

Multiple Levels Of The Criminal Mind: Modeling, Profiling & Predicting Serial Killers

UNIVERSITY OF LEEDS

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1. Objective

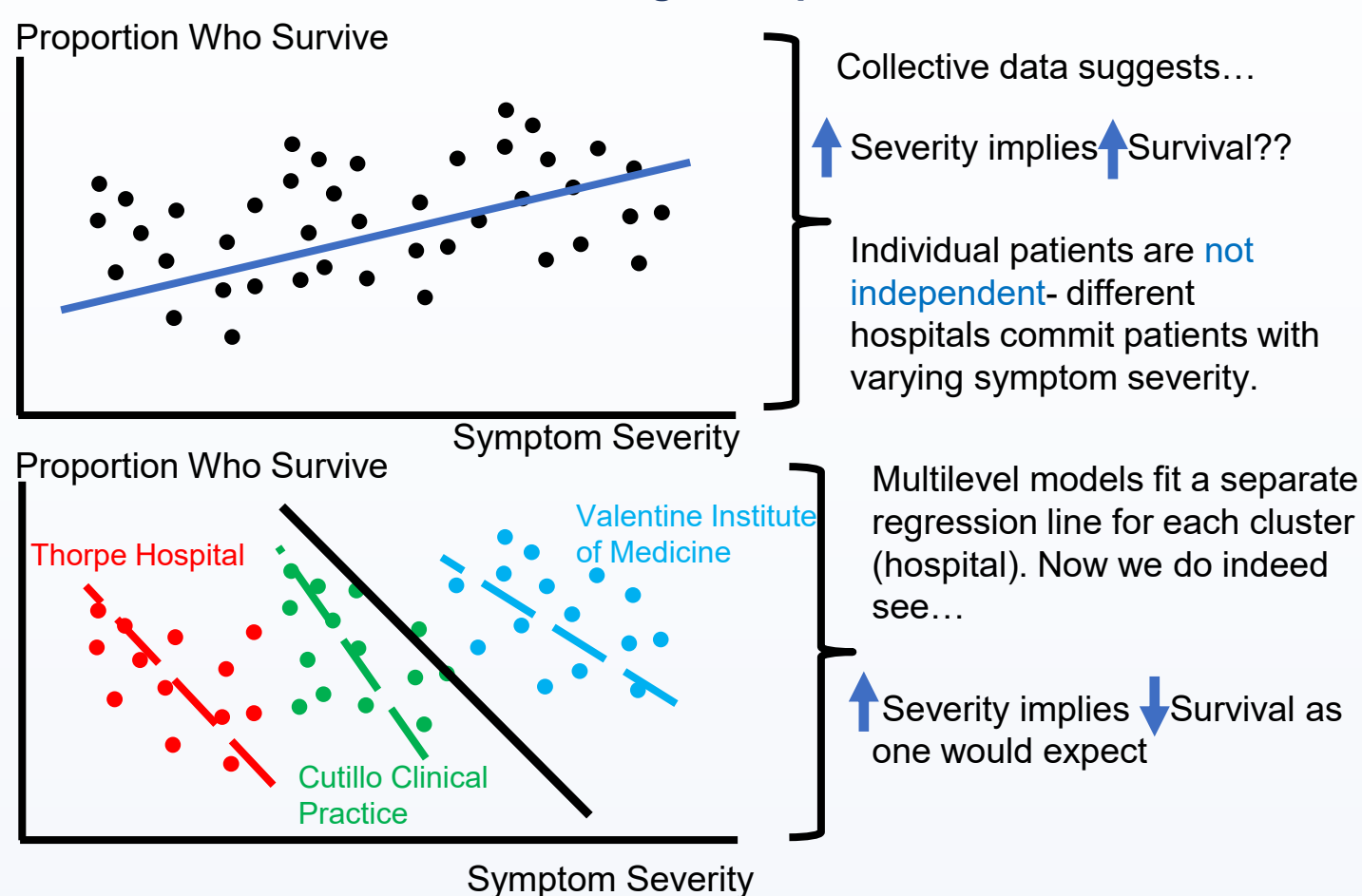
Explore **variations seen throughout serial killers** and show how these findings may be useful to profile serial killers, predicting their behaviour. The curious case of the criminal mind has been researched in great depth by psychologists [1] - Instead of applying a qualitative approach towards understanding serial killers, my research focuses on a quantitative approach, applying the family of statistical models known as **multilevel models** with the aims to explore:

1. Is multilevel modeling a justified approach to understand the criminal mind?
2. If so, what variations are prevalent between serial killers with certain traits?
3. Could variations between serial killers analysed be used to profile killers, predicting their behaviour?

