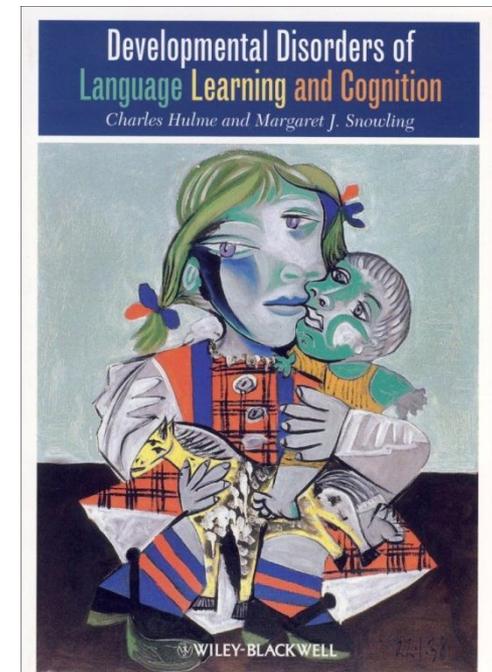


Evidence-based interventions for children's language and reading difficulties

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The Take Home Messages!

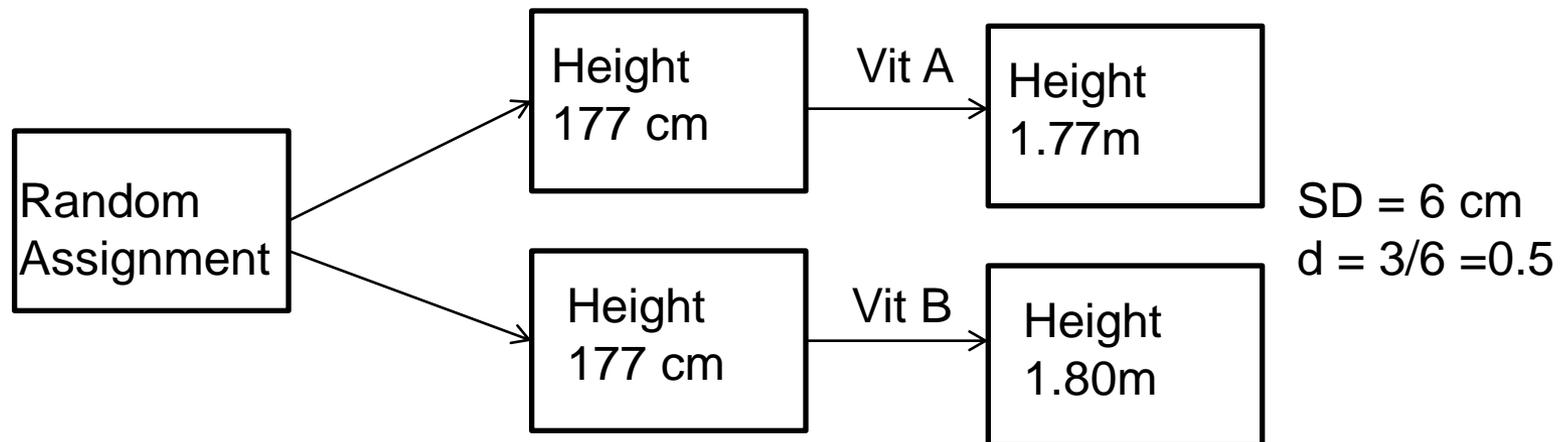
- Children's oral language skills can be effectively improved by structured teaching programmes delivered to individuals and small groups by specially trained Teaching Assistants working in schools
- Interventions that promote Letter Knowledge and Phonemic skills (in the context of reading instruction) are highly effective in developing decoding skills
- Interventions including vocabulary teaching and narrative work can be effective in boosting Oral Language skills
- I will pay particular attention to the forms of evidence needed to draw firm conclusions about which forms of intervention are effective

Some methodology

- Studies of intervention can be thought of as involving at least three inter-related steps
 1. Establish that an intervention has a *causal effect* in improving the condition in question
 2. Estimate the *size* of the causal effect
 3. Explore the *moderators* and *mediators* of an effect
- Moderators – does the effect vary as a function of participants characteristics? For whom does the intervention work best?
- Mediators – what are the mechanisms underlying an effect? How does the intervention work?

Establishing Causal Effects

- The simplest method (with fewest assumptions) is to randomly assign participants to conditions (RCT)
- Random assignment controls for unknown differences between people that might produce differences in scores (counterfactual reasoning – what else can account for effects of vitamins on height?)



