically constituted the principal resort regions, although tourism activities also occur in Kingston, Port Antonio and the South Coast. Jamaica Tourist Board statistics demonstrate the magnitude of this spatial concentration, with Montego Bay, Ocho Rios and Negril accounting for the overwhelming majority of Jamaica’s major hotel room capacity in the period examined. The geographical concentration of tourism generates employment and income but simultaneously produces intensive movements of visitors, workers, and commercial activities between communities (Dodman, 2009; Hall, 2005; Li et al., 2021; Marcouiller & Xia, 2008; Naranpanawa et al., 2019). Such mobility does not itself generate HIV transmission, but it can alter the structure and geographical reach of social and sexual networks. Examining whether HIV burden differs systematically between tourism-intensive and non-tourism areas constitutes an important public-health research question.

Jamaica’s HIV epidemic is geographically heterogeneous, with national surveillance and epidemiological studies documenting substantial differences in HIV burden across parishes (Figueroa et al., 2008; Figueroa et al., 2010; Ministry of Health, Jamaica, 2015; Ministry of Health, Jamaica, 2016; UNAIDS, 2017). In 2015, the Ministry of Health reported that approximately 63% of reported HIV cases were concentrated in Kingston and St Andrew, St Catherine, and St James, areas characterised by comparatively high levels of urbanisation and population mobility (Ministry of Health, Jamaica, 2015). The national epidemiological profile also identified St James and Kingston and St Andrew among the geographical areas experiencing relatively high cumulative HIV/AIDS rates, demonstrating that Jamaica’s epidemic has historically exhibited important spatial concentrations rather than being uniformly distributed across the island (Figueroa et al., 2008; Figueroa et al., 2010; Ministry of Health, Jamaica, 2015; Ministry of Health,

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Jamaica, 2016; UNAIDS, 2017). Importantly, the Ministry also observed that parishes with significant tourism-based economies had comparatively high cumulative case burdens. This observation raises the possibility that tourism intensity may constitute one contextual correlate within a much broader epidemiological system. Nevertheless, urbanisation, population density, migration, socioeconomic conditions, sexual behaviour, health-service availability and differential testing can all confound an apparent tourism–HIV association.

Previous research has also examined the intersection between tourism, transactional sexual relationships, commercial sex, and sexually transmitted infection risk in Jamaica, demonstrating that tourism-dependent environments may create social and economic contexts in which interactions among visitors, tourism workers, sex workers, and local residents contribute to sexual-network formation and potential HIV/STI exposure (Boxill et al., 2005; Figueroa et al., 2008; Kempadoo, 1999; Padilla et al., 2010; White & Carr, 2005). Ethnographic and related research concerning male involvement in sexual and transactional relationships with visiting tourist women in Jamaica has identified important sexual-health implications and highlighted the need for improved STI education, HIV-prevention outreach, condom-use interventions, and risk-reduction programmes among persons participating in transactional sexual relationships (Duncan et al., 2010; Figueroa, 2012; Johnson, 2012, 2016; Pruitt & LaFont, 1995). Such findings should not be interpreted as indicating that tourists, tourism employees or hotel workers generally represent sources of HIV transmission. Instead, they demonstrate that sexual networks may develop within tourism economies and that economic exchange, mobility and sexual relationships can sometimes intersect. The distinction is essential because an ecological relationship between hotel concentration and HIV cannot identify individual transmission pathways. The appropriate research question is whether tourism intensity remains associated with HIV burden after relevant demographic, economic and behavioural characteristics are considered.

1.1 Research Gap

Despite Jamaica's extensive HIV surveillance and its well-developed tourism statistical system, relatively limited research has mathematically integrated parish-level tourism intensity with parish-level HIV burden. Existing evidence frequently treats tourism, sexual behaviour, HIV surveillance, employment and regional development as separate subjects. It remains unclear whether Jamaica's major tourism belt systematically differs from non-tourism areas after geographical and socioeconomic differences are considered in an analytic review. A simple comparison is insufficient because Kingston and St Andrew demonstrate that a substantial HIV burden can develop in a highly urbanised economy without comparable dependence on resort tourism. Likewise, variation within the tourism belt itself suggests that hotel concentration cannot operate as a complete explanation of HIV geography. This study addresses this gap by proposing a Tourism–HIV Transmission Framework and establishing an empirical foundation for subsequent multivariate and longitudinal investigation.

