National Foundation for Educational Research

Developing a Single Model for Statistical Neighbour Benchmarking

May 2007

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Aims of research

- Create new set of statistical neighbours
- Appropriate for ECM outcomes
- Build on existing models (Ofsted, IPF)
- Create easy to use tool for LAs

Strands of Research

- Literature review and data mapping
- Consultation with stakeholders
  - Bulletin board, telephone interviews
- Creating statistical neighbours
  - Ensuring relevance to ECM outcomes
- Displaying statistical neighbours

Main findings from consultation

- Important to explain rationale behind new model
- Exploring ‘reciprocity’ between statistical neighbours
- Model should use a variety of variables relating to socio-economic and demographic characteristics
- Model needs to evolve

Performance assessment

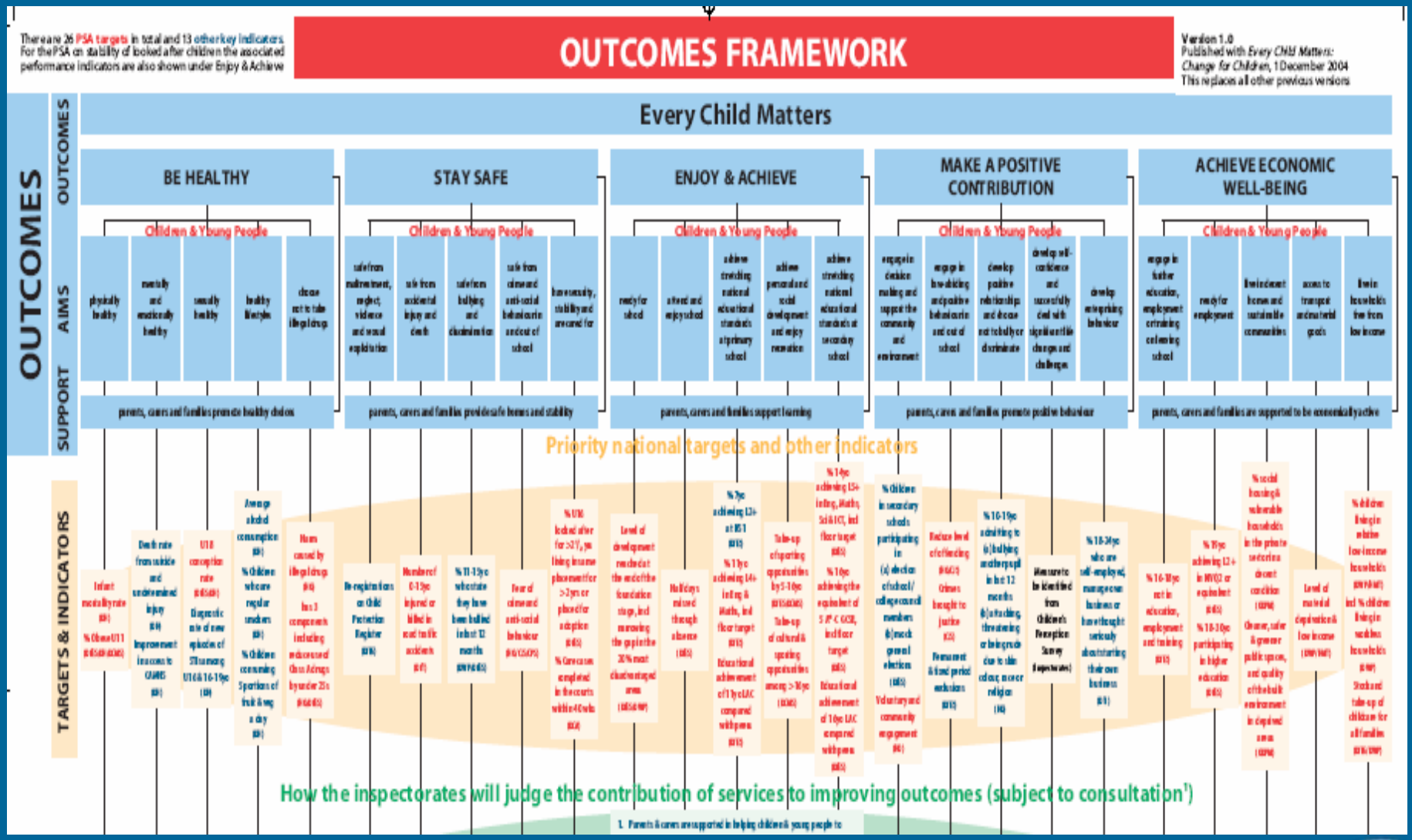
Quantitative indicators provide a common method of performance assessment

Within Every Child Matters:

- be healthy **à** teenage pregnancy, obesity
- stay safe **à** road accidents, child protection
- enjoy & achieve **à** test results, absence
- make a positive contribution **à** youth offending
- achieve economic well-being **à** further education

as well as many other indicators.

Performance assessment



Performance assessment

How do we adjust for context?

Local Authority	*% achieving 5 A*-C (2005)*	*% children in income deprived households*
Windsor & Maidenhead	*59%*	*9%*
Liverpool	*49%*	*45%*
National Figure	*56%*	

What are statistical neighbours?

Each local authority has other similar authorities designated as its statistical neighbours.

- Compare performance with neighbours
- Adjusts for context

For example:

> Results at the end of Key Stage 1 are good and have consistently been above national averages and those of statistical neighbours, although for reading and writing rates of improvement are below statistical neighbours.

(Bedfordshire APA 2005)

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New statistical neighbour model

- Empirical basis for model
  - Relevance to ECM outcomes
- Breadth of data explored
- Comparisons with previous statistical neighbour models

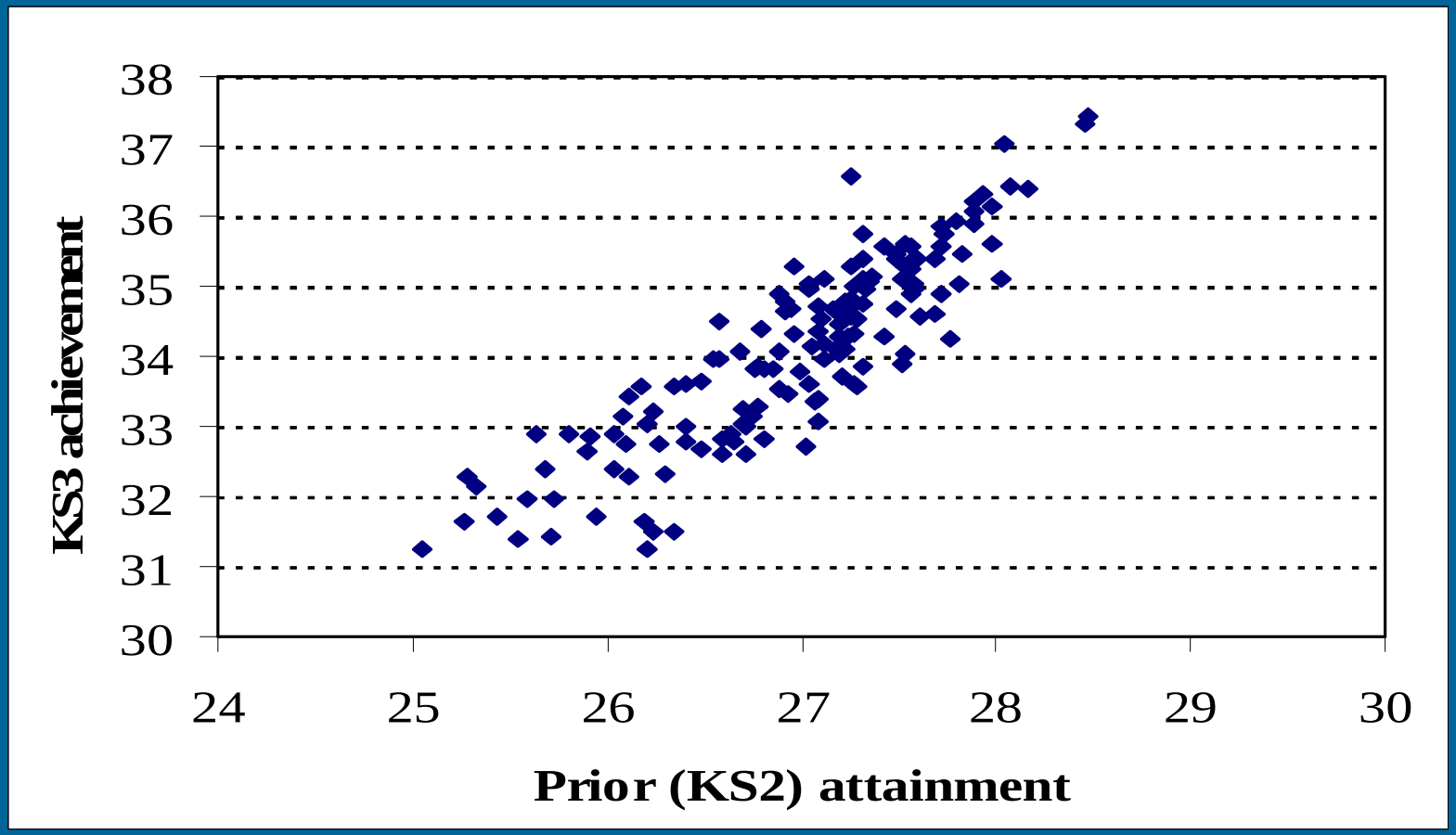
Empirical principles

- Choose model features to maximise predictive performance
  - Ø Background variables
  - Ø Number of statistical neighbours
  - Ø Variable weighting

