



Home Office

Modern Slavery and Multiple Systems Estimation

Bernard Silverman

Chief Scientific Adviser, Home Office

December 2014

The National Referral Mechanism

- The National Referral Mechanism (NRM) is a framework for identifying victims of human trafficking and ensuring they receive the appropriate protection and support. It is run by the National Crime Agency (NCA).
- At the core of every country's NRM is the process of locating and identifying "potential victims of trafficking" (PVoT).
- The NRM collates data from a range of sources to produce statistics on PVoTs: police forces, the Home Office and other government departments, the UK Border Force, the Gangmasters Licensing Authority, international agencies, non-governmental organisations (NGOs) and many charitable and voluntary expert groups.

The National Crime Agency (NCA) Strategic Assessment of the Nature and Scale of Human Trafficking (2013)

- The NCA Strategic Assessment provides a measure of the number of PVoTs
 - In 2013, the Strategic Assessment identified 2,744 unique PVoTs
- This measure is produced using information about PVoTs from various sources:

LA: Local Authority	NG: Non-governmental organisation
PF: Police force	NCA: National Crime Agency
GO: Government Organisation (mostly Home Office agencies e.g. UK Border Force, Gangmasters Licensing Authority)	GP: The general public, through various routes

The dark figure

- Despite all efforts, the Strategic Assessment can only present a partial picture of the size of human trafficking. This is because:
 - Human trafficking is a hidden crime and some victims may be controlled or still in servitude
 - Victims may not come forward due to feelings of fear and shame.
 - Some individuals may not be identified as victims of human trafficking by professionals who encounter them.
 - Some victims may not view themselves as victims of exploitation.
 - The NCA's coverage is not complete: only a limited number of agencies respond to the NCA's intelligence requirement (e.g. in 2013, 37 police forces and 4 NGOs responded to the intelligence requirement) so agencies may be aware of potential victims who are unknown to the Strategic Assessment.
- An approach called **multiple systems estimation (MSE)** can be used to estimate the “dark figure” of potential victims that do not come to the Strategic Assessment's attention.

Mark-recapture

- The simplest form of MSE is called “mark-recapture”.
- It was proposed in 1895 as a method of estimating the number of fish in a pond (though it is a much older idea). You catch a number of fish (say 100), mark them in some way, and then release them. Some time later you take a new catch (say another 100) and see how many of the second catch were part of the original first catch. If the overlap between the two catches is 20, for instance, the natural estimate of the whole population size is 500.
- A mark-recapture approach was used in the 2011 census to estimate the undercount, the proportion of the population not “caught” by the initial census, by conducting a survey and assessing the overlap between the census and the survey.

Multiple systems estimation: more than two lists

LA	x					x	x	x								x	x	x	
NG		x				x			x	x	x					x	x	x	x
PF			x				x		x			x	x		x	x		x	
GO				x				x		x		x		x	x		x	x	
GP					x						x		x	x					
number	54	463	995	695	316	15	19	3	62	19	1	76	11	8	4	1	1	1	???

- The “dark figure” is the number in the last column—which do not appear on any list
- A lot of work went into this table!

Results: the total figure

- The estimated confidence interval for the actual population size is from 10K to 13K, so this suggests that the Strategic Assessment is aware of 20% to 25% of all the potential victims of trafficking in the UK in 2013.
- This must be regarded as a tentative conclusion, because the model is based on assumptions that (while sensible) can't be easily verified and inevitably uses data that has some limitations.

Results: interactions

- Cases reported by a local authority are somewhat more likely also to be reported by an NGO or the police.
 - This may reflect the existence of referral pathways for potential victims between these agencies.
 - It may also reflect joint operations where victims are identified by more than one agency.
- There's a negative interaction (very little overlap) between GP and most other lists, so it suggests that the general public are “fishing in a different pool” in some way.
 - However to check robustness we tried leaving these out altogether and the results were scarcely different

The standard MSE model

- MSE works by fitting a model to the observed data.
- It fits main effects, for example the odds of appearing on list i
- It also allows for interaction effects, where the odds of appearing on both lists i and j are not simply the product of the individual odds. For five lists there will be ten possible interaction effects, but we try to fit a simpler model where only some of these are included
- Once the effects are all estimated, the model provides an estimate (with a standard error) for the total size of the population

Fitting the model---the technical stuff

- Use the R package `Rcapture`.
- The routine `closedp.mX` allows for an arbitrary design matrix giving specified interactions.
- Starting with a model fitting main effects only, stepwise add the two-factor interaction which makes the biggest improvement in the AIC, until the AIC starts to increase again.
- Typically, one or more interactions may have extremely high estimated standard errors. We drop these from the model even it means increasing the AIC.
- The resulting model not only estimates the overall population size but also sets out which interactions are modelled as being positive and which negative.
- Some individuals may appear on lists in groups (for example as a result of an operation which finds several victims) so the accuracy of estimation may be optimistically assessed by the standard Poisson model.
- Overall there may also be other reasons why the accuracy is optimistic.

UK is home to 13,000 slaves: Home Office says number is four times higher than previously thought

- The shocking figures include women trafficked for prostitution or service
- Others are brought in to work in factories, fields or even fishing boats
- The Home Office confirmed it underestimated the scale of the problem
- The most common victims are from Romania, Poland, Albania and Nigeria

By MAIL ON SUNDAY REPORTER

PUBLISHED: 01:55, 30 November 2014 | UPDATED: 15:56, 30 November 2014



Up to 13,000 people in Britain are being held in conditions of slavery, four times the number previously thought, the Home Office has said.

In what is said to be the first scientific estimate of the scale of modern slavery in the UK, the Home Office has said the number of victims last year was between 10,000 and 13,000.

They include women forced into prostitution, domestic staff and workers in fields, factories and fishing boats.

Scroll down for video



Home Secretary Theresa May, pictured, described the scale of human trafficking as 'shocking'

Data from the National Crime Agency's Human Trafficking Centre had previously put the number of slavery victims in 2013 at 2,744.

The new estimate is based on a statistical analysis by the Home Office chief scientific adviser, Professor Bernard Silverman, which aims for the first time to calculate the 'dark figure' of victim numbers who are not reported to the law enforcement agencies.

'Modern slavery is very often deeply hidden and so it is a great challenge to assess its scale,' he said.

'The data collected is inevitably incomplete and, in addition, has to be very carefully handled because of its sensitivity.'

Read more:

<http://www.dailymail.co.uk/news/article-2854601/UK-home-13-000-slaves-Home-Office-says-number-four-times-higher-previously-thought.html#ixzz3L2PU4VAD>

Reflections: science and policy

- Accuracy of reporting: did the paper get it right?
- Thinking about how it will be received
- Explaining a model and a confidence interval
- The Minister explained it better than I could
- Importance of relationships
- Science really does inform policy