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# Which Children Benefit From Non-Parental Care?*

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**Abstract**

Although randomized experiments have shown the positive impact of high-quality, early-intervention programs on disadvantaged children, there is little consensus on the effect of ordinary childcare. This study investigates the relationship between children's behavioural outcomes and their exposure to ordinary center-based care in Australia. In order to address possible endogeneity of the childcare choice, propensity score matching and instrumental variable methods are used. Results show that exposure to center-based care is associated with increased reactivity or tantrum. This association is largest among low socio-economic-status (SES) households. A possible explanation for these results is that low-SES parents use center-based care of low quality. We plan to extend this research by investigating whether this negative relationship is concentrated among children who use center-based care of low quality, using quality measures such as the proportion of qualified staff and the national accreditation system.

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## 1. Introduction

As maternal labor force participation increased, a growing number of small children are being looked after by adults who are not their own parents. With growing interest in early childhood education, many parents are also choosing center-based childcare arrangements such as daycare, rather than home-based arrangements such as babysitters and nannies. These trends have created a serious concern about how exposure to different kinds of childcare arrangements influences children's development.

In this paper, we analyse the relationship between child outcomes and the use of non-parental care, in particular center-based childcare. Our focus is on parent-reported measures of child behaviour, Short Temperament Scale for Children (STSC), when their children were aged 2-3. Since children have not entered the formal school system, the timing of measurement ensures that our estimates are not confounded by differences in kindergarten quality or attendance.

While the use of center-based care can be endogenous, we use several strategies to reduce the impact of bias on our results. First, we include a wide range of controls for observable characteristics, including socioeconomic background, parenting style, and lagged outcome measures. Second, we present specifications using matching estimators to ensure that the treatment and control groups are as similar as possible. Third, we use instrumental variables approaches to identify exogenous shocks in the supply and demand for centre-based care. In particular, we use as instrumental variables the number of center-based childcare places per 100 children and the size of birth cohort in each neighborhood. This is combined with the 2004 and 2006 Longitudinal Study of Australian Children (LSAC), which provides detailed information on exposure to different kinds of childcare arrangements since a child's birth and the socio-economic and demographic characteristics of the child's household.

Results suggest that exposure to center-based care is associated with reactivity or tantrum. This result is significant when we define care as current care and as exposure over the previous two years since birth. Across different socio-economic groups defined by parental education, the negative association between outcome indices and non-parental care is largest among low socio-economic-status (SES) households. These results suggest two possible pathways: low-SES parents choose center-based care of low quality; alternatively,

unobserved heterogeneity in family environment between parents who use center-based care and parents who do not is wider among low-SES households.

These results contrast with previous findings that are based on randomized demonstration projects. Positive effects on cognitive development and social behavior were found in experiments which randomly assigned disadvantaged children to a package of services including childcare (Blau and Currie (2004) provides an excellent review). However, Blau and Currie (2004) argue that the effect of such high quality center-based care (combined with home visits by social workers and service for parents) might be different from the effect of more widely available childcare

Evidence on effects of exposure to ordinary childcare arrangements is more mixed, particularly for behavioral outcomes. On one hand, exposure to the Head Start was reported to have had positive effects on measures of social adjustment (Lee et al., 1990).[1] On the other hand, an increase in the use of institution-based childcare, induced by the introduction of a new subsidy, led to an increase in behavioral problems in Canada (Baker et al., 2008). Studies that used no experiment or natural experiment also found the negative association between behavioral outcomes and center-based childcare/preschool (Magnuson, et al., 2004) or between behavioural outcomes and childcare subsidy receipt (Herbst and Tekin, 2008). Yet another set of studies found no relationship between behavioral outcomes and center-based care usage (Loeb et al., 2004, Loeb et al., 2007).[2]

It is not surprising that the effects of demonstration projects and more widely available programs differ because the former is funded at higher levels and provided with highly qualified staff (Blau and Currie, 2004). This implies that the negative effect of widely available childcare exposure on behavioural outcomes is due to its low quality. Alternatively, the reason for the negative effect of ordinary childcare on behavioral outcomes might be that

[1] The positive effects of Head Start were also found for reading and math scores (Currie and Thomas (1995), though the effects faded out for black children.

[2] Loeb et al. (2004) found that, while continuous use of center-based care is not significantly correlated with behavioral outcomes, continuous home-based care users showed more aggressive behavior. Loeb et al. (2007) also reported no correlation between center-based care usage and behavioural outcomes. Though other non-parent care users were found to exhibit better behavioral outcome measured by a social-behavior index, this relationship disappeared when they used instrumental variable method based on the number of childcare establishment.

a possibly positive effect of widely available childcare for disadvantaged children is offset by a possibly negative effect of that care for advantaged children.[3] It could even be negative if the quality of teachers and peers is low or being away from the parents has larger negative effects for children from advantaged families.

Our preliminary results imply that the latter is unlikely because it is low-SES children who indicate lower temperament scores associated with exposure to center-based childcare. We plan to extend this research by investigating whether this negative relationship is concentrated among children who use center-based care of low quality, using quality measures such as the proportion of qualified staff and the national accreditation system.