Simple example

Example to demonstrate principle

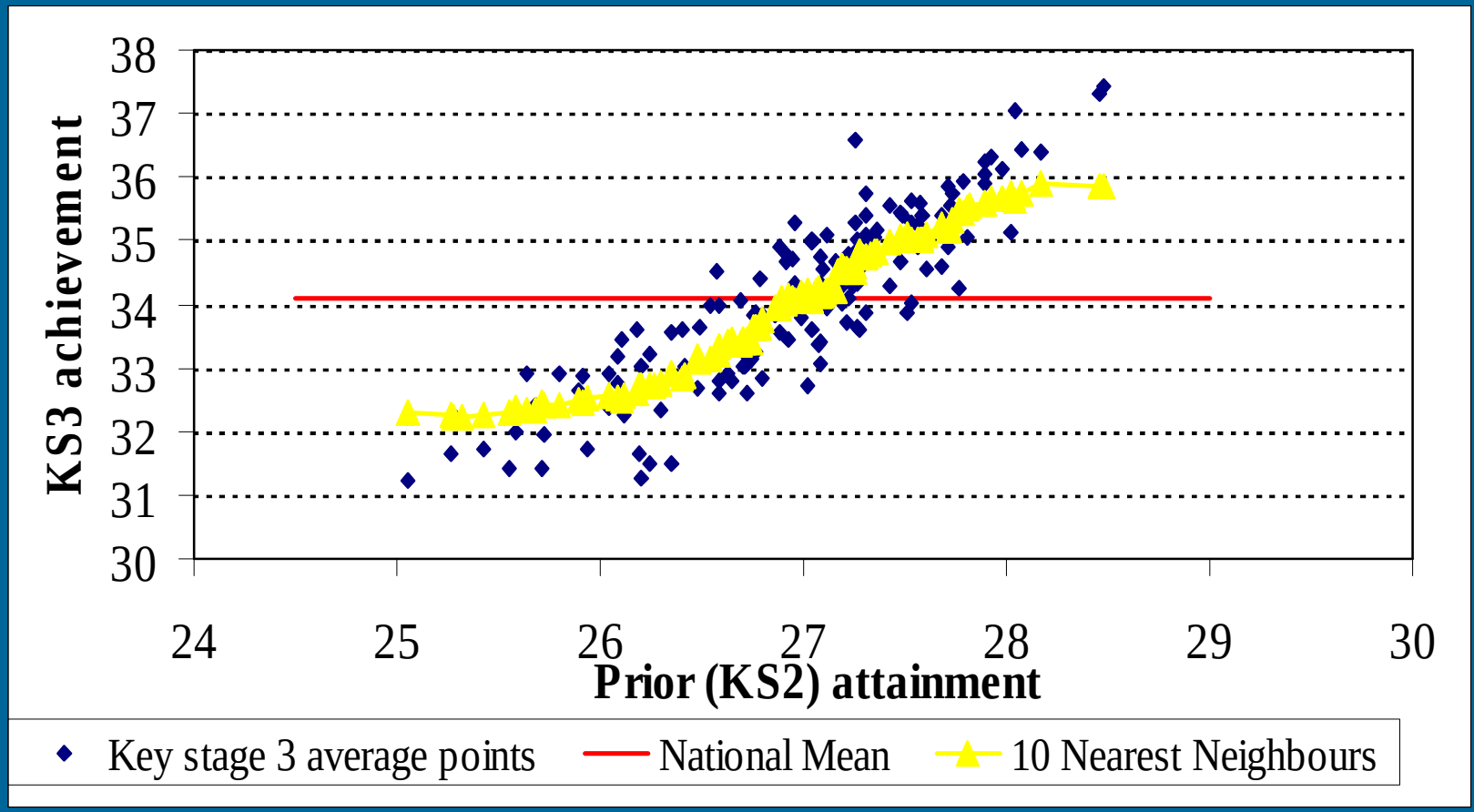
- 1 outcome (average key stage 3 score 2004)
- 1 background variable (prior attainment of cohort)



Simple example

Compare to:

- National mean
- Average for statistical neighbours (10)



Simple example

Compare to:

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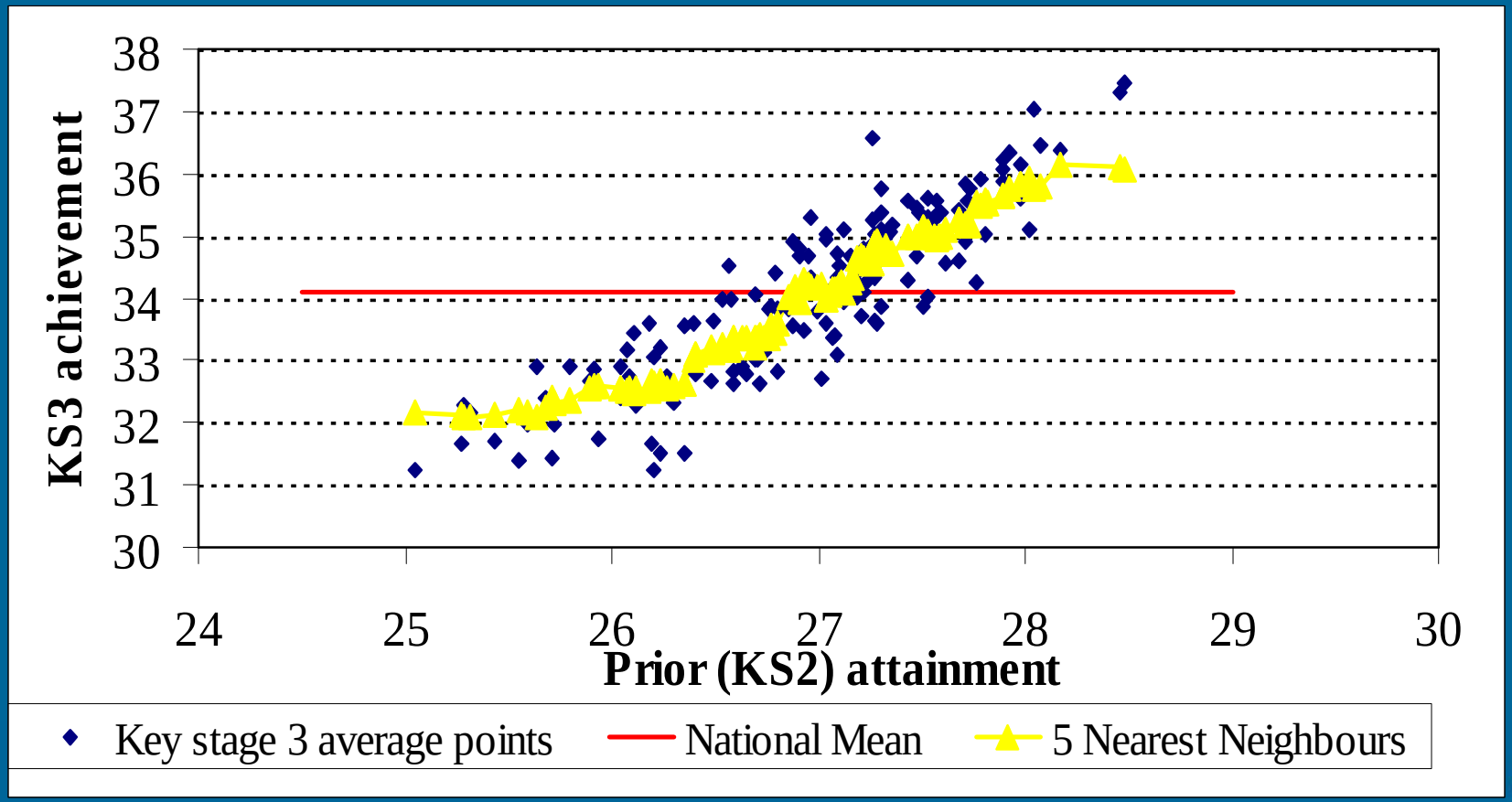