Calculating an effect size

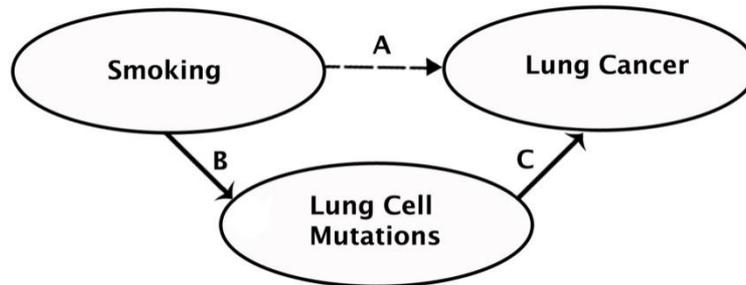
- An effect size expresses the “strength” of an intervention effect in units that are comparable irrespective of the units of measurement used.
- For interventions the usual effect size estimate used is Cohen’s d
- Cohen’s d requires that we know the degree of variability in the measure (the standard deviation)
- If we measure the height of the two groups (Group A 177cm , (sd 6cm); Group B, 180cm (sd 6cm); d here is 0.5 ($180-177/6 = 3/6 = 0.5$).

Exploring Moderators of Effects

- We might be interested in variations in the effect of an intervention between children
- For example do girls benefit more than boys? Do children with more severe language problems benefit more (or less) than children with less severe language problems?
- These are examples of “moderators” measures that tell us about response to intervention
- Questions about moderators are often post-hoc and probably need to be examined with some caution; the statistical issues can get complicated

Direct versus mediated relationships

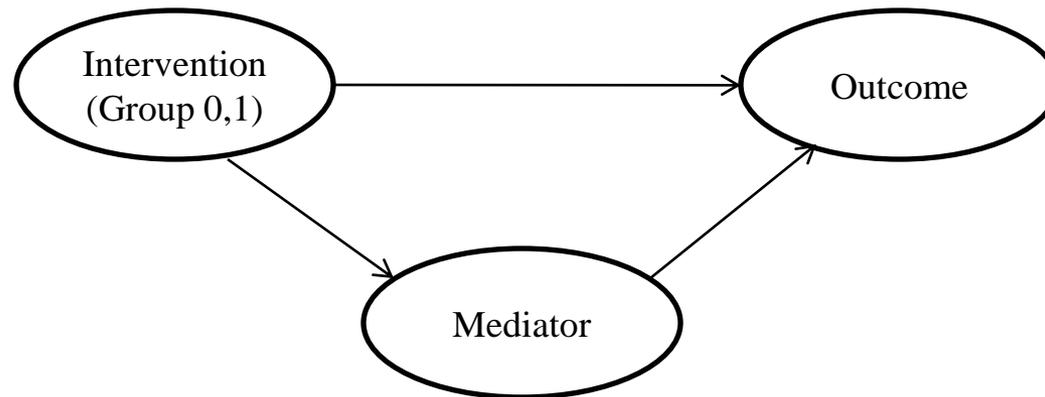
- Consider the example of Lung Cancer



- Baron & Kenny's (1986) steps to test mediation:
 - 1. Establish (A) - cause predicts outcome (sig univariate regression)
 - 2. Establish (B) - cause predicts mediator (sig univariate regression)
 - 3. Establish (C)-mediator predicts outcome (sig univariate regression)
 - 4. If 1, 2, and 3 are true: In a simultaneous regression predicting outcome from mediator and cause (paths A & C) path C should be significant and path A should be zero (complete mediation) or at least reduced in size (partial mediation)

Mediators in Intervention Studies

- Apply this idea to an intervention design



- Here group is coded as a dummy variable (Control vs. Intervention 0,1; Therefore Beta for Dummy by itself gives Mean Difference in Outcome between groups)
- We can assess whether the effects of the intervention on outcome are mediated or direct
- Note: given random assignment – Group is a causal effect

Contrasting Interventions for Reading and Oral Language Skills: The Nuffield Language for Reading Project



Developing Language and Literacy

Julia M. Carroll, Claudine Bowyer-Crane, Fiona J. Duff,
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 WILEY-BLACKWELL

 Nuffield
Foundation

Nuffield Language *for* Reading Project: Aims

- To develop two theoretically motivated programmes of intervention for children who enter school with poor speech and language development
 - To be delivered by trained teaching assistants (TAs) in mainstream schools
- To compare the relative effects of a programme to promote phonological skills (P+R) with one to promote oral language (OL)

Design

- Evaluation of two 20-week programmes (P+R or OL)
- Randomised Controlled Trial (following the CONSORT guidelines)
- Investigators blind to group membership
- 4 test phases: pre-test, mid-test, post-test, maintenance test
- Longer-term follow-up after one year

Programme Content

- **Oral Language**
 - Vocabulary development
 - Listening Comprehension
 - Expressive language (grammar and narrative production)
 - Inferencing
 - Question generation
- **Reading with Phonology**
 - Training in letter sound knowledge (Jolly Phonics)
 - Oral phonological awareness
 - Reading books at instructional levels
 - Sight word vocabulary development
 - Letter formation

Delivery of Programmes

- Teaching assistants selected by schools
 - Attended 5 day intensive training programme (2 + 2 + 1) and refresher day mid-way (1)
- Implemented 20-week programme
- Alternating group and individual sessions

