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EPITOME end of grant showcase: WP1

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02/07/2026

wellcome
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Outline

1. Method Development
2. 2010s Welfare Reform
3. 2012 Suicide Prevention
   a) Suicide trends
   b) Suicide prevention

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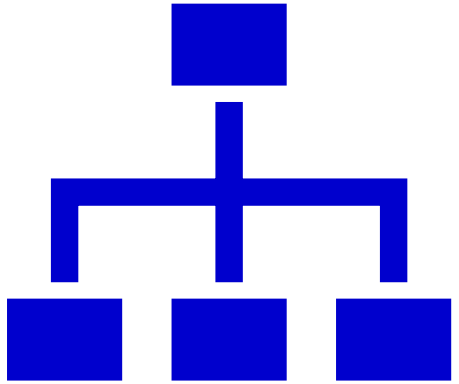
Backbone of the Grant

- General structure of research problems:
  - Outcome (e.g., measure of depression) measured over time.
  - Intervention applied (i.e., welfare reform).
  - Measure the same outcomes before and after intervention.
  - Unit depends on context (i.e., individual, administrative region).

- Things to consider:
  - Individuals exposed to but not effected by intervention (controls).
  - Important confounders (e.g., age, sex, ethnicity).



Quasi-Experimental Design

- Cause-and-effect relationships:
  - Gold standard are randomised controlled trials.
  - Ethically impossible when considering real-world policy.
  - Cannot withhold policy from a population for research purposes.
  - Often, we consider policies retrospectively.

- What do we want:
  - Use real-world data.
  - Can be applied retrospectively.
  - Applied to population level analysis.
  - Approximate *potentially* causal inference without randomisation.

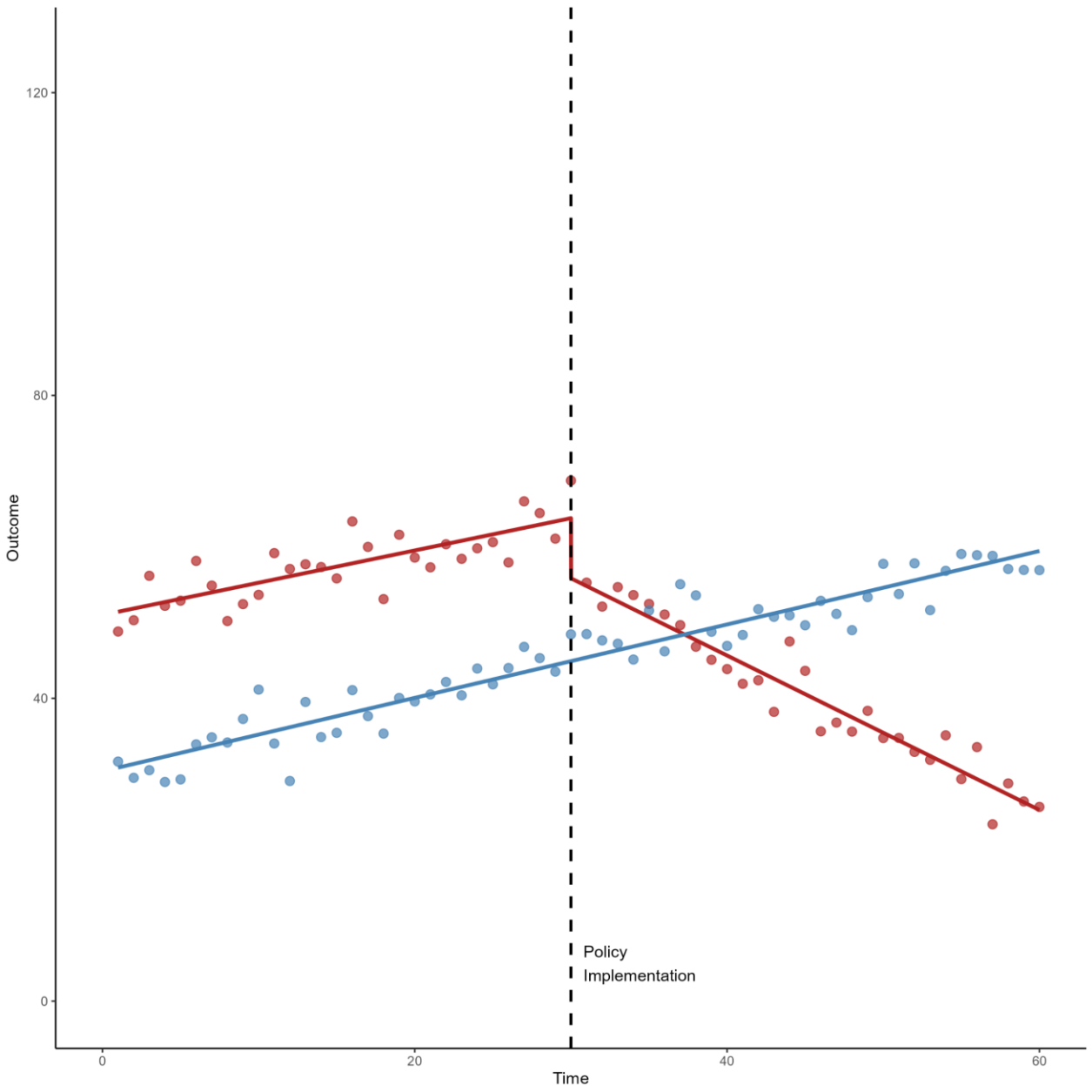
- Quasi-experimental designs:
  - Difference-in-difference: compares groups before and after policy implementation.
  - **Interrupted time series**: examines trends in a single population before and after a policy .