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Model (simple example)	*Criterion*
5 neighbours	*0.256*
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Nearest neighbour models can be less accurate than national mean

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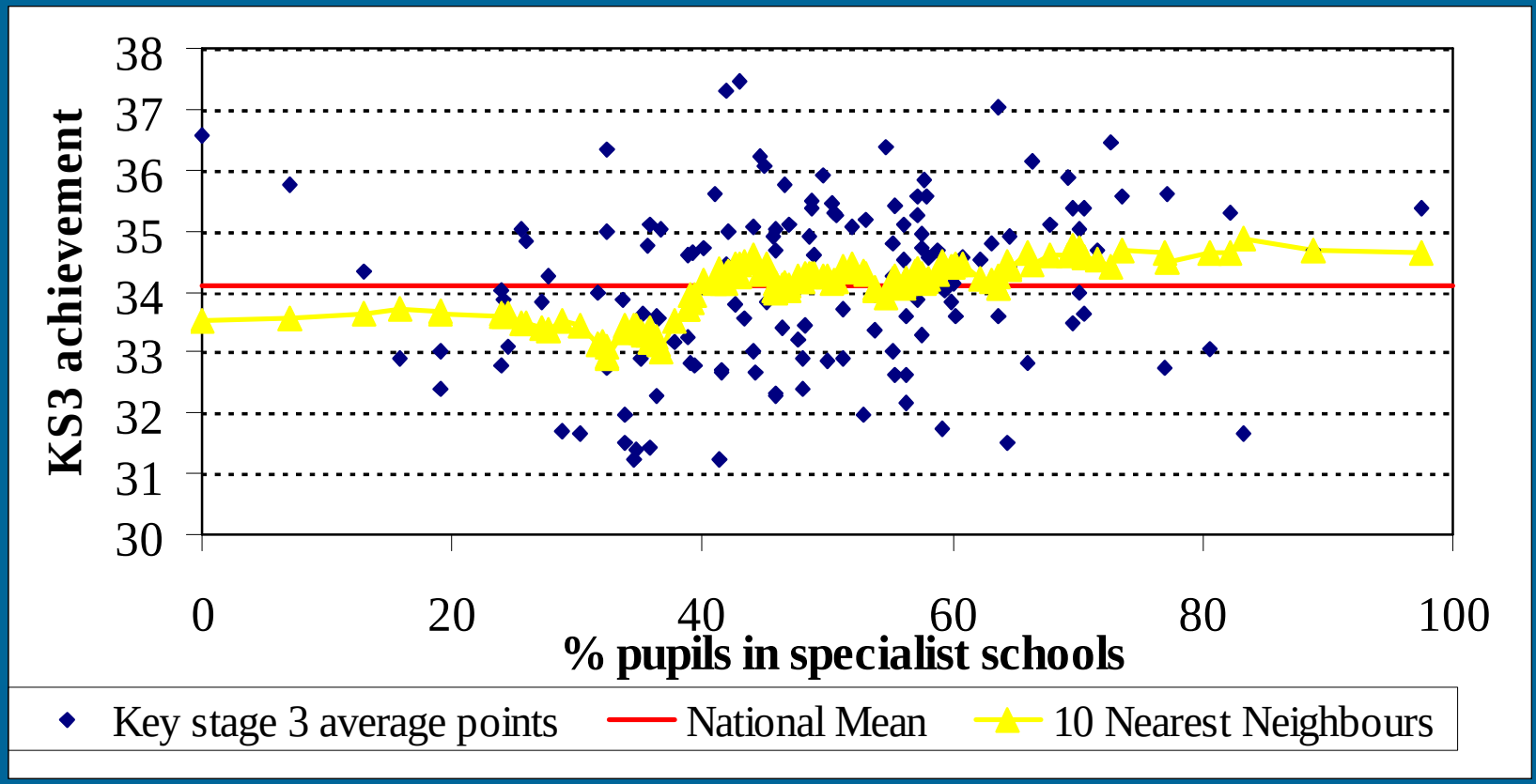


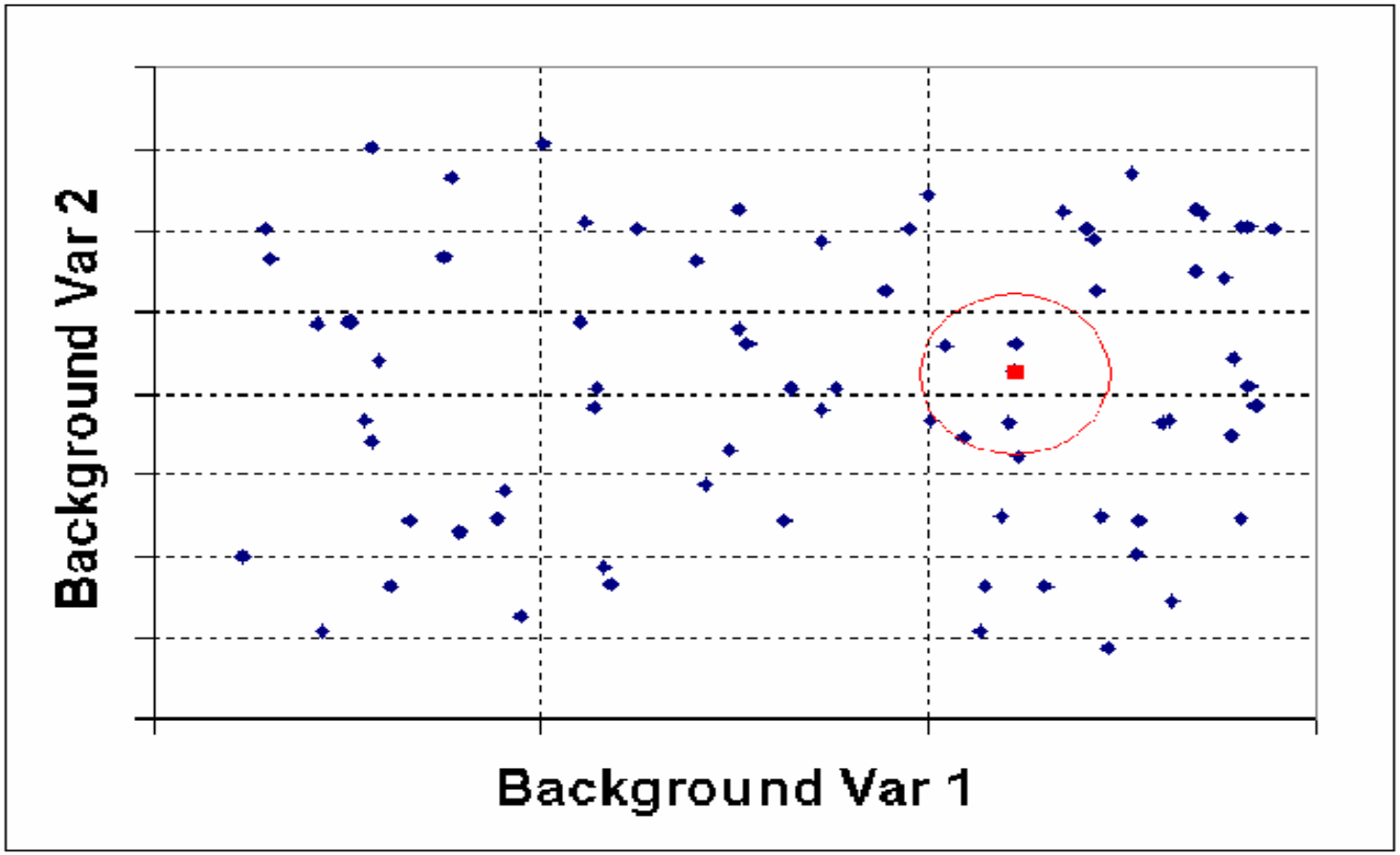
Empirical principles

New model based on same technique except:

- Multiple outcomes
- Multiple background variables (weighting)

Weighting variables

Background variables equally important



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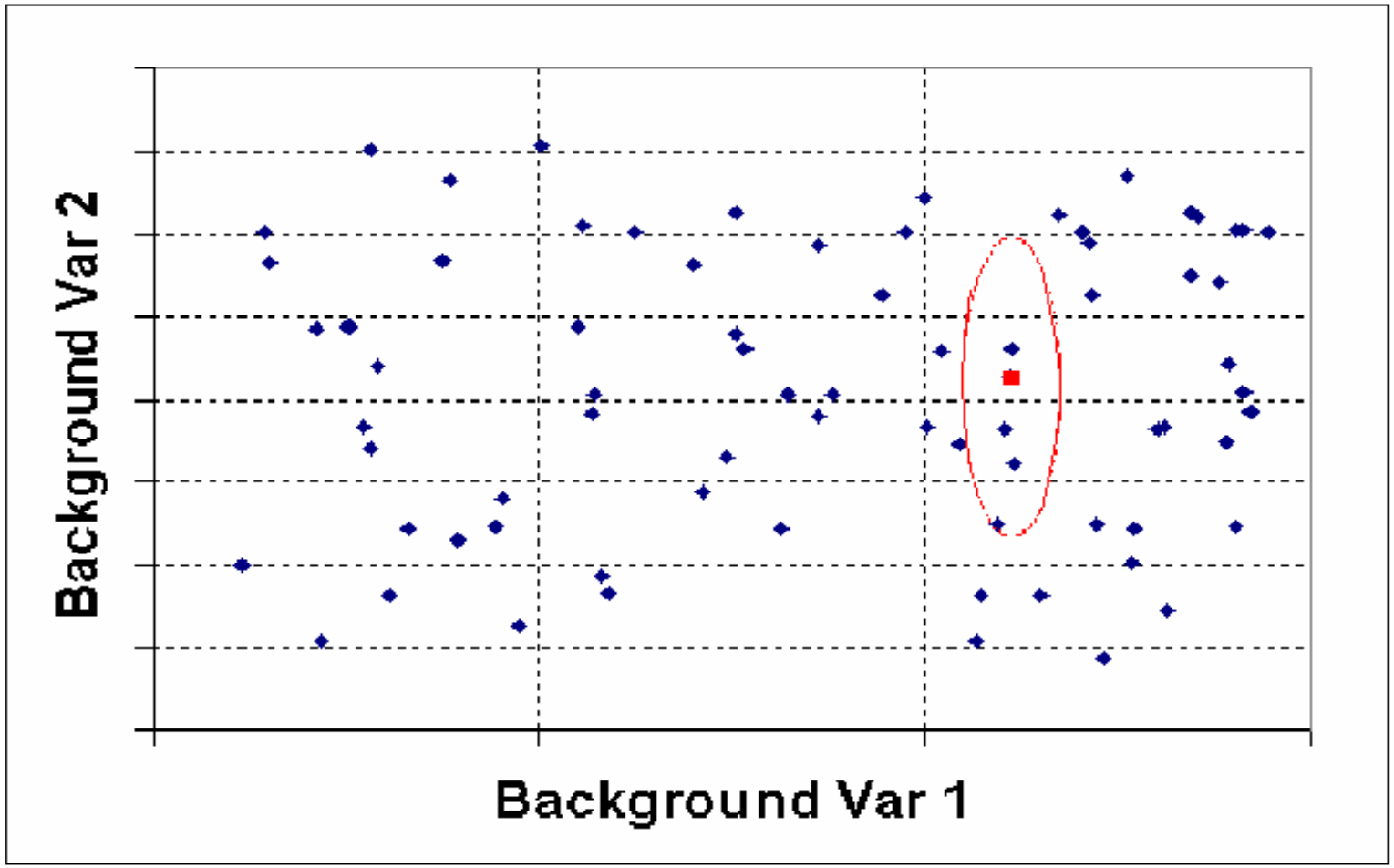

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Sixty-three initial background variables chosen from:

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- DVLA information on vehicle numbers and ages
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How to create the neighbours 1

The methodology began with variable selection.

- **Regression analysis of performance indicators on the proposed background variables.**
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- **Analysis of correlations between background variables.**
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How to create the neighbours 1a

Performance indicators used in regression analysis

- Infant mortality rate
- Under 18 conception rate
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- % of children who have been looked after for more than two and a half years and of those, have been in the same placement for at least two years or placed for adoption
- Child casualties in road accidents
- Achievement at each key stage
- School absence
- Permanent and fixed exclusions
- Police records
- Post-16 progression to further education and training

Compare models

Variables in common with OFSTED

Variable used in Ofsted model	Kept/Replaced/Discarded
% of households where HOH is in Registrar Generals Group IV or V	Replaced with % dependent children in households where household reference person is in any routine occupation.
% of households with dependent children and no car	Replaced with % dependent children in households with 2 or more cars.
% of pupils in maintained schools eligible for free school meals	Variable kept in new model.
% of households in dwellings with 7 or more rooms	Replaced with % dependent children living in households with occupancy rating of +2 or more.
% of households with 3 or more children	Variable kept in new model.

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% of population in rural areas or urban settlements of less than 20,000	Replaced with % of the population living in villages, hamlets or isolated settlements.

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Variables **not in common** with OFSTED

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Population density	Discarded from model due to weak relationship with outcomes.
Population growth/decline: % change	Discarded from model due to weak relationship with outcomes.
Number of pupils in state maintained schools	Discarded from model due to weak relationship with outcomes.

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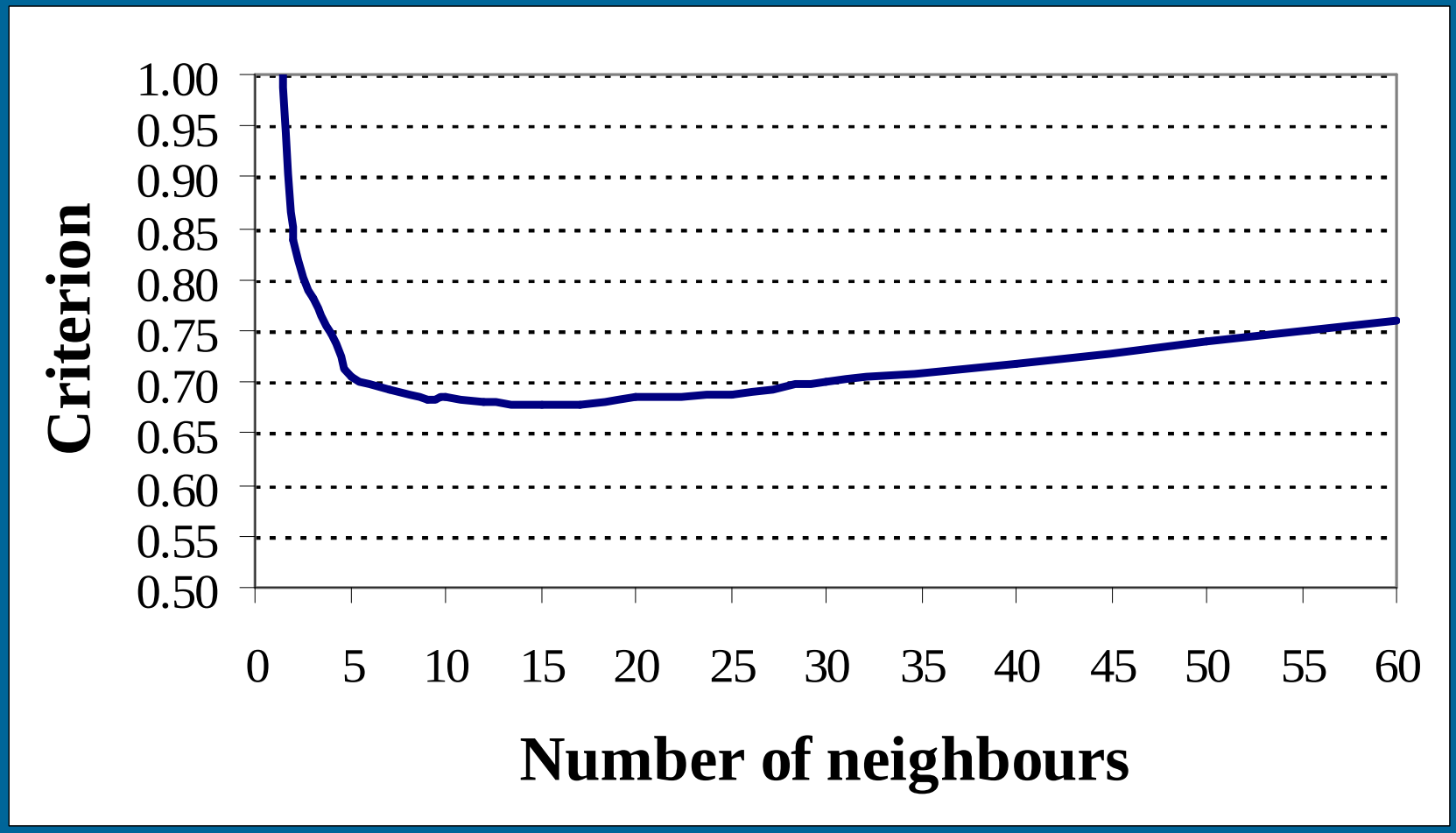
- Mean gross weekly pay
- % of vehicles that are 3 years old or less
- % of dependent children in one adult households
- % of people in good health
- % of households owned outright or owned with a mortgage