Treatment Fidelity

- Fortnightly tutorials
- On-site tutorials
- Lesson records

Measures

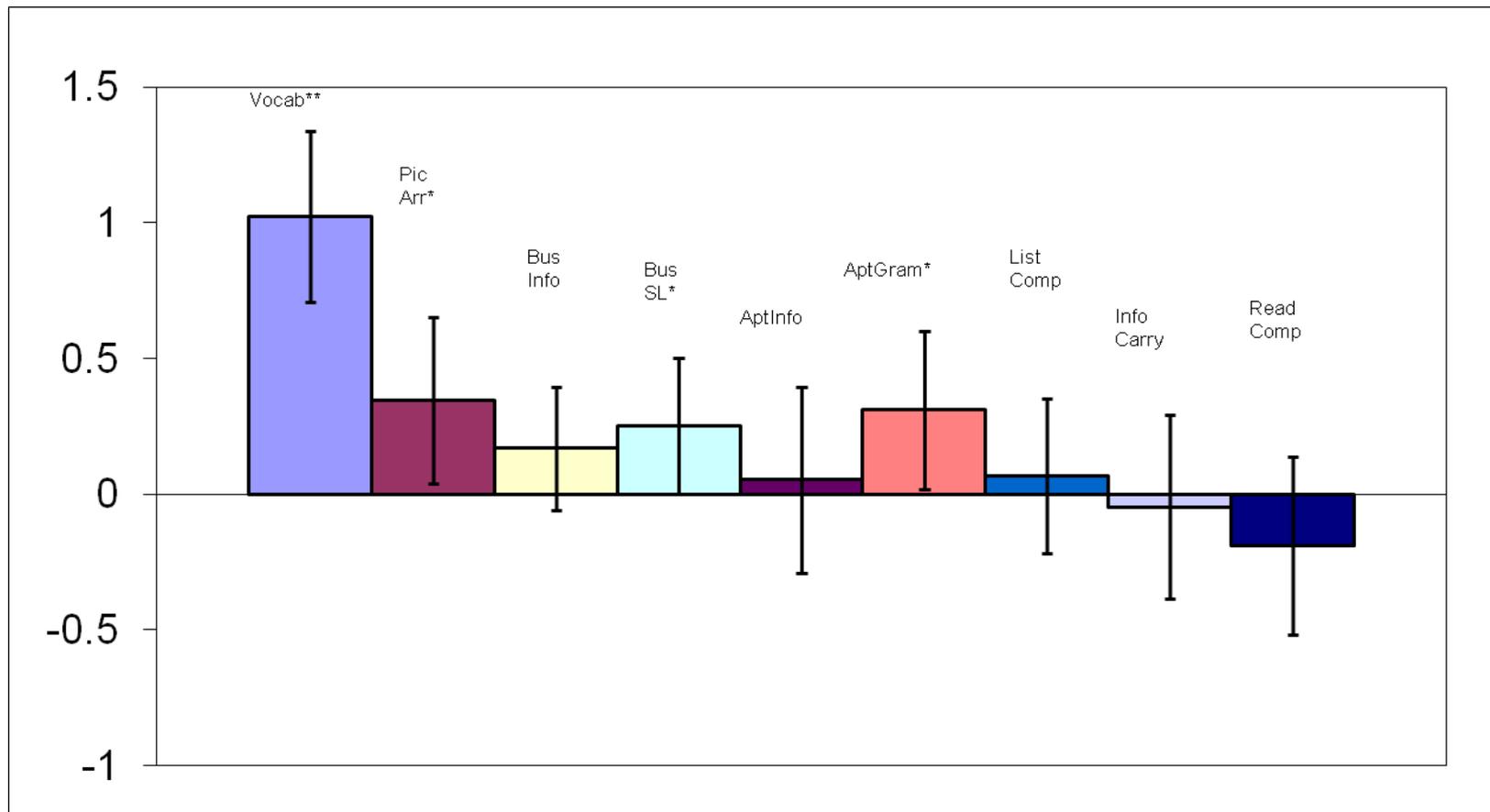
Language Skills

- Specific Vocabulary
- Action Picture Test
- Bus Story
- Listening Comprehension