Interrupted Time Series

- Basics:
  - Observes outcomes over time.
  - A known ‘interruption’ points (i.e., policy implemented, shock to system, exposure event, etc...).
  - Compare trends before and after the intervention.

- Measured quantities:
  - Overall temporal trend (or pre policy): what is happening before.
  - Short-term effect: the immediate effect after the policy.
  - Long-term effect: the sustained change from the policy.

- Why this works?
  - Uses routinely collected data.
  - Accounts for pre-existing trends.
  - Can easily extend:
    - Known confounders.
    - Unknown confounders.
    - Control populations.



Now Some Time for the Maths....

Let us assume that $j = 1, 2, \cdots, j^*, \cdots, J$ and $k = 1, \cdots, k$ so that Y_{jk} is the outcome of interest at the j^{th} time point for the k^{th} unit.

Then and comes from the following distribution

$$Y_{jk} \sim \mathcal{D}(\mu_{jk}, \phi)$$

Where:

- $\mathcal{D}$ is a distribution suitable for Generalized Linear Models (GLMs; Normal, Poisson, Binomial, ...).
- $\mu_{jk} = \mathbb{E}[Y_{jk}]$ is the expected value of the outcome at time j for unit k.
- ϕ is a dispersion parameter available in some distributions (e.g., Normal's variance).

A Little More....

To capture the trends in time and effect of policy on the outcome, we use the following linear predictor

$$g(\mu_{jk}) = \beta_0 + \beta_t t_j + \beta_I I_{jk} + \beta_{t^+} t^+_{jk}$$

Where:

- $g(\cdot)$ is the link function connecting expected value to outcome (e.g., Poisson's $\log$).
- β_0 is the is baseline level of the outcome (i.e., when $j = 0$) .
- β_t captures the overall temporal trend.
- β_I captures the short-term effect of policy.
  - $I_{jk} = \begin{cases} 0, & \text{if } j < j^*_k \\ 1, & \text{if } j^*_k \leq j \end{cases}$
- β_{t^+} captures the short-term effect of policy.
  - $t^+_{jk} = \begin{cases} 0, & \text{if } j < j^*_k \\ j - j^*_k + 1, & \text{if } j^*_k \leq j \end{cases}$

Okay Last One....

Assume Y_{jk} is the outcome of interest at the j^{th} time point for the k^{th} unit, then

$$g(\mu_{jk}) = E_{jk} * (\beta_0 + \beta_t t_j + \beta_I I_{jk} + \beta_{t^+} t_{jk}^+) + x'_{jk}\beta_{jk} + z'_{jk}\gamma_{jk}$$

$E_{jk} \epsilon \{0,1\}$ if unit k is treated at time j

To Summarise

Assume Y_{jk} is the outcome of interest at the j^{th} time point for the k^{th} unit, then

$$g(\mu_{jk}) = E_{jk} * (\beta_0 + \beta_t t_j + \beta_I I_{jk} + \beta_{t^+} t_{jk}^+) + x'_{jk}\beta_{jk} + z'_{jk}\gamma_{jk}$$

Where:

- $\beta_0, \beta_t, \beta_I$, and β_{t^+} account for the baseline and ITS terms.
- $x'_{jk}\beta_{jk}$ accounts any known confounders.
- $z'_{jk}\gamma_{jk}$ accounts for any unknown confounders.
- E_{jk} allows for ITS components to vary by different exposure group(s).

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2010s Welfare Reform

Context

- UK government overhauled welfare in 2010s.
- Change from existing benefits to Universal Credit caused delay in payments, reduced payments, and no payments.
- Vulnerabilities in mental ill-health due to social inequalities.

Aim

- Evaluate the effect of Universal Credit on mental wellbeing.
- Account for difference due to geographical location.
- Propose Bayesian hierarchical controlled Interrupted Time Series.

2010s Welfare Reform

Key Findings

- UC led to 2.36% (95% CrI: 0.57%, 4.37%) increase in GHQ-12 in exposed.
- Geographical areas with largest GHQ-12 increases where more deprived.
- Impact of UC was not uniform across England.