How to create the neighbours 2

- **Calculating the appropriate number of statistical neighbours**
  - Ø Base calculation on model assigning equal weight to each variable
- **Assigning weights**
  - Ø Choose weights to optimise criterion
  - Ø Compare final model to existing models

How to create the neighbours 2

How many neighbours?



How to create the neighbours 2

Calculate best set of weights.

Starting with equal weights model

1. Calculate criterion for current model
2. Randomly generate new set of weights
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Model Outcomes

How does this model compare with other models?

Statistical neighbour model	Value of criterion
Final Model	0.63
Equal Weights Model	0.68
Ofsted's Statistical Neighbours	0.72
Institute of Public Finance comparator councils (CSCI)	0.71
Comparison to national means	1.00
Families of LAs (forced reciprocity)	0.71

Individual Model Outcomes

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Outcome (Data used in analysis)	***New model***	***Ofsted***	***CSCI***	***IDACI***
Infant mortality rate	0.74	0.87	0.87	0.90
U18 Conception rate	0.39	0.50	0.56	0.54
% achieving L4 in KS2 Maths	0.46	0.57	0.60	0.73
% achieving 5 A*-C	0.56	0.57	0.66	0.69
Absence rate at primary school	0.40	0.53	0.42	0.45
Fixed exclusions	0.85	1.00	0.98	1.06

Differences to previous models

How does this model compare with OFSTED's previous model?

Number of similar neighbours	Number of LAs with this number in common in each model
0	1
1	3
2	9
3	28
4	31
5	34
6	29
7	10
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Reciprocity

How often does a LA's neighbour have that LA as a neighbour themselves?

Number of reciprocal neighbours	Number of LAs with this number of reciprocal neighbours
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Neighbour Outcomes

Demonstrated that model works well for following outcomes:

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Neighbour Outcomes

- % of 14 year olds achieving level 5 or above in key stage 3 English, Maths & Science

- % of 16 year olds achieving the equivalent of 5 A*-Cs at GCSE

- % of pupils who had one or more episodes of fixed period exclusion from school

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Reasonable to assume model is appropriate for:

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Take care with:

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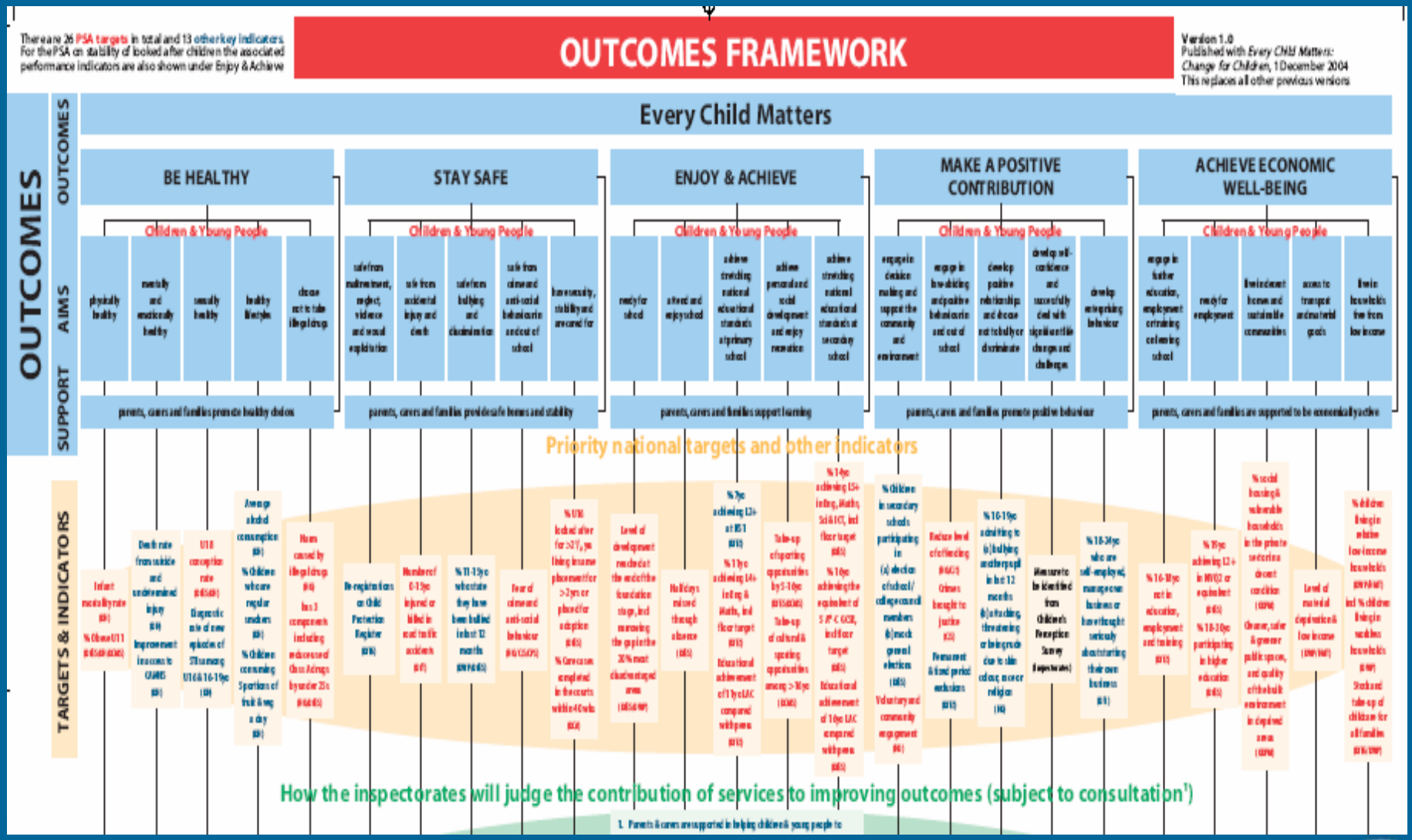

