

# Child Care in Infancy and Cognitive Performance until Middle Childhood in the Millennium Cohort Study

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# Childcare & Cognition

- **High variability in the impact of childcare on children's later cognitive development**
  - **Positive effect** (NICHD & Duncan, 2003; Clarke-Stewart, 1991, 1994; NICHD 2002, 2007)
  - **Negative effect** (Brooks-Gunn et al, 2002; Belsky & Eggebeen 1991; Baydar & Brooks-Gunn 1991; Burchinal et al. 1995; NICHD 2000; Hickman 2006)
- **Results vary by:**
  - Timing of childcare
  - Type of childcare
  - Role of SES
  - Attrition
  - Social selection

# Issues in the Literature

## ■ Timing

- Positive effects for childcare initiated during toddlerhood (Loeb et al. 2007, NICHD, 2000a, 2002)
- Mixed results for childcare initiated during infancy (Positive –Andersson, 1989; Hansen & Hawkes, 2009; No effect -Jaffee et al 2011; Park & Honig, 1991 )
- Maternal employment literature – negative effect for employment initiated during infancy (Ruhm, 2004; Waldfogel et al. 2002; Brookes-Gunn et al, 2002)

## ■ Type

- Positive effect of formal childcare & negative effects of informal care (Gregg et al. 2006; Sylva et al. 2011)

# Issues in the Literature

## ■ SES Moderation

- **Compensatory hypothesis:** childcare benefits low SES children by providing stimulation & enriched environment (Geoffroy et al. 2010; Caughy et al. 1994)
- **Loss of resource hypothesis:** childcare negatively effects middle-high SES children by depriving children of maternal stimulation & high quality home environment (Caughy et al. 1994; Brookes-Gunn et al. 2002)

## ■ Attrition

- Longitudinal analyses are subject to attrition which may bias results if non-random
  - Yet few childcare studies account for attrition
  - Hill et al. 2005: Multiple imputation reduced negative effect of employment on child development

# Issues in the Literature

## ■ Social Selection

- Types of families who use childcare may differ from those that do not
  - bias results if non-random selection into childcare
- Relatively few studies control for selection into childcare
- **Propensity score matching:** match individuals who were treated to individuals who were not, but have a similar probability of being treated based on observable characteristics
  - Hill et al. 2005; Berger et al. 2008; Schneider et al. 2007; Zhai et al. 2011
  - Find minimal differences between OLS and PSM approaches

# This Study

- Examines association between childcare use during infancy & cognitive development at ages 3, 5 & 7 using UK data

Specifically:

1. **Type of childcare** (parental vs. any childcare; informal care vs. centre-based care)
2. **Differential effect by SES** (maternal education & family income)
3. **Multiple imputation** (missing data)
4. **Propensity Score Matching** (selection bias)

# Data – UK Millennium Cohort Study

- Longitudinal study of **18,819** children born in UK between 2000-2002
- 4 waves to date: 9 months, 3, 5 and 7 yrs old
- Over-represented areas of high child poverty, high concentration of ethnic minorities & smaller UK countries
- Wealth of info on child development, childcare type and timing, parental resources and home environment

# Primary Measures

## Childcare by 9 months

- 34% in any form of childcare & 66% in parental care
- 80% in informal care (61% grandparents, 21% nanny, 18% other)
- 20% in centre-based care

## Cognitive development

- Bracken School Readiness Assessment (Bracken, 1984) Age 3
- British Ability Scales (Elliot et al. 1996) Age 3, 5, 7
- Foundation Stage Profiles Age 5
- Standardised each instrument using mean scores across all sub-domains



# Control variables

- **Variables used in Matching**

- **Child Characteristics**

- Age, ethnicity, birth weight, gestation, birth by c-section, birth order

- **Maternal Characteristics**

- Education, literacy difficulties, high social class, age at child's birth, marital status at birth, planned pregnancy, smoked when pregnant, antenatal classes, ever breastfed, long term chronic illness, living in social housing

- **Variables included in OLS & PSM models of cognition**

- All variables listed above plus...

- **Maternal Characteristics**

- Employment (9 months, 3, 5, 7 years), attachment score (9 months), self-esteem (9 months)

- **Family Characteristics**

- Annual household income (9 months, 3, 5, 7 years), HOME score (3 years), parental investment in reading & teaching (3 years)

- **Subsequent childcare experiences**

- Any/Centre Childcare up to age 3 & age 5

# Analytic Strategy: 5 steps

1. Conducted **multiple imputation** using chained equations
  - Imputed missing values using 70+ individual items
  - Resulted in 50 'completed' datasets & pooled using Rubin's combination rules (n~14,000)
2. Estimated **OLS *main effect*** models of childcare on cognitive development at 3, 5 & 7 (parental vs. any; informal vs. centre)
3. Estimated **OLS *interaction*** models including interaction b/w childcare and low maternal education & interaction b/w childcare and low family income
4. Estimated propensity score matching (**PSM**) models
5. Re-estimated **OLS** models & applied **propensity score weights** (main effects & interaction models)