Key Contributions

- Novel Bayesian hierarchical controlled ITS framework.
- Combining policy evaluation with accounting for unmeasured confounding.
- Replicable framework for others...

Original Research

A Bayesian Interrupted Time Series framework for evaluating policy change on mental well-being: An application to England's welfare reform

Connor Gascoigne [a], Annie Jeffery [b], Zejing Shao [c], Sara Geneletti [d], James B. Kirkbride [b], Gianluca Baio [c], Marta Blangiardo [a]

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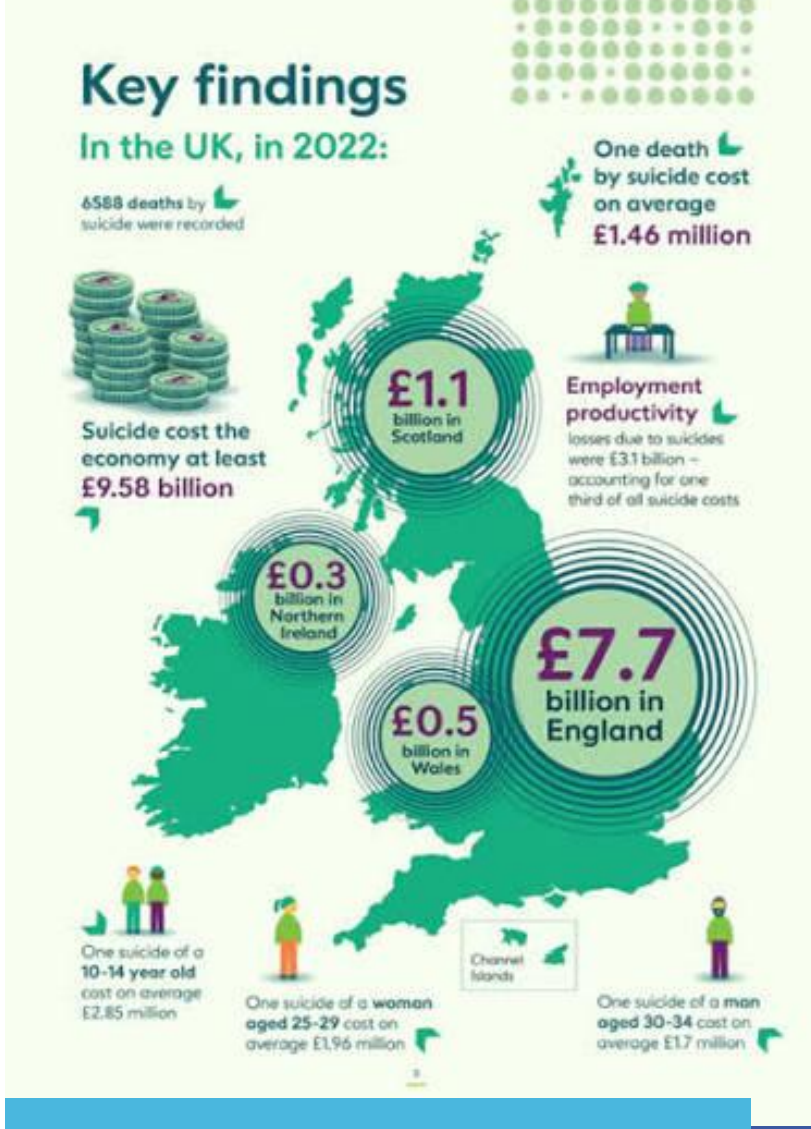
2012 Suicide Prevention

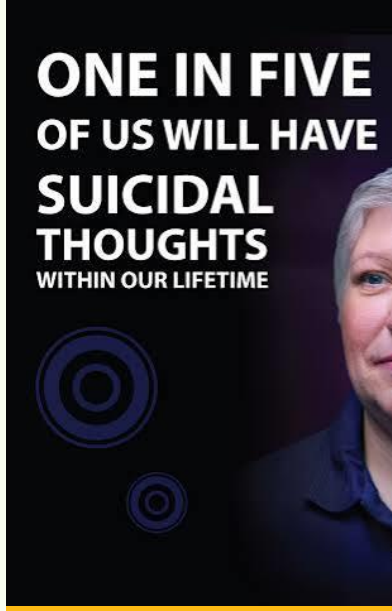
Context

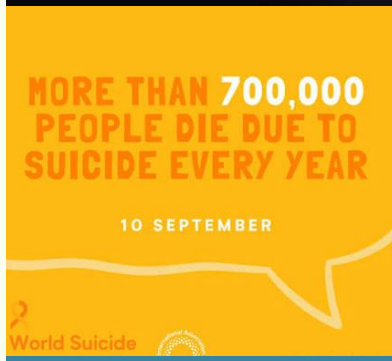
- Between 6,000 - 7,000 suicide deaths in England.
- One suicide death
  - Costs NHS £1.46 million.
  - Affects 5 family and up-to 135 community members.
- England is 1 of 38 countries with suicide prevention.
- In 2012 UK government updated suicide prevention strategy with focus on local, targeted strategies.
- No study looking at suicide trends in time across England.
- No study evaluating UK governments suicide prevention in England.