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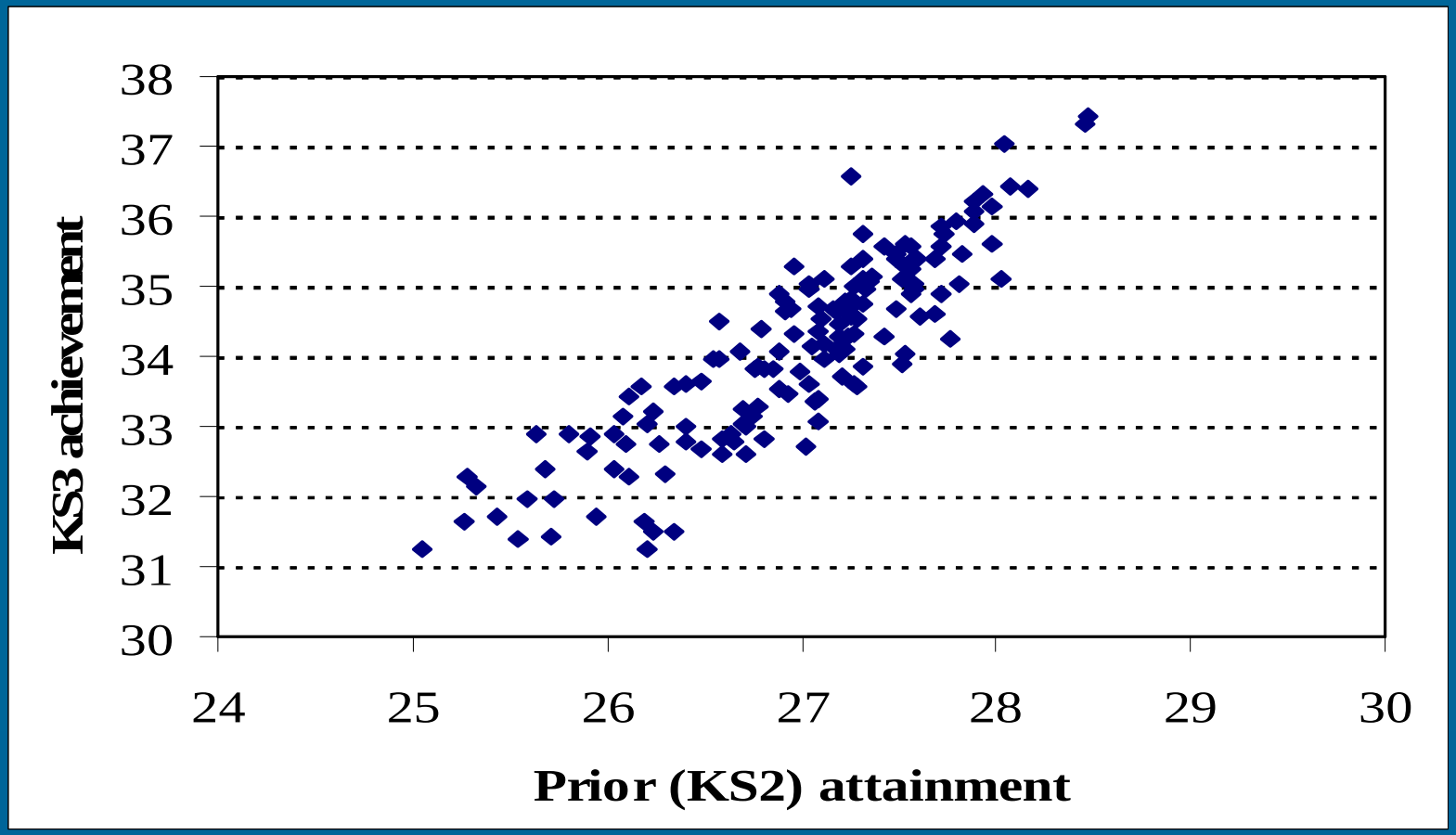

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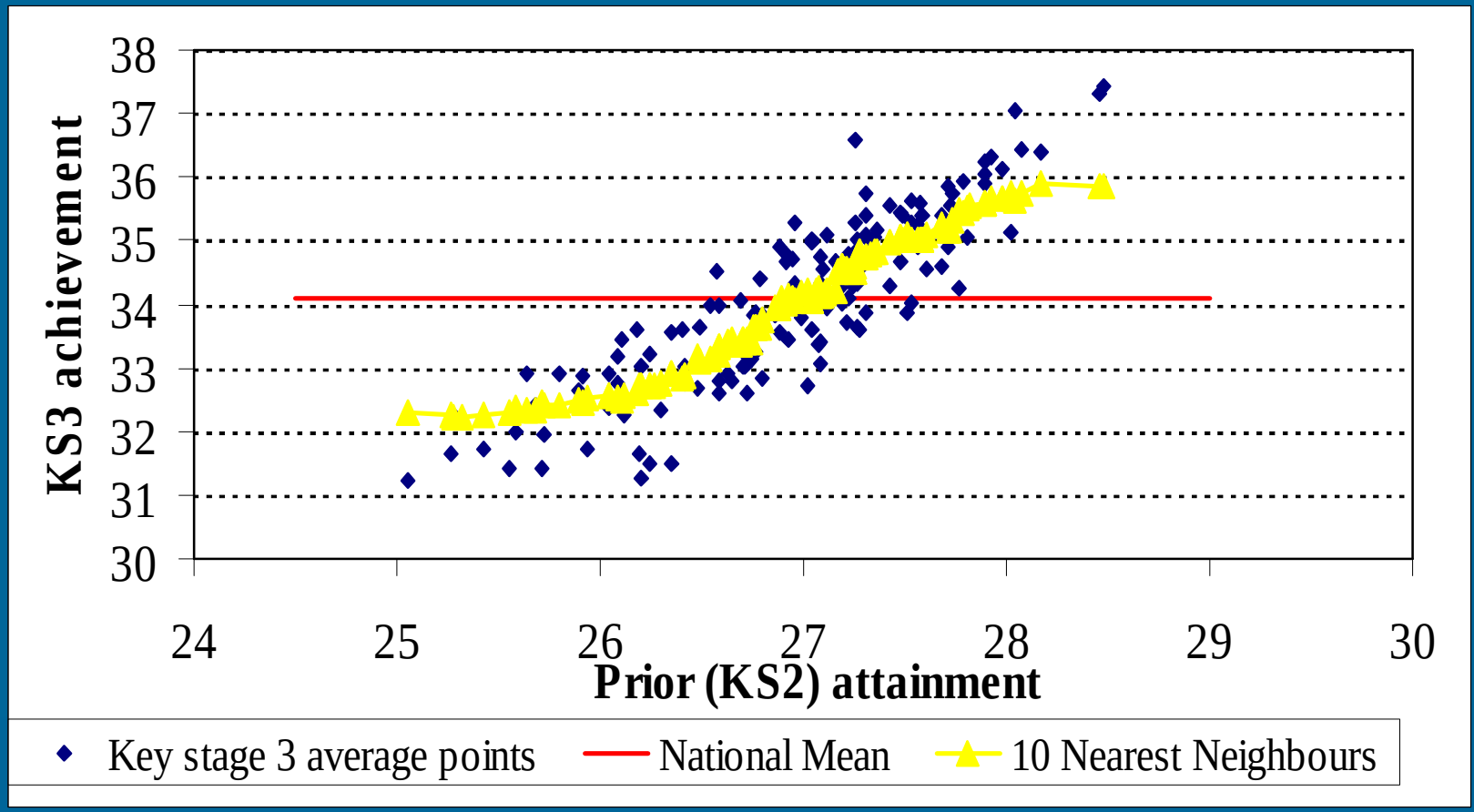

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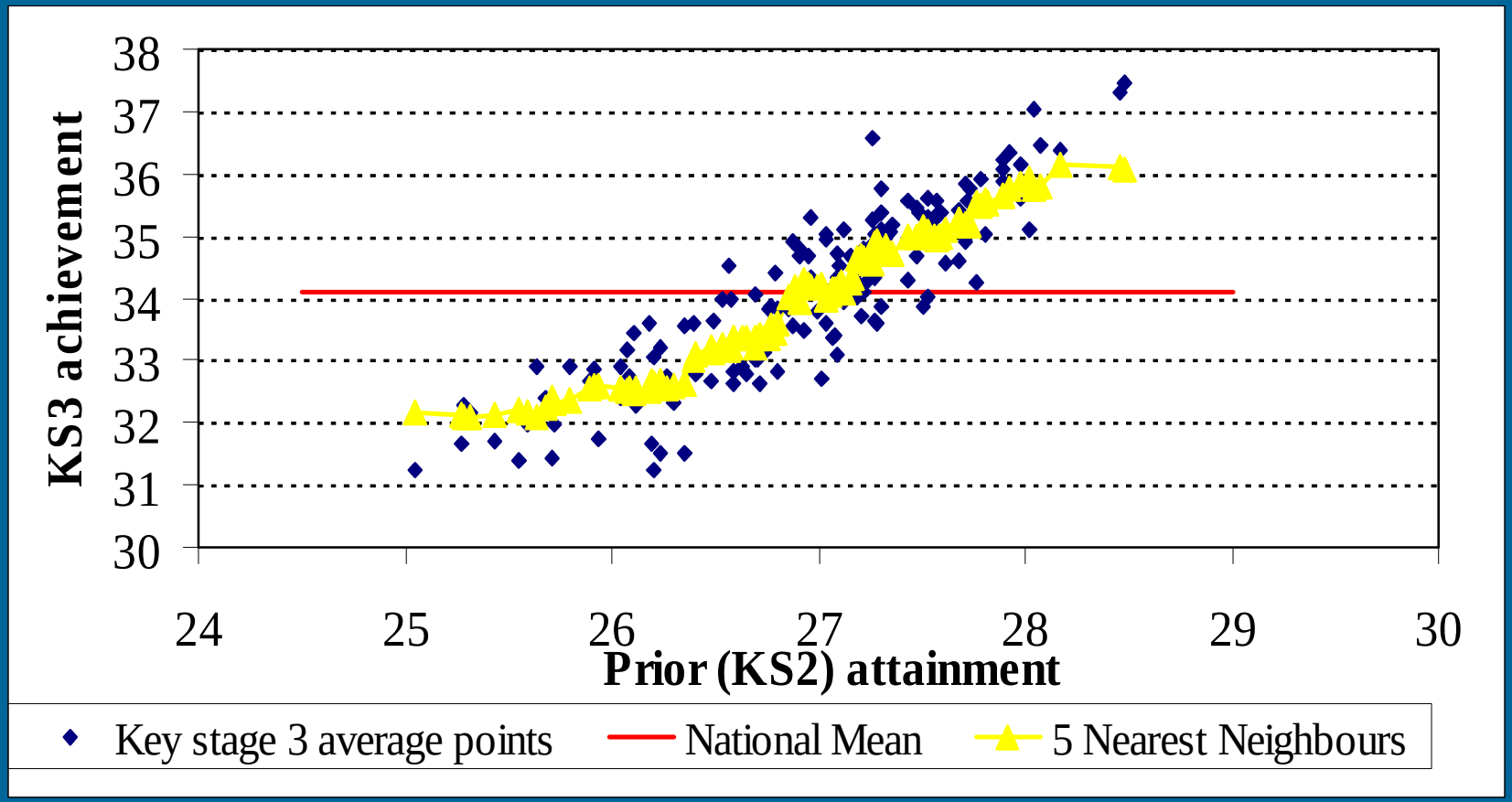