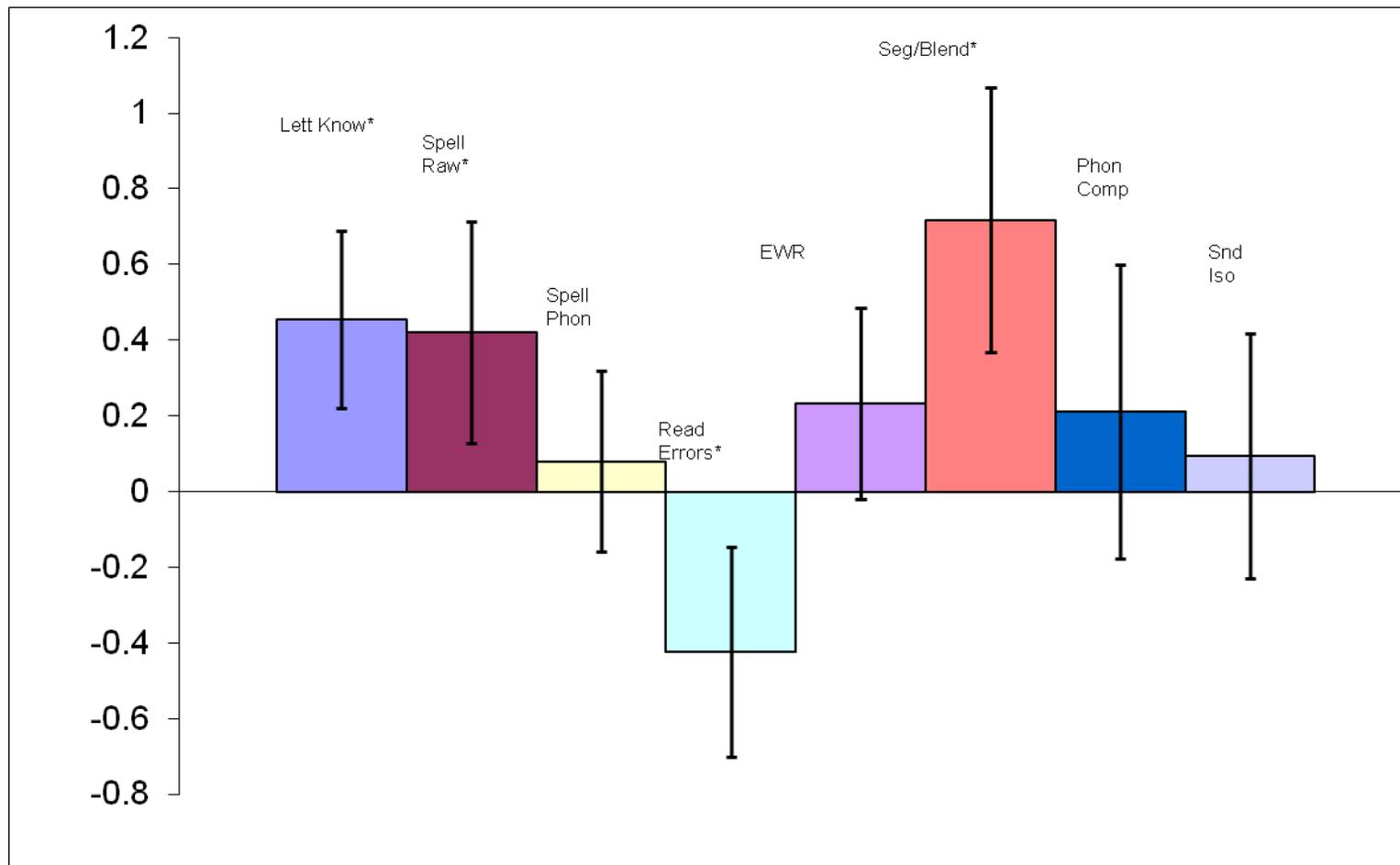
Reading and Phonological Skills

- Letter Knowledge
- Early Word Reading
- Spelling
- Nonword Reading
- Reading Accuracy
- Phoneme awareness
- Reading Comprehension

Relative Advantage of Language Group at T3 in z-score units (95% CIs)



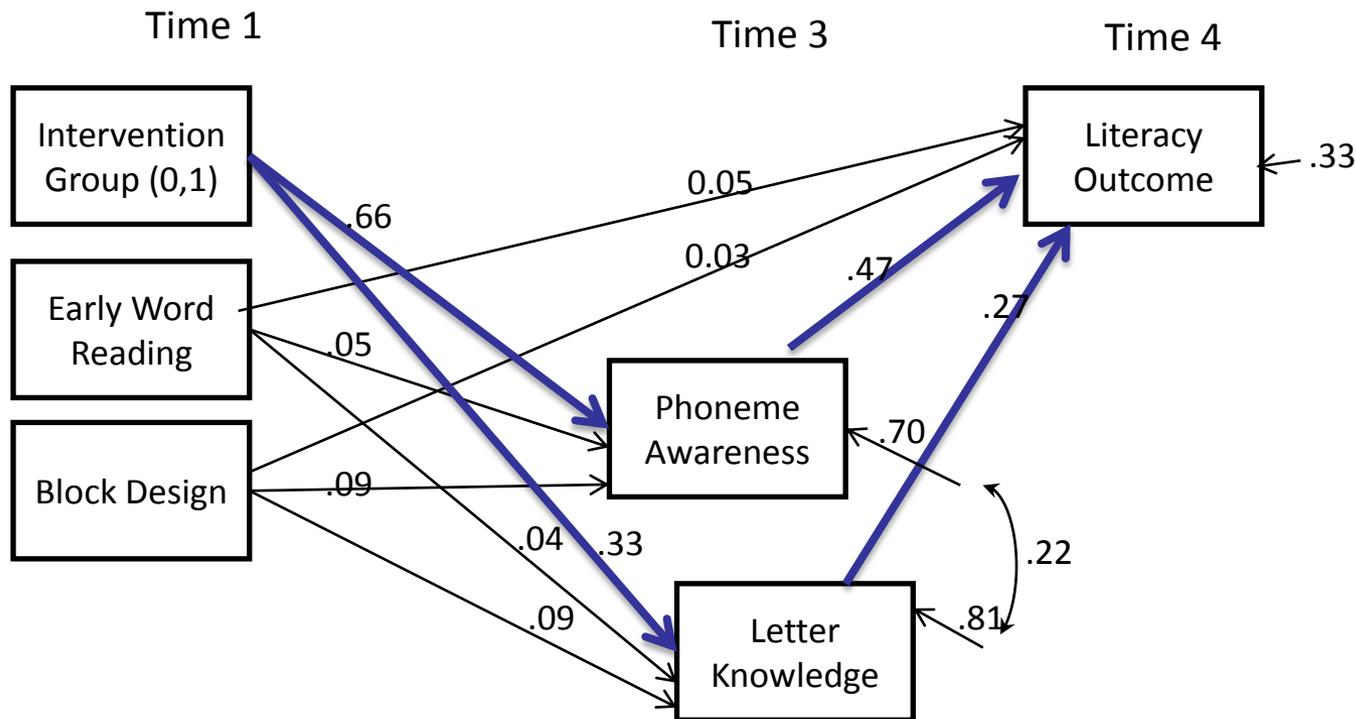
Relative Advantage of Reading with Phonology Group at T3 in z-score units (95% CIs)