Aim

1. Update literature on suicide trends in England.
   i. High resolution in space and time.
   ii. Examine effect of local community characteristics.
2. Evaluate 2012 suicide prevention scheme:
   i. Evaluate national effect.
   ii. Evaluate the implementation of local targeted policies.







2012 Suicide Prevention: Suicide Trends

Key Findings

- No substantial change -4.26% (95% CrI: -8.95%, 0.72%) in overall risk of suicide from 2002-2022.
- North East and West consistently above average suicide risk.
- Deprivation and transport risk factors.

Key Contributions

- First high spatio-temporal resolution study on suicides in England.
- Identified community characteristics linked with high suicide risk.
- Gained media attention.

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Deprivation, transport and population levels all linked to suicide risk in England

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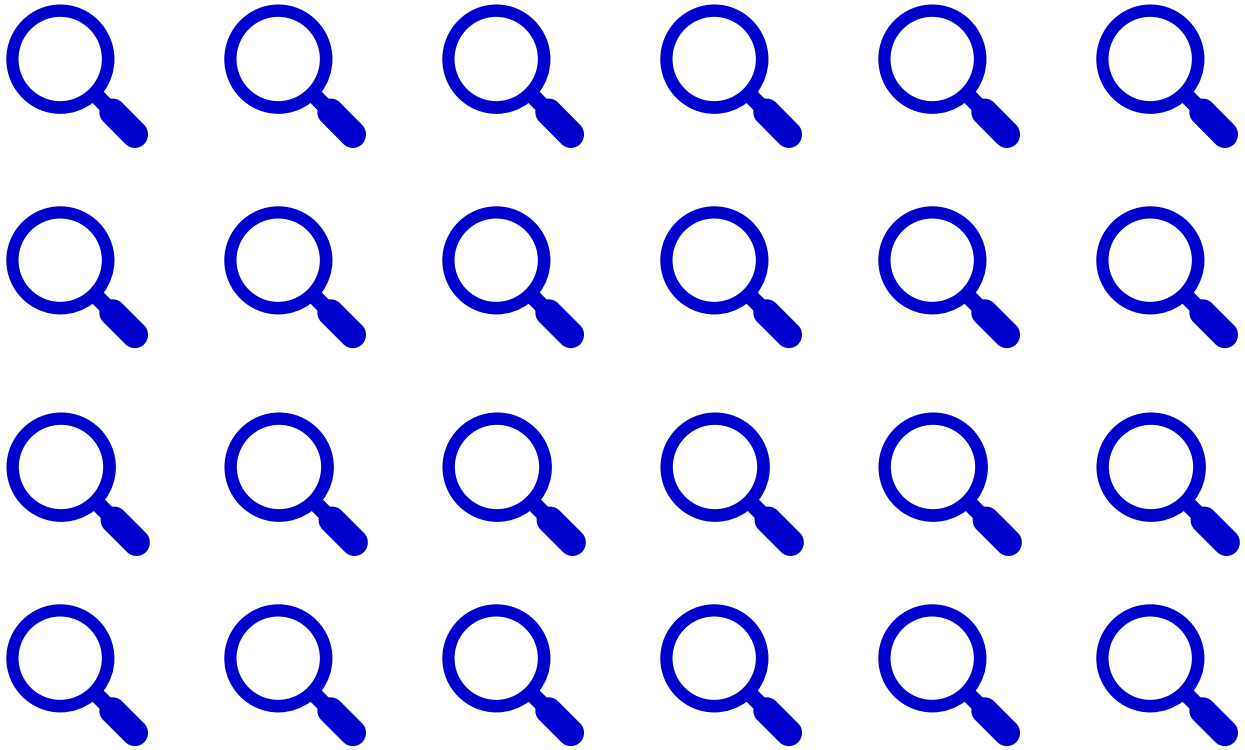
'Little surprise' that North East suicide rates are 40% worse than in London says charity boss

A new study has highlighted the North East's continuing struggle against high suicide rates

2012 Suicide Prevention: Suicide Prevention

Key Findings

- No substantial evidence of national short- or long-term effect.
- Large local differences in short-term effect.
- No local difference in long-term effect.



Key Contributions

- First quantitative evaluation of 2012 suicide prevention.
- Long-term convergence across local authorities.
- Evidence driven decision making when defining future policies.

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Thank you

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