# PSM: Probability of being treated given observed variables

1. Estimated probit models with childcare status as outcome variable and controls which preceded the childcare experience
2. Generated a propensity score for each child indicating the probability that the child would be treated
3. Use matching procedure (calliper & radius matching) to match untreated children with treated children with similar propensity scores
4. Tested quality of matching by comparing the 2 groups to ensure they are balanced i.e. no statistical differences on any observed characteristics
5. The mean difference in cognitive scores between the 2 groups represented the impact of childcare on ability
6. To further reduce any bias not controlled for, used OLS and apply propensity score as weights

# Results: Main Effect Models

- **OLS & PSM: Any Child Care v Parental Care**
  - Any type of childcare during infancy had *no effect* on any cognitive outcome at age 3, 5 or 7
- **OLS & PSM: Centre-based Care v Informal Care**
  - Centre-based care had *no effect* on BAS at age 5 or 7 or FSP at age 5
  - Centre-based care had *positive effect* on BSR at age 3 & BAS at age 5
- **Low Income Interaction Models**
  - *No significant interactions* between low income & childcare using OLS or PSM approaches

# Results: Education Interaction Models

## Any Childcare V No Childcare

	Age 3 years				Age 5 years				Age 7 years	
	Bracken School Readiness Scores (n = 13652)		British Ability Scale (BAS) (n = 14374)		British Ability Scale (BAS) (n = 14793)		Foundation Stage Profile (n = 11708)		British Ability Scale (BAS) (n = 13464)	
	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM
Low Maternal Education X Any Child Care	1.32* (0.62)	1.70** (0.64)	1.41* (0.61)	1.46* (0.63)	0.42 (0.65)	0.41 (0.70)	-0.53 (0.71)	-0.42 (0.80)	0.13 (0.69)	0.71 (0.76)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

### Findings

- Little differences between OLS & PSM
- Positive effects for children of low educated mothers at age 3

# Results: Education Interaction Models

## Centre-based v Informal Care

	Age 3 years				Age 5 years				Age 7 years	
	Bracken School Readiness Scores (n = 4260)		British Ability Scale (BAS) (n = 4456)		British Ability Scale (BAS) (n = 4634)		Foundation Stage Profile (n = 3641)		British Ability Scale (BAS) (n = 4304)	
	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM	OLS	PSM
Low Maternal Education X Centre-based Child Care	4.09 (2.14)	<b>3.94*</b> <b>(1.80)</b>	1.67 (2.02)	1.77 (1.67)	2.32 (2.26)	2.57 (2.37)	4.57 (2.55)	<b>4.50*</b> <b>(1.99)</b>	1.90 (2.40)	1.85 (2.71)

### Findings

- Some differences between OLS & PSM
- Positive effect for children of low educated mothers at 3 & 5
- Effect larger for children of low educated mothers

# Summary

## ■ Main effects

- Being in any form of childcare (v parental care) during infancy has no overall effect on cognitive development
- Being in centre-based care has a positive effect on some cognitive outcomes at 3 & 5 years

## ■ SES moderation

- Low education matters, low income does not
- For low SES children:
  - Any form of childcare had positive effect on early cognitive outcomes (3)
  - Centre-based care had a positive effect on early cognitive outcomes (3 & 5)
- For high SES children :
  - Any form of childcare has no effect on cognitive outcomes
  - Centre-based care has a positive effect on early cognitive outcomes (3 & 5), although effects smaller than low SES children

# Summary

## ■ Selection

- Strong selection effects in the use of childcare
  - Children exposed to higher levels of family and maternal risk more likely to receive parental care or informal child care
- Overall similar pattern of results with OLS & PSM
  - 2 exceptions: detected Education X Centre-care interactions using PSM but not OLS

## ■ Imputation

- Similar pattern of results with imputed and non-imputed datasets
  - Yet 3 exceptions: detected Education X Childcare interactions with MI but not with the listwise deletion approach
- Coefficients and the standard errors were larger in the listwise deletion results compared to the imputed results



# Conclusions

- Ongoing debate about use of childcare services in infancy
  - Found that early childcare did not carry risk, made no difference or contributed positively
- Centre-care particularly beneficial to children of low educated mothers
  - Support for compensatory hypothesis
- Important to control for selection into childcare (PSM) & missing data/attrition (MI)
- **Limitations:** do not control for childcare quality, selection on observables only, small sample size of interactions
- **Strengths:** non-US study, large sample, multiple measures of cognition at different time points, use of PSM & MI