What accounts for the improvements in Literacy skills seen in the R+P programme?

- One way of answering this question is mediation analysis
- Theoretically, we believed that Letter Sound Knowledge and Phoneme Manipulation (Segmentation and Blending) should be critical determinants of how well children will learn to decode and spell
- We can therefore conduct analyses to see to what extent improvements in a composite Literacy outcome are accounted for by improvements in Letter-sound knowledge and Phoneme Manipulation

The Mediators of Improvement in Literacy



Chi sq = .86 df. 1 NS; CFI 1.0; RMSEA 0.00 (0-.19). Parameter estimates for model standardized on outcome variable . Literacy outcome is entirely mediated by these two variables . Dropping direct effect of group has no effect on fit indices of model

Total Indirect Effects 0.4 SD units (.31 via Phoneme Awareness; .09 via Letter Knowledge)

Summary: Nuffield Language for Reading Project

- This is an RCT that contrasts two related but distinct interventions: Reading+Phon vs. Oral Language
- Given the design (an RCT with an active comparison group) we have excellent evidence for causal effects
- Arguably effect sizes here are conservative (both groups are treated)
- Effect sizes are generally moderate in size
- Mediators of the effect of reading intervention programme appear to be phoneme awareness and letter-sound knowledge

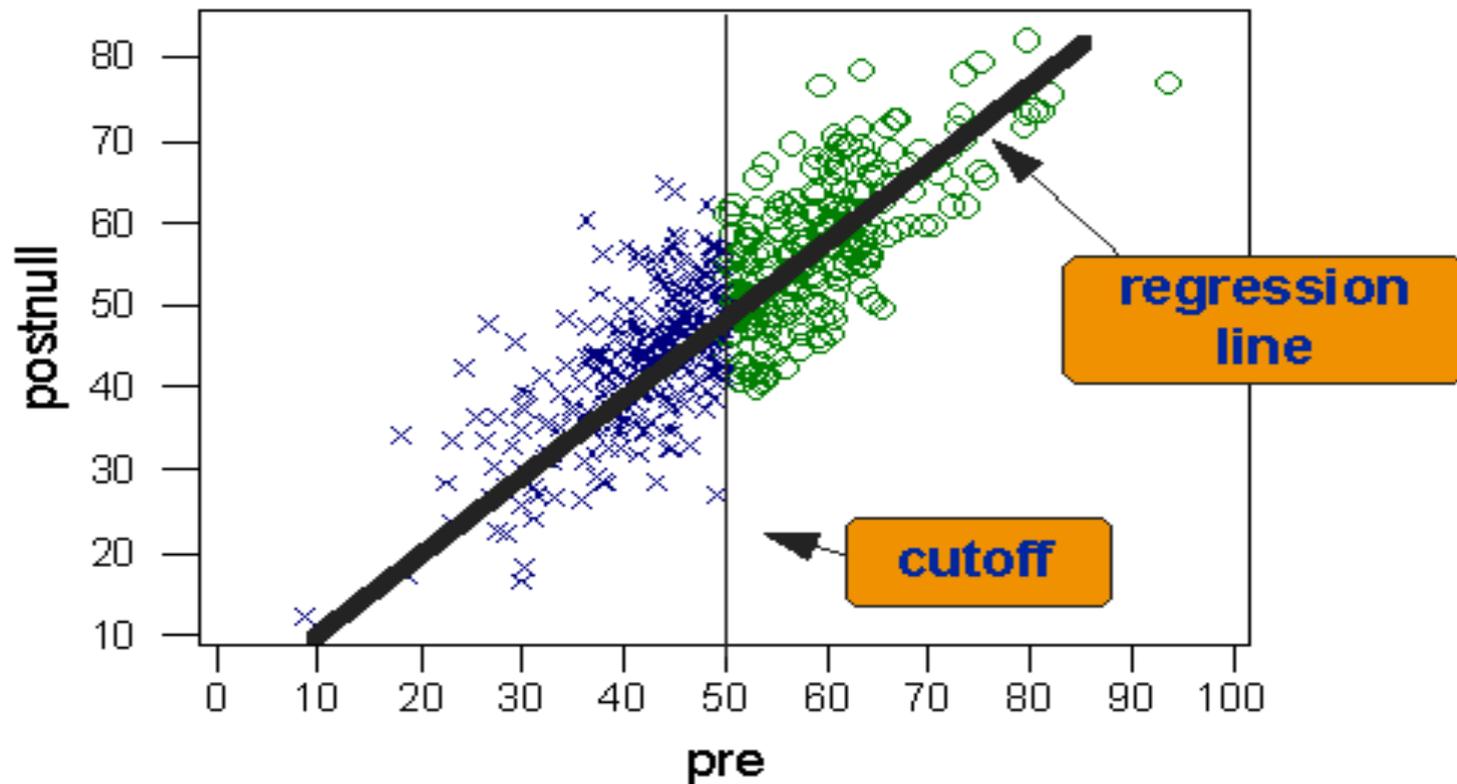
Alternatives to RCTs as a way of showing causal effects