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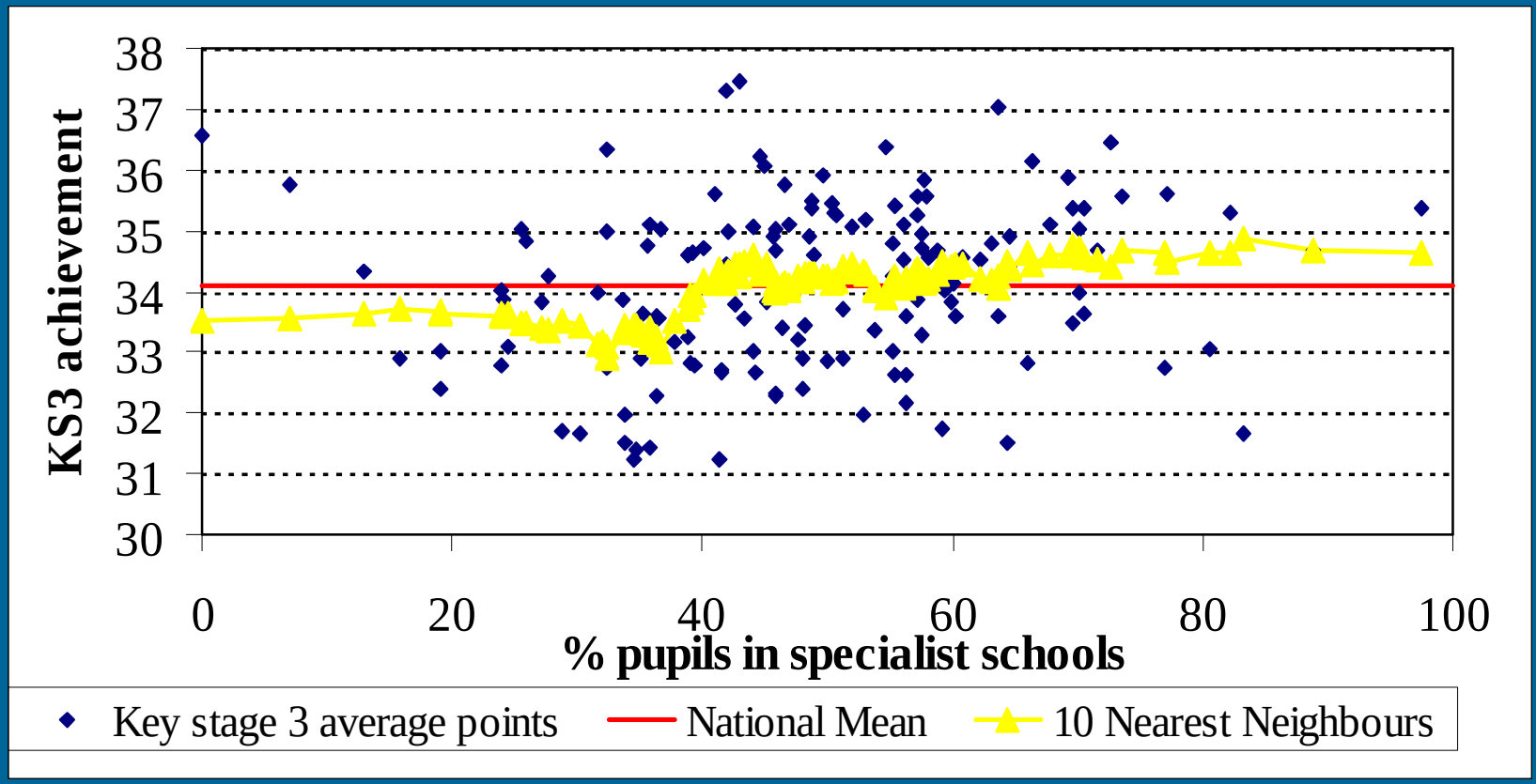

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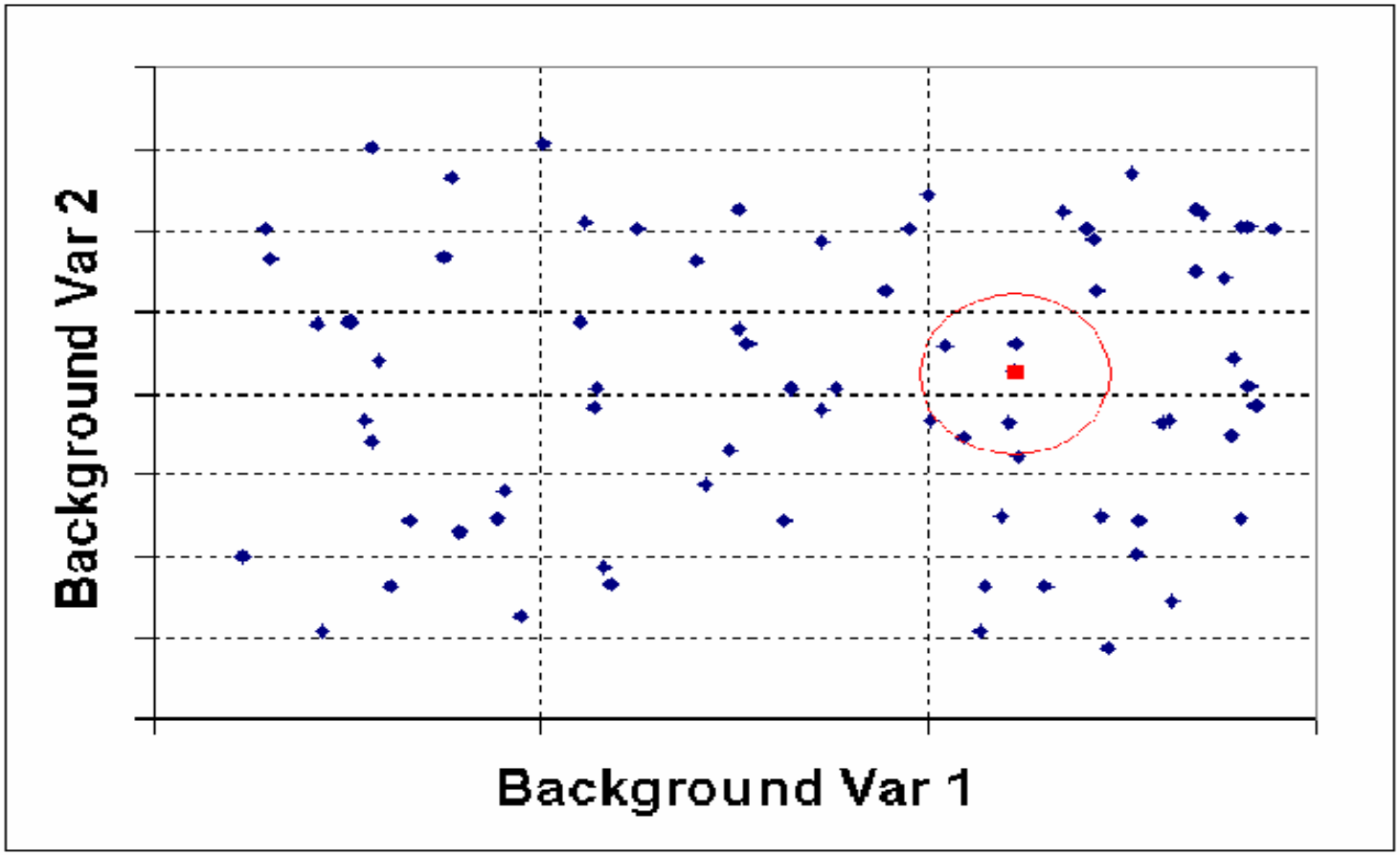