1.2 Study Objectives

The principal objective is to examine whether the historical cumulative reported HIV case rate differs between Jamaica's principal tourism belt and non-tourism areas. A second objective is to determine whether increasing hotel intensity is mathematically associated with HIV burden at the parish level. Third, the study develops a conceptual model incorporating tourism intensity, population mobility, urbanisation, socioeconomic characteristics, sexual-network factors and access to HIV testing. Fourth, it examines heterogeneity within the tourism belt rather than assuming that all tourism-intensive parishes have equivalent HIV experiences. Fifth, it identifies alternative explanations capable of producing an apparent tourism–HIV relationship. Finally, the study develops a framework that can be tested using future parish-year HIV and tourism datasets.

2. MATERIALS AND METHODS

This study employs a quantitative ecological secondary-data design in which the geographical unit of analysis is the parish or combined parish reporting unit. HIV statistics are drawn primarily from Jamaica's Ministry of Health Annual HIV Epidemiological Profile for 2015, while tourism statistics come from the Jamaica Tourist Board's annual travel statistics. The principal tourism belt is operationally defined as St Ann, Trelawny, St James, Hanover and Westmoreland because these parishes encompass or adjoin the dominant north and north-western tourism corridor associated with Ocho Rios, Montego Bay and Negril. Kingston and St Andrew are retained within the comparison category for the principal belt analysis despite having a hotel sector because their economic structure differs substantially from Jamaica's dominant resort-tourism corridor. This operational definition measures membership in the principal resort belt rather than the complete absence or presence of tourism. Sensitivity analyses in future studies should employ continuous hotel intensity instead of relying exclusively on a binary tourism classification.

The primary HIV outcome is the cumulative reported HIV case rate per 100,000 population from 1982 through December 2015. These data represent reported diagnosed cases rather than the true underlying prevalence of HIV infection within each parish. Differences in HIV testing, diagnosis, migration, reporting completeness and healthcare access can influence geographical rates. Furthermore, cumulative historical rates incorporate infections reported across several decades and should not be interpreted as measurements of contemporary transmission risk. The present comparison is descriptive and hypothesis-generating rather than

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causal. Future research should replace cumulative rates with annual newly diagnosed cases, estimated prevalence or incidence wherever sufficiently complete parish-level data become available.

3. MATHEMATICAL FRAMEWORK

3.1 Hotel Intensity Index

Hotel concentration can be standardised for population size using:

$$H_i = \frac{Rooms_i}{Population_i} \times 1,000$$

Where H_i represents hotel intensity in parish i , $Rooms_i$ represents the number of available hotel rooms, and $Population_i$ represents the resident population. The resulting index measures hotel rooms per 1,000 residents. A higher value indicates a greater concentration of hotel infrastructure relative to the resident population. This approach is preferable to comparing raw room numbers because Jamaican parishes differ substantially in population size. The measure can also be calculated annually to construct a parish-year tourism panel. Resort areas crossing parish boundaries, such as Negril, require careful geographical allocation.

3.2 Tourism–HIV Ecological Model

The basic parish-level relationship can be expressed as:

$$HIV_i = \beta_0 + \beta_1 H_i + \beta_2 U_i + \beta_3 M_i + \beta_4 S_i + \beta_5 E_i + \gamma' X_i + \varepsilon_i$$

where HIV_i represents the HIV rate in parish i , H_i represents hotel intensity, U_i represents urbanisation, M_i represents population mobility, S_i represents relevant sexual-network or behavioural characteristics, and E_i represents socioeconomic conditions. The vector X_i contains additional controls including age structure, sex composition, population density, healthcare accessibility and HIV testing intensity. The parameter β_1 estimates the conditional association between hotel intensity and HIV burden after measured confounding characteristics are considered. A positive β_1 would indicate a positive statistical association but would not demonstrate that hotels cause HIV transmission. Establishing causation would require stronger longitudinal or quasi-experimental evidence.