- It is generally accepted that RCTs are the most direct way of demonstrating causal effects in intervention studies.
- Analyses are simple, and few assumptions are needed to support causal interpretations
- Two alternatives of particular relevance:
 - Regression Discontinuity Design
 - Multiple baseline designs

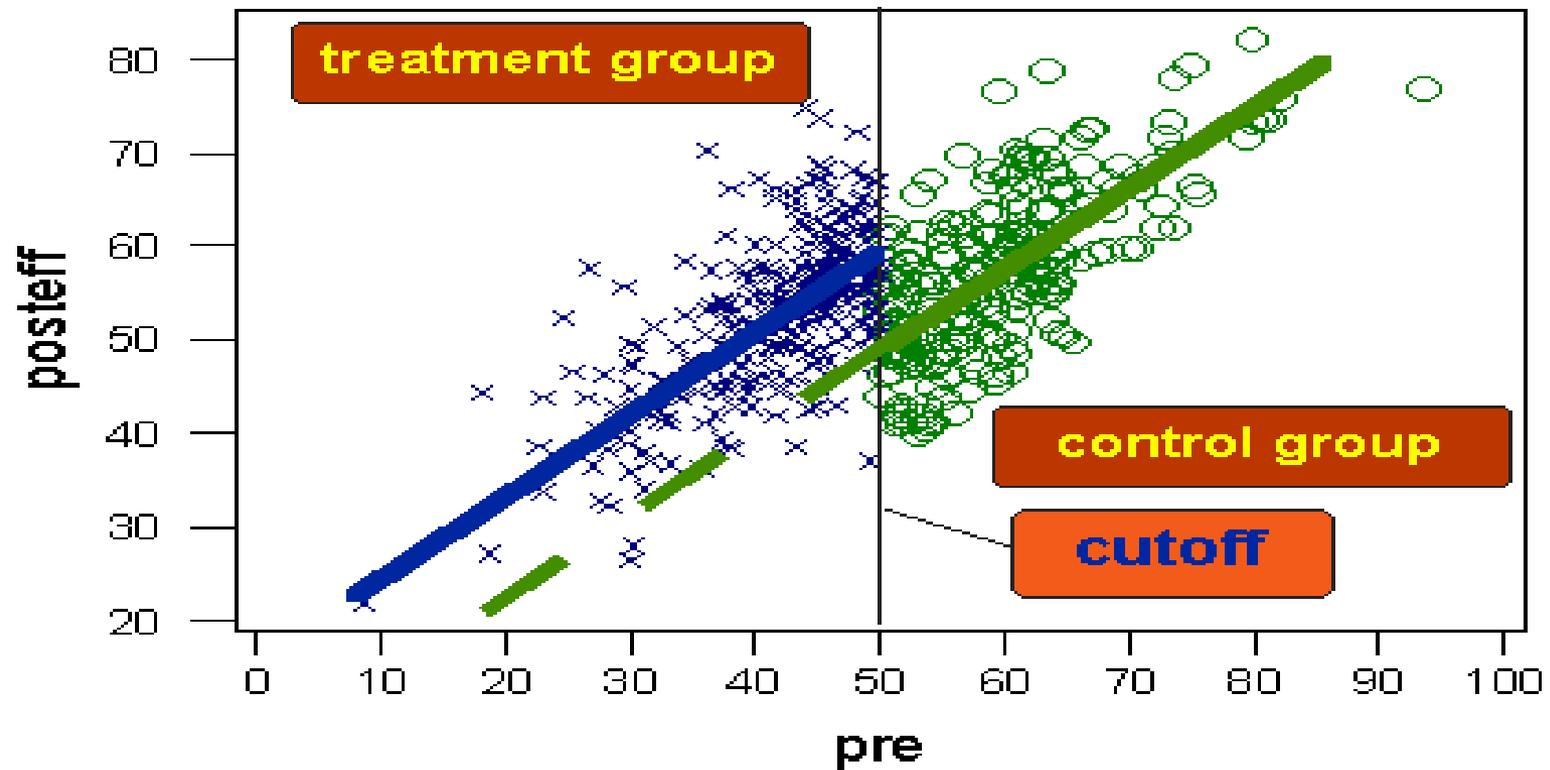
The Regression Discontinuity Design

- A design that allows for all individuals identified as needing treatment to receive it
- Basic design involves setting a cut-off score on a baseline measure below (or above) which all children receive treatment
- Baseline measure must be highly correlated with outcome measure (could be outcome measure itself)
- Measure the outcome after treatment

Regression Discontinuity Design – assumption given no treatment



Regression Discontinuity Design – model for where treatment is effective



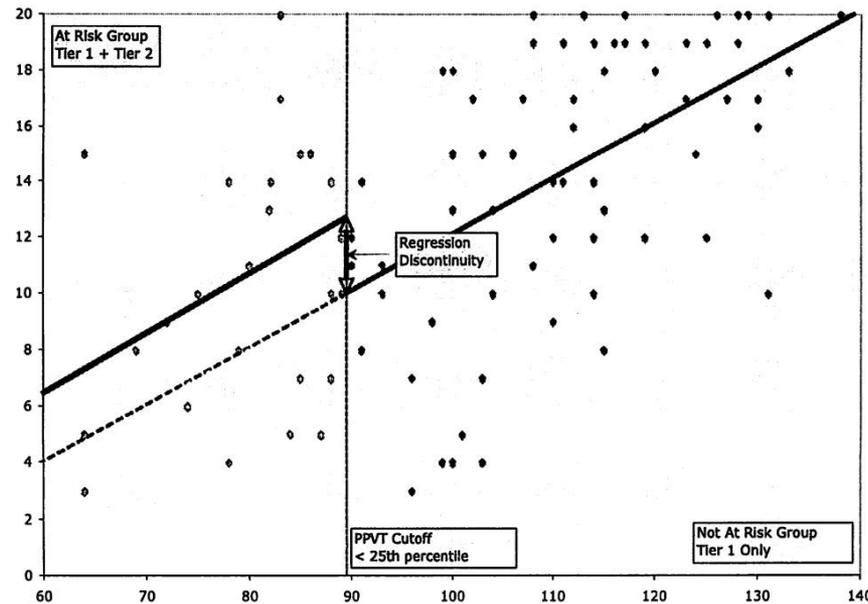
Tuckwiller et al. 2010 - RDD to assess vocabulary instruction in kindergarten

- 92 Children in kindergarten classes
- Assess receptive vocabulary in all children (PPVT)
- Cut-off – all children below 25 centile on PPVT receive additional vocabulary instruction
- Children taught just 4 “tier 2 words” from a book
- Teaching done in 2 small group sessions with groups of 4 children on 2 different days
- A very small-scale intervention
- Outcome – composite of expressive and receptive knowledge of the 4 taught words

Tuckwiler et al – Results

Moderate effect size ($d=.33$) not significant

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The Regression Discontinuity Design: Advantages and Disadvantages

- Design has been little used to date but is likely to become more popular
- Major Advantage – does not require any individual to be denied treatment
