**Additional file 1**

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| **Algorithm 1** Thompson sampling Strategy |
| For each zone *i = 1…,n2* set *Xi(0)=0, Yi(0)=0*.  **for each** *t = 1, 2…tmax,* **do**  For each zone *i = 1…,n2,* sample *θi(t)*from the Beta *(αi + Xi(t), βi + Yi(t))* distribution.  Select zone *j=argmaxi θi(t).*  Perform *m* Bernoulli trials in zone *j* with success probability *UPj(t)* and observe *xj* successes and (*m-xj*) failures.  Let *Xj(t + 1) = Xj(t) + xj* and *Yj(t + 1) =Yj(t) + (m-xj).*  For all zones *i ≠ j,* let *Xi(t + 1) = Xi(t)* and *Yi(t + 1) =Yi(t).*  **end** |

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| **Algorithm 2** BYM Strategy |
| For each zone *i = 1, …, n2* set *Xi(0)=0, Yi(0)=0*.  **do while the number of unique visited zones is < 10:**  For each zone *i = 1, 2, …,n2,* sample *θi(t)*from the Beta *(αi + Xi(t), βi + Yi(t))* distribution.  Select zone *j=argmaxi θi(t).*  Perform *m* Bernoulli trials in zone *j* with success probability *UPj(t)* and observe *xj* successes and (*m-xj*) failures.  Let *Xj(t + 1) = Xj(t) + xj* and *Yj(t + 1) =Yj(t) + (m-xj).*  For all zones *i ≠ j,* let *Xi(t + 1) = Xi(t)* and *Yi(t + 1) =Yi(t).*  **do while the number of unique visited zones is ≥ 10:**  Fit the hierarchical Bayesian spatial logistic regression model:  where is the total number of identified HIV cases in zone *i* up to time *t*, is the total number of administered tests in zone *i* up to time *t*, represents the actual but unobserved prevalence at zone *i*, is the shared intercept term, is the spatial random effect which follows the ICAR distribution, and is the exchangeable random effect (normally distributed with constant variance parameter). Note that only previously sampled zones contribute data to the fitting of this model.  After fitting the model, we obtain posterior samples from for each zone (even those that haven’t been visited yet) where and are the complete set of data from all currently sampled zones (; defined similarly). We then randomly select a value from each distribution, *θi(t)*.  Select zone *j=argmaxi θi(t).*  Perform *m* Bernoulli trials in zone *j* with success probability *UPj(t)* and observe *xj* successes and (*m-xj*) failures.  Let *Xj(t + 1) = Xj(t) + xj* and *Yj(t + 1) =Yj(t) + (m-xj).*  For all zones *i ≠ j,* let *Xi(t + 1) = Xi(t)* and *Yi(t + 1) =Yi(t).*  **End** |
| Prior Specifications:   * ; Results in *uniform*(0,1) prior probabilities for each zone a priori assuming no excess variability in the data. * (variance parameter for the ICAR random effect) * (variance parameter for the exchangeable random effect) |

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| **Algorithm 3** Clairvoyant Strategy |
| **For each** *t = 1, 2…tmax* **do**  Select zone *j= argmaxi UPi(t)*  Perform *m* Bernoulli trials with success probability *UPj(t)*.  **end** |