3.3 Non-linear Model

A quadratic specification can examine whether the association changes at higher levels of tourism concentration:

$$HIV_i = \beta_0 + \beta_1 H_i + \beta_2 H_i^2 + \gamma' X_i + \varepsilon_i$$

The squared term H_i^2 allows the tourism–HIV relationship to be non-linear. For example, moderate tourism intensity may have little relationship with HIV, while exceptionally high tourism and mobility concentrations could be associated with different epidemiological conditions. Conversely, highly developed tourism areas may possess stronger health services, prevention programmes and testing systems that alter the observed relationship. The signs of β_1 and β_2 must be estimated empirically rather than assumed in advance. This formulation also prevents the study from imposing a simplistic linear relationship on complex social processes. With only 13 reported geographical units in the 2015 surveillance table, however, a fully adjusted version should not be estimated without additional parish-year observations.

3.4 Tourism–HIV Exposure and Transmission Context

A broader contextual index may be represented as:

$$THE_i = H_i V_i M_i N_i$$

where THE_i is the Tourism–HIV Exposure Context Index, H_i is hotel intensity, V_i represents visitor intensity, M_i represents population mobility, and N_i represents the connectivity of relevant social and sexual networks. This is not a biological HIV transmission equation and should not be interpreted as an individual's probability of acquiring HIV. Instead, it describes the intensity of contextual characteristics that could influence opportunities for network formation and population mixing. HIV transmission requires specific biological exposure, and tourism alone cannot produce infection. The index should be tested alongside behavioural and epidemiological variables rather than substituted for them. Its principal value is to organise measurable dimensions for future empirical analysis.

4. RESULTS

4.1 Geographical Distribution of Historical HIV Burden

Table 1. Cumulative reported HIV cases and rates by Jamaican parish/reporting area, 1982–2015

Parish/reporting area	Cumulative reported HIV cases	Rate per 100,000	Principal tourism belt
Kingston & St Andrew	11,983	1,787.6	No
St Thomas	548	576.7	No
Portland	756	914.0	No

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St Mary	1,153	1,002.9	No
St Ann	2,447	1,403.5	Yes
Trelawny	941	1,237.4	Yes
St James	4,582	2,465.4	Yes
Hanover	889	1,264.2	Yes
Westmoreland	1,931	1,324.9	Yes
St Elizabeth	919	604.7	No
Manchester	1,185	617.1	No
Clarendon	1,783	719.2	No
St Catherine	4,679	896.9	No

The geographical distribution demonstrates substantial variation in Jamaica's historical reported HIV burden. St James recorded the highest cumulative rate at 2,465.4 cases per 100,000, followed by Kingston and St Andrew at 1,787.6 per 100,000. All five parishes classified within the principal tourism belt recorded cumulative rates exceeding 1,200 per 100,000. By comparison, several non-tourism parishes, including St Thomas, St Elizabeth and Manchester, recorded rates below 650 per 100,000. Nevertheless, Kingston and St Andrew constitute a major counterexample to any proposition that elevated HIV burden is unique to resort-tourism areas. The distribution indicates a geographical pattern worthy of investigation but simultaneously demonstrates the importance of urbanisation and other confounders.