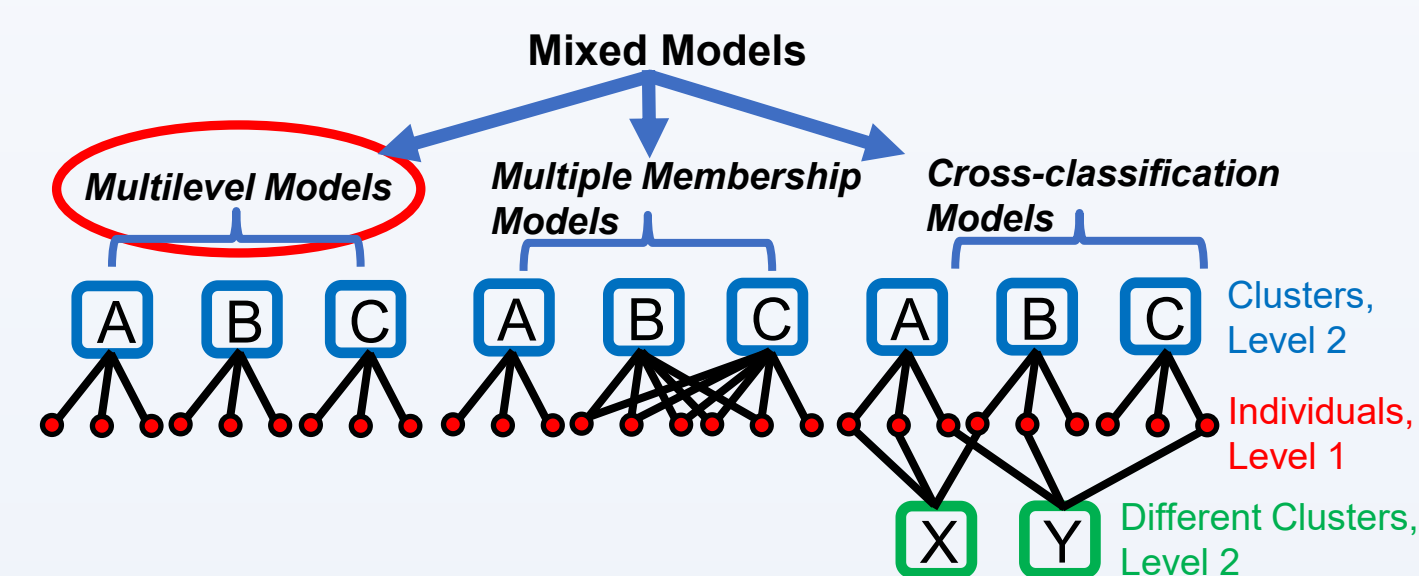
2. What Is A Multilevel Model?

Multilevel models are useful tools that should be applied **when natural clusters form within the data** [2].