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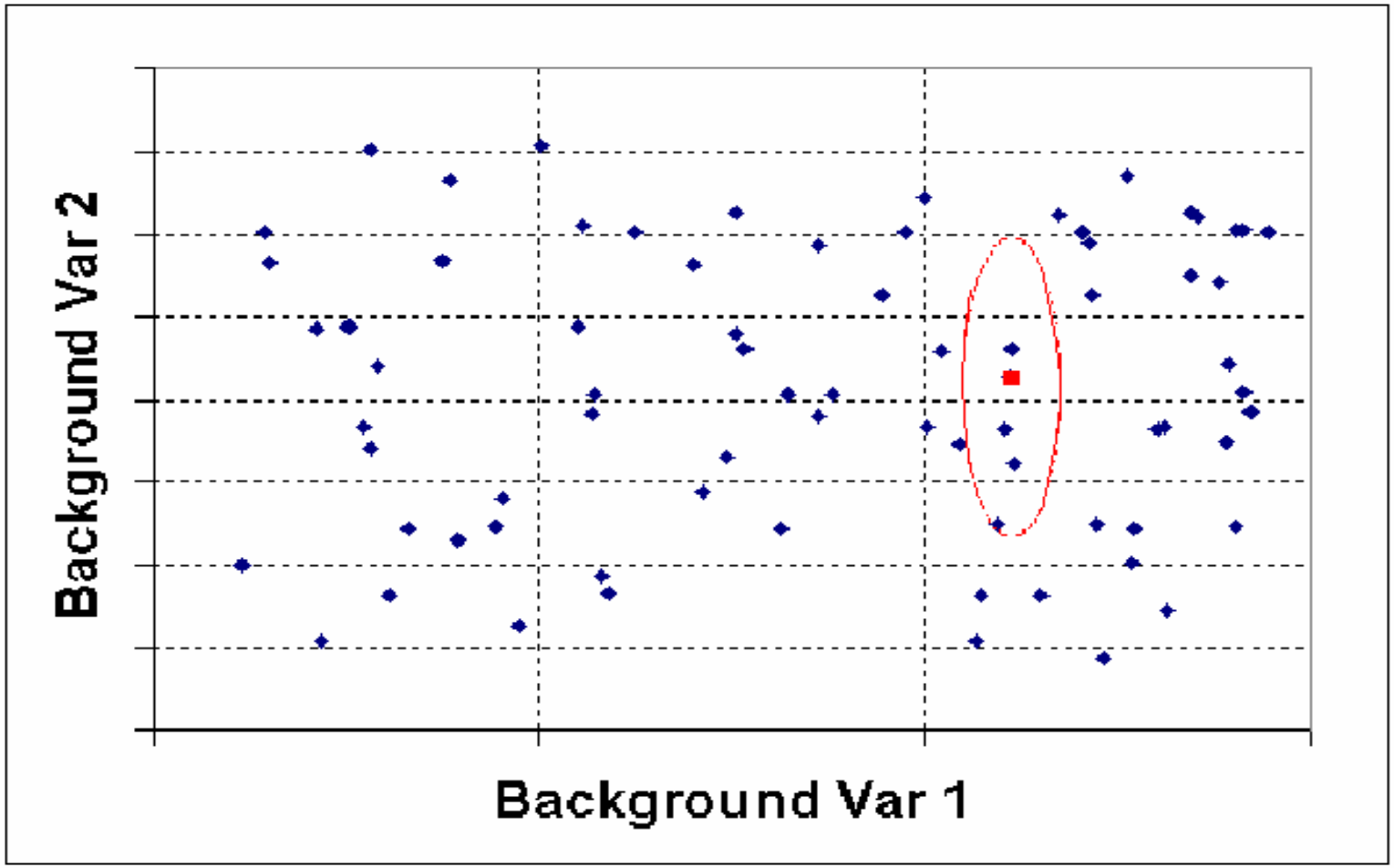

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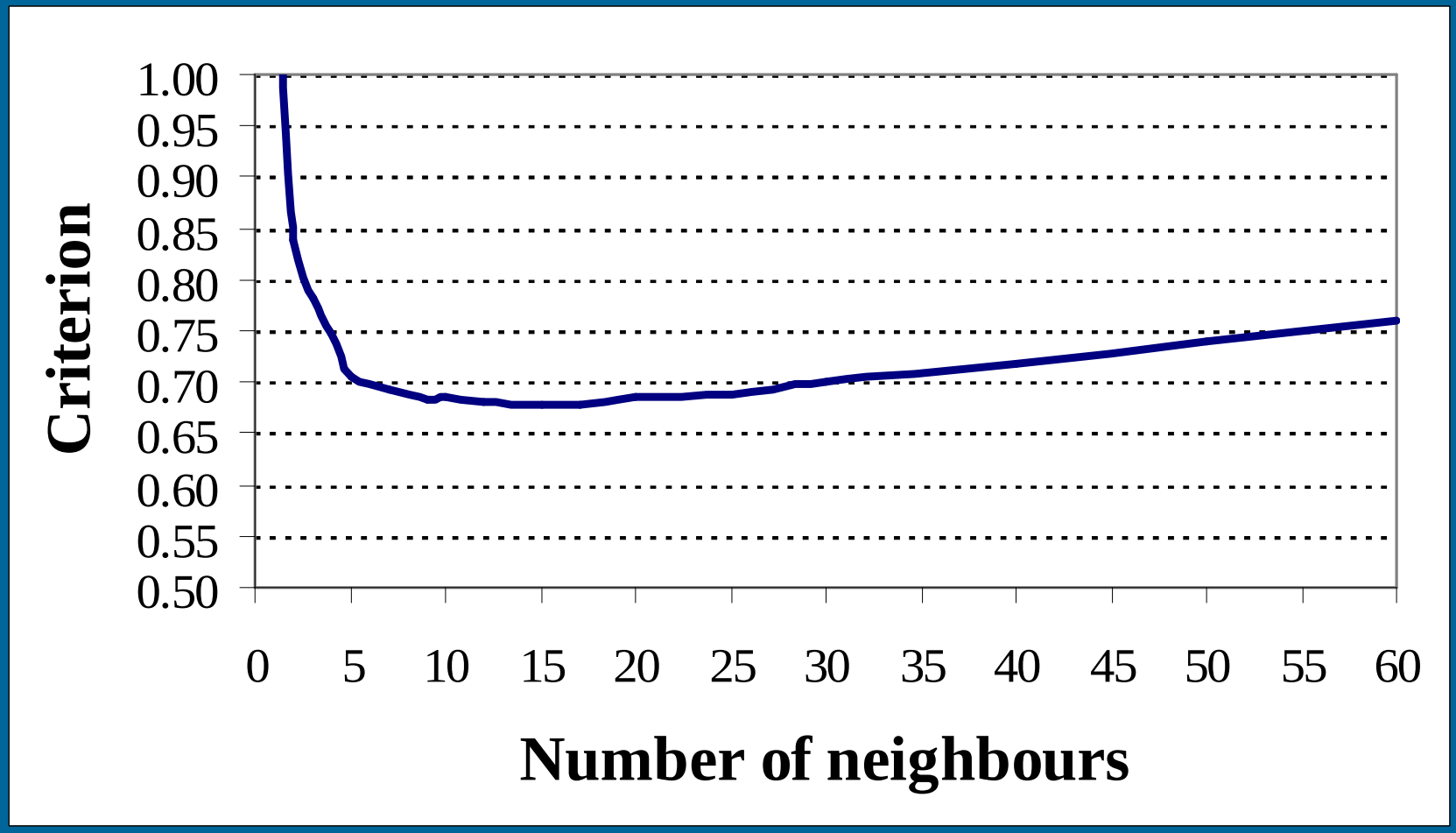

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