4.2 Tourism-Belt Versus Non-Tourism Comparison

Table 2. Descriptive comparison of historical cumulative reported HIV rates

Geographical group	Number of reporting units	Mean cumulative HIV rate per 100,000	Relative comparison
Principal tourism belt	5	1,539.1	1.73
Non-tourism-belt comparison	8	889.9	Reference
Difference	—	+649.2	—

The unweighted mean cumulative reported HIV rate was approximately 1,539.1 per 100,000 across the five principal tourism-belt parishes and approximately 889.9 per 100,000 among the eight remaining reporting units. The absolute difference was approximately 649.2 reported cases per 100,000 population. The corresponding ecological rate ratio was approximately 1.73, indicating that the historical cumulative rate in the defined tourism belt was about 73% higher than the comparison-group mean. This calculation is descriptive and is not an individual-level relative risk of acquiring HIV. It also does not adjust for age, sex, urbanisation, population mobility, testing intensity, socioeconomic characteristics or other potential confounders. Nevertheless, the magnitude of the descriptive difference supports further investigation using more rigorous longitudinal data.

4.3 Hotel Geography and HIV Geography

Jamaica Tourist Board data demonstrate substantial concentration of hotel capacity in the country's principal resort regions. In 2015, average available hotel-room capacity was approximately 7,304 rooms in Montego Bay, 4,971 in Ocho Rios and 4,885 in Negril, compared with 1,139 in Kingston and St Andrew, 592 in Mandeville/South Coast and 114 in Port Antonio. The three major resort areas accounted for approximately 17,160 of Jamaica's 19,005 average available hotel rooms, or about 90% of the national total. This tourism geography overlaps substantially with the high-HIV-rate western and northern parishes identified in the Ministry of Health surveillance data. St James, containing Montego Bay, provides the clearest geographical overlap between intensive hotel development and elevated historical HIV burden. However, geographical overlap alone cannot identify the mechanisms responsible for the association.

4.4 Evidence from Sentinel Populations

Additional surveillance evidence illustrates why interpretation requires caution. Among STI clinic attendees tested in 2015, HIV seroprevalence was 3.95% in Kingston and St Andrew, 3.68% in St James, 3.29% in St Catherine, 2.62% in Westmoreland, 1.28% in St Ann and 0.24% in Manchester. The comparatively high value in St James is consistent with the cumulative geographical pattern, but the high values in Kingston and St Andrew and St Catherine again demonstrate that tourism cannot be treated as the sole explanation. Among antenatal-clinic attendees in the same surveillance system, St James also exhibited a relatively high seroprevalence, although estimates from specific sentinel populations cannot automatically be generalised to entire parish

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populations. Testing populations differ in demographic composition, sexual behaviour, healthcare utilisation and underlying risk. Multiple epidemiological indicators should be triangulated before conclusions are drawn about tourism-related geographical patterns.

5. DISCUSSION

The principal finding is that Jamaica's historical HIV burden exhibits a notable geographical overlap with its dominant tourism belt. The unweighted cumulative reported HIV rate across St Ann, Trelawny, St James, Hanover and Westmoreland was approximately 73% higher than that of the comparison group. This difference is sufficiently large to justify formal epidemiological investigation of tourism intensity as a contextual correlate of HIV geography. Nevertheless, the result does not mean that hotels create HIV infection or that tourists are responsible for Jamaica's HIV epidemic. Tourism areas differ systematically from other parishes in mobility, employment, urban development, nightlife, migration, health-service availability and patterns of social interaction. These factors provide several competing explanations for the observed ecological association.

St James is particularly important to the tourism–HIV nexus because it contains Montego Bay, Jamaica's principal resort centre, while historical HIV surveillance has identified the parish as one of the areas most severely affected by the epidemic and as having a particularly high cumulative reported HIV burden (Figueroa, 2012; Figueroa et al., 2007; Johnson, 2016; Ministry of Health, 2015; Pruitt & LaFont, 1995). Montego Bay, however, should not be conceptualised solely as a hotel or tourism enclave, as it simultaneously functions as a major urban, commercial and transportation centre characterised by substantial movements of residents, workers, domestic and international visitors, and economic activity (Figueroa et al., 2007; Johnson, 2016; Ministry of Health, 2015; Pruitt & LaFont, 1995; Statistical Institute of Jamaica, 2011). Hotel concentration represents only one component of a considerably more complex urban economy and population-mobility system within which HIV transmission and sexual networks must be interpreted. The high HIV burden in Kingston and St Andrew strengthens this interpretation because those areas demonstrate that intense urban connectivity can coexist with elevated HIV rates outside the principal resort belt. Conversely, the tourism-belt parishes themselves do not have identical rates, suggesting substantial intra-belt heterogeneity. A credible model must separate tourism intensity from urbanisation, mobility and population density. Failure to make these adjustments risks attributing to hotels an association that may partly reflect broader patterns of human connectivity.