2.1 Motivating Example

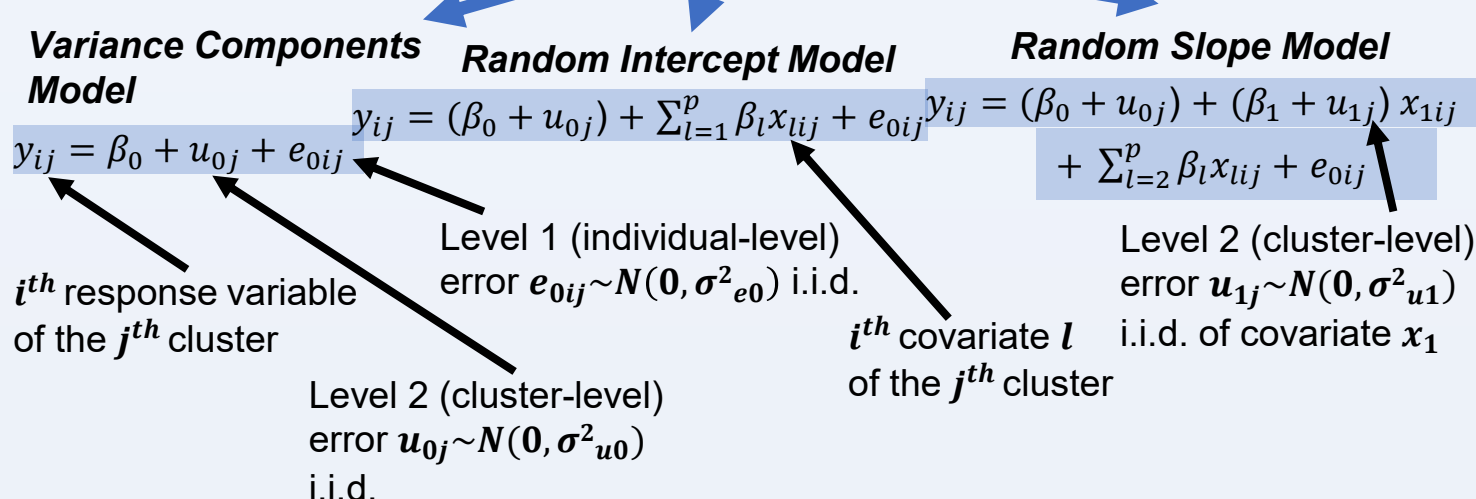


2.2 Model Structure Visualisation



2.3 Multilevel Model Types

Multilevel Models



References

- [1] Jacobs, D., 2011. *Analyzing Criminal Minds: Forensic Investigative Science for the 21st Century: Forensic Investigative Science for the 21st Century*. ABC-CLIO.
- [2] University Bristol. Multilevel Modelling online course: LEMMA VLE Centre for Multilevel Modelling. (www.cmm.bris.ac.uk/lemma/), 2012.
- [3] Aamodt, Michael & Leary, Terence & Southard, Larry. (2020). *Radford/FGCU Annual Report on Serial Killer Statistics: 2020*.
- [4] Harvey Goldstein. *Multilevel statistical models*. John Wiley & Sons, 2011.

3. Application

Recall our first aim, that is:

1. Is multilevel modeling a justified approach to understand the criminal mind?

Let's apply the simplest multilevel model, the variance components model to our data with the aim of answering the question:

3.1 Hypothesis

- The **age at first kill of a serial killer varies between serial killers with different motives**. Motives such as *Financial/personal gain* or *Black widow* (the killing of spouses) occur at a later age in comparison to motives such as *Organised crime* or *Cult*-related serial killings.

3.2 Data Used: Radford/FGCU Database

Largest serial killer database in the world- access to serial killers active in the USA after the year 1900: **1902 serial killers spanning 80 variables**. Sources have been cross-examined and referenced prior to being added to the database [3].

3.3 Applying The Variance Components Model

Age at first kill corresponding to the i^{th} serial killer (the i^{th} level 1 individual) of the j^{th} cluster (level 2). Define level 2 clusters as the motives of a serial killer.

