# CASA0007 Research Proposal

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* Proposed research question

How are levels of unmet HIV pre-exposure prophylaxis (PrEP) need associated with regional characteristics in England?

* Bibliography (single source inspiration paper)

Hammoud, M.A., et. al., 2019. HIV Pre-exposure Prophylaxis (PrEP) Uptake Among Gay and Bisexual Men in Australia and Factors Associated With the Nonuse of PrEP Among Eligible Men: Results From a Prospective Cohort Study. JAIDS Journal of Acquired Immune Deficiency Syndromes 81, e73. <https://doi.org/10.1097/QAI.0000000000002047>

* Description of source

The source paper is an observational study of HIV PrEP uptake and retention patterns among Gay and Bisexual Men (GBM) in Australia, during the period of inclusion of the medication on the public-subsidised pharmaceuticals scheme. The study identifies age, residential region (state), and social engagement with other GBM as key factors associated with the uptake of PrEP, among others.

* Explanation of value of research question (with reference to paper)

PrEP was made available as a publicly subsidised medication in England through the NHS in 2020. Given that regional variation in access was identified as an independent factor in PrEP uptake in Australia, and both countries have only recently made the subsidised medication available nationwide, there is reason to believe that a similar pattern may be evident in the UK. This has implications for health equity and identifying areas of greatest need for PrEP access and education.

* Summary of methods that may be applied
* Descriptive statistics and correlation between variables
* Regression modelling to identify which variables (e.g. regional demographics, service funding, social characteristics) are potential determinants of PrEP uptake
* Possibly a system dynamics model of PrEP uptake over time (using annual data – could base off SIR type model)

## Planning Material

A good research question…

1. Cannot be answered with a single calculation
2. Is not vague (can be quite detailed, and split into subsections if required)
3. Asks about the real world (not just data or methods)
4. Is interesting, valuable, and ambitious

Workflow for hypothesis testing:

1. State the null and alternative hypotheses
2. State variables and data type
3. State assumptions
4. State test statistic used
5. State test results
6. State hypothesis conclusion

Assumptions for a *linear regression*:

1. Line relationship exists
2. Independent errors
3. Normally distributed errors
4. Equal variance of errors (uniform distribution of variance)

What to report in a *linear regression*:

1. Fitted equation
2. P-value
3. R2 value (and adjusted R2)
4. Scatter plot of data
5. Residuals vs fit plot

Workflow for *linear regression*:

1. Identify the regression problem
2. Explore the data (clean, visualise)
3. Select dependent and independent variables
4. Build and fit regression model
5. Conduct residual analysis
6. Refine the model
7. Interpret the model

Workflow for *cluster analysis*:

1. Standardise the data (Z-score, min-max rescaling)
2. Choose and apply a clustering method (K-means or hierarchical)
3. Assess clustering quality (SSE/Elbow diagram, Silhouette analysis)
4. Visualisation (cluster plot, elbow diagram, silhouette plot)
5. Follow up (Describe cluster characteristics, examine cluster centroids, compare against unconsidered variables/geography, consider analysing clusters separately)

## Resources

**Potential Data Sources**

|  |  |  |
| --- | --- | --- |
| **Theme** | **Description** | **Source** |
| Monkeypox | Monkeypox cases in the EU/EEA, by day and country | [European Centre for Disease Prevention and Control](https://www.ecdc.europa.eu/en/publications-data/data-monkeypox-cases-eueea) |
| COVID | National Flu and COVID-19 Surveillance reports UK | [UK Health Security Agency](https://www.gov.uk/government/statistics/national-flu-and-covid-19-surveillance-reports-2022-to-2023-season) |
| Indigenous health outcomes | Australian Prisoner Statistics by Indigenous status, Jurisdiction and Year | [ABS](https://www.abs.gov.au/statistics/people/crime-and-justice/prisoners-australia/2021#data-download) |
| HIV | HIV Annual Data Tables UK | [UK Health Security Agency](https://www.gov.uk/government/statistics/hiv-annual-data-tables) |
| HIV | Local Government Expenditure UK | [Ministry of Housing, Communities and Local Government](https://www.gov.uk/government/statistics/local-authority-revenue-expenditure-and-financing-england-2020-to-2021-budget-individual-local-authority-data) |

**Test Statistic Decision Tree**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Is the independent variable categorical or quantitative? | Cat. | Is the dependent categorical or quantitative? | C | Logistic Regression; Wald Test | | | | |
| Q | How many independent variables are there? | 1 | Simple regression; t-test | | |
| >1 | Multiple regression; f-test | | |
| Quant. | Is the dependent categorical or quantitative? | C | Chi-squared | | | | |
| Q | How many groups are being compared? | 2 | Are the standard deviations similar? | Y | Comparison t-test |
| N | Welch’s test |
| >2 | ANOVA or MANOVA | | |