The current findings can also be interpreted through a network-mobility framework. Tourism destinations create repeated movement of hotel employees, transportation workers, entertainment workers, vendors, visitors and other populations between communities and economic spaces. Greater mobility can expand the geographical range of social networks, but it does not necessarily imply risky sexual behaviour. Certain transactional or economically mediated sexual relationships have nevertheless been documented in Jamaican tourism settings, including research concerning Jamaican men and visiting tourist women. Public-health interventions should focus on voluntary testing, condom availability, PrEP awareness and access, STI services, sexual-health education and stigma reduction rather than stigmatising tourism employees, communities or visitors. A tourism-centred HIV strategy should complement, rather than replace, Jamaica's broader national HIV response.

5.1 The Tourism–HIV Paradox

A useful conceptual interpretation emerging from the analysis is the Tourism–HIV Paradox. Tourism can simultaneously improve household income, employment and access to economic opportunities while creating highly mobile environments in which social and sexual networks extend beyond traditional geographical boundaries. Economic development may improve access to prevention and treatment, while increased connectivity can create different epidemiological challenges. The relationship between tourism and HIV need not be uniformly harmful or protective. The direction of the association depends upon prevention coverage, sexual-health knowledge, healthcare accessibility, socioeconomic inequality, network structures and individual behaviour. This framework explains why similar levels of hotel development need not produce similar HIV outcomes.

5.2 Comparison with the Caribbean and International Context

The Jamaican findings have relevance to other tourism-dependent Caribbean economies where visitor activity is concentrated in relatively small coastal destinations. Tourism-intensive environments throughout the Caribbean combine international mobility with local labour markets, entertainment economies and seasonal population flows. Similar mechanisms may operate in tourism destinations in Latin America, Africa, Asia, Europe and Oceania, although their epidemiological consequences will depend strongly on local HIV prevalence and health systems. International comparisons should focus on mechanisms rather than assume that tourism produces identical outcomes across destinations. The most useful comparative indicators include hotel density, visitor-to-resident ratios, seasonal labour mobility, HIV testing, PrEP access, condom use, STI prevalence and socioeconomic inequality. Jamaica provides a useful case because both tourism and HIV surveillance exhibit pronounced geographical variation.

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6. Proposed Tourism–HIV Vulnerability Index

For future research, a composite Tourism–HIV Vulnerability Index may be specified as:

$$THVI_i = w_1h_i + w_2v_i + w_3m_i + w_4s_i + w_5d_i - w_6p_i$$

where h_i represents normalised hotel intensity, v_i visitor intensity, m_i population mobility, s_i empirically measured sexual-network vulnerability, d_i socioeconomic deprivation and p_i HIV-prevention coverage. The weights w_j represent the relative contribution assigned to each component. All variables should be defined from empirical data and normalised before construction of the index. Prevention coverage receives a negative sign because stronger prevention services are hypothesised to reduce vulnerability. The index should not be used to label individuals or communities as inherently risky. Its purpose would instead be to identify geographical areas where additional prevention resources and research may be warranted.

The weighting constraint may be represented as:

$$\sum_{j=1}^6 w_j = 1$$

This condition requires the component weights to sum to unity. Initial studies could employ equal weights for exploratory purposes, but empirical estimation or validated expert weighting would provide stronger justification. Sensitivity analysis should determine whether conclusions change under alternative weighting schemes. Importantly, behavioural indicators should be based on population-level survey evidence rather than assumptions about tourism workers or residents. The resulting index could then be compared with annual HIV diagnosis or incidence estimates. Such an approach would transform the conceptual framework into a testable epidemiological model.