- Generally argued that this design provides relatively good evidence for causal effects when assumptions are met (but the assumptions are non-trivial so evidence here is inherently weaker than in a randomized design)

The Regression Discontinuity Design: Advantages and Disadvantages

- Analyses relatively complicated (depend critically on data being fit by a polynomial function – i.e. linear, plus quadratic and cubic effects)
- Inferences from data modelling depend critically on the assumption that relationship relating baseline to outcome is the same in treatment and comparison groups – this may often be reasonable, but is difficult to test

The Multiple Baseline Design

- Sometimes used in single case studies or small group studies
- Does not require any individual to be denied treatment
- But evidence of causal effects here is at best weak – it is always difficult to rule out other possible influences that may have led to improvements

An example of a multiple baseline design

- Hatcher et al. (2006): reported an RCT implementing a version of Reading Intervention (phonological awareness training coupled with reading instruction) with 74 children in North Yorks schools
- 27% of children no progress in reading standard scores between pre-test and the end of the intervention
- Duff et al. (2008) selected 12 children who were poor responders to receive a further intervention combining work on Reading Intervention and Vocabulary Instruction (REVI)

Reading with Vocabulary Intervention (REVI)

- Follow up of poor responders to Reading Intervention
 - 12 children; mean age 7 years, 3 months
 - Characterised by
 - Poor reading
 - Poor spelling
 - Poor phonological awareness
 - Poor oral language skills (vocabulary and grammar)
- Devised Reading with Vocabulary Intervention (REVI)
 - 9 weeks, daily individual intervention delivered by TAs
 - 2 15-minute sessions a day