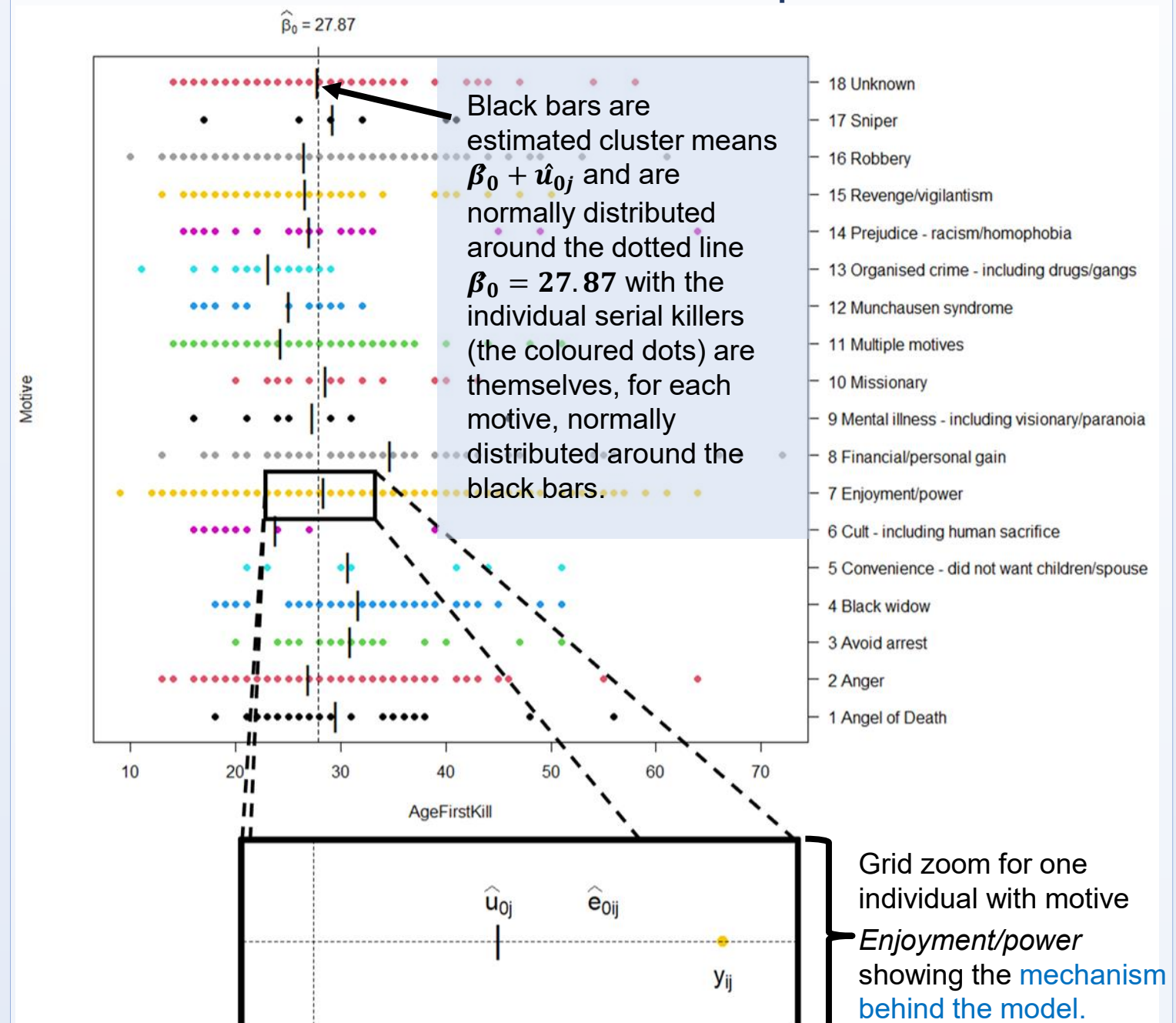
Population mean $E(y_{ij}) = \beta_0$

Level 2 (cluster-level) error $u_{0j} \sim N(0, \sigma^2_{u0})$ i.i.d.

Level 1 (individual-level) error $e_{0ij} \sim N(0, \sigma^2_{e0})$ i.i.d.

$y_{ij} = \beta_0 + u_{0j} + e_{0ij}$

3.4 Visualisation Of The Variance Components Model



3.5 Variance Components Model Results

AgeFirstKill			
Predictors	Estimates	CI	p
(Intercept)	27.87	26.19-29.56	<0.001
Random Effects			
σ^2_{u0}	8.41 ²		
$\sigma^2_{u0Motive}$	3.15 ²		
ICC	0.13		
N _{Motive}	18		
Observations	1763		

$$ICC = \frac{\sigma^2_{u0}}{\sigma^2_{u0} + \sigma^2_{e0}} = \frac{3.15^2}{3.15^2 + 8.41^2} = 0.13, \text{ for the example above.}$$

Intraclass correlation coefficient- describes how strongly individuals in the same cluster resemble each other.

Further Information

Please see: <https://marcus07957.github.io/> for my portfolio containing up-to-date code and research regarding this topic as well as past projects that I have worked on related to data analytics.

Please email: mm18ms@leeds.ac.uk if you have a question or comments.