7. Public-Health Implications

The current findings support geographically targeted HIV prevention without implying that tourism communities themselves are responsible for transmission. HIV testing and prevention services can be strengthened around major mobility corridors, resort towns, transportation centres, nightlife areas and communities supplying labour to tourism districts. Extended-hour testing may be useful for workers whose employment schedules make conventional clinic hours difficult to access. Prevention programmes should include residents and workers of all relevant occupational groups rather than narrowly targeting hotel employees. Condom distribution, STI screening, linkage to antiretroviral treatment and access to PrEP can form part of an integrated tourism-destination sexual-health strategy. Monitoring should simultaneously examine whether observed geographical disparities narrow as prevention coverage improves.

Hotel and tourism organisations can participate without collecting sensitive employee HIV information. Workplace programmes can provide confidential referrals, sexual-health information, anti-discrimination policies and access to prevention resources through established health agencies. Public-health partnerships can also include taxi associations, entertainment establishments, community organisations and tourism training institutions. The objective should be universal prevention and access rather than surveillance of occupations or communities. Such an approach recognises that HIV is transmitted through specific biological and behavioural pathways, not through employment in tourism itself. It also reduces the risk of creating stigma around Jamaican tourism destinations.

8. LIMITATIONS

Several limitations require explicit acknowledgement. First, the primary parish rates are cumulative historical reported case rates and do not represent current HIV incidence. Second, HIV diagnoses depend partly on testing availability and healthcare utilisation, meaning that better-served tourism or urban areas could identify a larger proportion of infections. Third, the analysis is ecological, and parish-level associations cannot be transferred to individuals without committing the ecological fallacy. Fourth, tourism areas and administrative parish boundaries do not align perfectly, around Negril and broader resort regions. Fifth, only a small number of geographical units are available, limiting conventional multivariable cross-sectional regression. Finally, historical cumulative rates cannot establish whether HIV infection occurred within the parish of reporting or whether tourism exposure preceded infection.

9. RECOMMENDATIONS FOR FURTHER RESEARCH

The next stage should construct a parish-year panel linking annual HIV diagnoses with hotel-room capacity, visitor nights, tourism employment, population, urbanisation and socioeconomic indicators. Fixed-effects models could then control for stable unobserved differences between parishes while year effects account for national changes in HIV prevention and treatment. Spatial regression could determine whether HIV patterns in neighbouring parishes are statistically interdependent. Lagged tourism variables could test whether changes in tourism intensity precede changes in HIV diagnoses rather than merely occurring simultaneously. Individual-level survey data would additionally permit adjustment for age, sex, socioeconomic status, sexual behaviour, mobility and prevention practices. Such extensions would provide substantially stronger evidence than a simple cross-sectional tourism-belt comparison.

10. CONCLUSION

This study identifies a substantial historical geographical association between Jamaica's principal tourism belt and reported cumulative HIV burden. The five-parish tourism belt recorded an unweighted mean cumulative HIV case rate of approximately 1,539 per 100,000 compared with approximately 890 per 100,000 among the remaining reporting units, producing a descriptive ratio of approximately 1.73. St James, home to Montego Bay, recorded the highest cumulative reported HIV rate, while Kingston and St Andrew demonstrate that high HIV burden also occurs in major non-resort urban environments. Hotel concentration should be considered a marker of a broader tourism, mobility and social-network environment rather than an independent causal explanation for HIV. The research gap is answered by demonstrating that a measurable ecological tourism–HIV relationship exists in the historical surveillance data, while also showing that tourism alone is insufficient to explain Jamaica's geographical HIV distribution. Future parish-year research should determine whether the relationship persists after urbanisation, mobility, testing intensity, socioeconomic conditions, prevention coverage and behavioural characteristics are controlled.

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