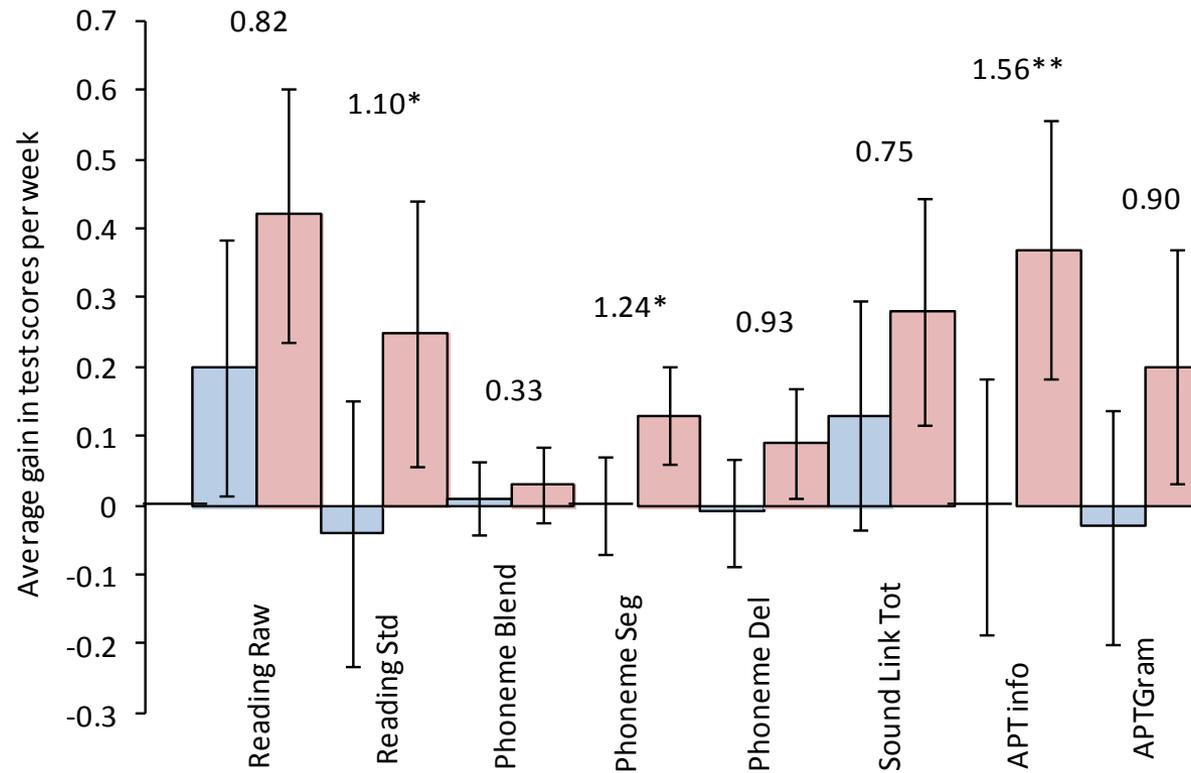
Reading with Vocabulary Intervention - Content

Session A	Session B
<p>Book reading (5 mins) Child reads an easy level book (>94% accuracy); child is assessed while reading an instructional level book (90-94% accuracy)</p>	<p>Vocabulary revision (3 mins) Child recaps target vocabulary word</p>
<p>Vocabulary instruction (5 mins) Multi-contextual learning of a “sophisticated” word linked to book</p>	<p>Phonological awareness (5 mins) Blending, segmenting and deleting phonemes</p>
<p>Narrative writing activity (5 mins) Child tells a short story then writes a small part of it down</p>	<p>Sight word learning (3 mins) Multi-sensory learning of inconsistent/high frequency words</p>
	<p>Introduce new book (3 mins) Child and TA read new instructional book</p>
	<p>Revision (1 min) Recap of sight and vocabulary words</p>

Duff et al. Design

- The children were assessed on the same measures at 4 time points (t1, t2, t3, t4)
- t1 and t2 were separated by approximately 6 months and occurred before the intervention occurred
- t2 was immediately before the intervention
- t3 was immediately after the intervention
- There was little progress on key measures between t1-t2 (relatively stable baseline) but more rapid progress between t2 and t3
- Express gains in progress per week in these two periods

Reading with Vocabulary Intervention



Conclusions: Duff et al.

- It appears that an intensive reading and vocabulary intervention improved the reading, phonological awareness and oral language skills (APT information score)
- However, evidence for causal effects here is necessarily weak. Such designs should only really be used as pilot studies or where resources are limited

The Take Home Messages!

- Children's oral language and reading skills can be effectively improved by structured teaching
- Interventions that promote Letter Knowledge and Phonemic skills (in the context of reading instruction) are highly effective in developing decoding skills
- Interventions including vocabulary teaching and narrative work can be effective in boosting Oral Language skills
- RCTs are very important for giving us solid evidence for causal effects of an intervention
- Regression Discontinuity Design is likely to become more popular in this field and can also provide relatively good evidence
- Multiple baseline designs viable for pilot studies, but evidence of causal effects is generally weak