The remainder of the paper is structured as follows. In section 2, we describe the data and empirical strategy. In section 3, we present our main results. We extend on this in Section 4 by presenting various robustness checks, and in Section 5 by exploring heterogeneity across parental socioeconomic status. The final section concludes.

## 2. Data and empirical strategy

Our analysis is based on data from the birth cohort of the Longitudinal Survey of Australian Children (LSAC), which collected data from around 5000 children in 2004 (when they were aged 0 or 1) and in 2006 (when they were aged 2 or 3). The longitudinal nature of the dataset is helpful for our purposes, since it allows us to include controls for parenting style and child outcomes that were measured in the first wave of the survey.

The outcome measure that we focus upon is the 'Short Temperament Scale for Infants' (STSI), which is based on a survey of parents. There are three component indices in the STSI. The first is an approach scale, based on questions such as whether the child laughs when arriving at unfamiliar places, smiles when playing with unfamiliar adult, and is outgoing with

[3] Given their family resources, advantaged children would have a better alternative to center-based care even if center-based care was unavailable. This implies that exposure to childcare may not alter their development very much. Hill et al. (2002) provide evidence that is consistent with this hypothesis. They found that the positive effects of randomized assignment to one of the demonstration projects on cognitive skills were larger for children who would have received home-based care or parental care, rather than children who would have received center-based care anyway.

strangers. The second is a persistence scale, which is based on questions such as whether the child plays consistently with a toy for more than 10 minutes, or returns to the same activity after a short toilet break. The third is a reactivity scale, which captures whether the child has a tendency to scream or yell in response to frustration, has moody days, and stomps feet when upset. We recode the three indices as z-scores (ie. with a mean of zero and a standard deviation of one), and so that a higher score represents better behaviour. We also create a composite index, which is the mean of the approach, persistence and reactivity scales, and also has a mean of zero and a standard deviation of one.

We use three measures of non-parental care. The first is an indicator variable denoting whether the child was in non-parental care at the time of the age 2-3 interview, while the second is an indicator variable denoting whether the child was in *full-time* non-parental care at the time of the age 2-3 interview. Our third measure is somewhat more complex, being the share of time that the child was in nonparental care from the age 0-1 interview to the age 2-3 interview. For the third measure, a child who was always in parental care would be coded 0, while a child who was in full-time nonparental care would be coded 1. A child who was in half-time nonparental care for the full duration between the interviews would be coded 0.5. Similarly, a child who was in full-time nonparental care for half the duration between the interviews would be coded 0.5. More details of this measure are provided in Appendix A. Although our analysis begins by simply comparing parental care and nonparental care, we also look separately at three types of nonparental care: centre-based care, family day care, and informal care.

To account for the possibility that the use of non-parental care might be correlated with factors that have a direct impact on the STSI outcome measures, all our regressions include five sets of controls. In choosing these variables, we have been guided by the previous literature, particularly NICHD and Duncan (2003) and Duncan and Gibson-Davis (2006).

- **Child controls:** Indigenous, born in a non-English speaking country, gender, age (2 month categories).
- **Parents controls:** Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education (6 categories), present at interview.

- **Household controls:** household income (6 categories), # of siblings, family size, parents' relationship (married/defacto/single)
- **Parenting style controls:** self-assessment of parenting quality and style, parents' mental wellbeing (all measured at age 0/1)
- **Lagged test score controls:** standardized scores for three STSI indices based on a parental questionnaire administered at age 0/1. The three indices were approachability, cooperativeness and irritability.

Where $Y$ is an outcome index for child i in survey wave t, ***CareType*** is a variable (or vector of variables) denoting non-parental care, ***Child***, ***Parent***, ***Household***, ***ParentingStyle*** and ***LaggedTests*** are vectors of control variables as defined above, our main estimating equation is:

$$Y_{it} = \alpha + \beta \boldsymbol{CareType}_{it} + \gamma 1 \boldsymbol{Child}_{it} + \gamma 2 \boldsymbol{Parent}_{it} + \gamma 3 \boldsymbol{Household}_{it} + \gamma 4 \boldsymbol{ParentingStyle}_{it} + \gamma 5 \boldsymbol{LaggedTests}_{it-1} + \varepsilon_{it} \quad (1)$$

In this equation, the parameter $\beta$ represents the marginal effect of non-parental care, holding constant other control variables.

To account for the possibility that nonparental care might have heterogenous effect on children, we also estimate an equation in which nonparental care is interacted with measures of the parents' socioeconomic status – being either tertiles in annual household income (less than $42,000, $42,001-$78,000, or over $78,000), or tertiles in the education of the primary parent (high school dropout, finished year 12, or university graduate).

Since equation 1 already includes controls for household income and parental education, it is unnecessary to include the main effects of being in the three SES tertiles. We therefore present a 'fully interacted' specification in which each of the three parental SES categories are interacted with an indicator for using nonparental care. We then estimate the equation:

$$Y_{it} = \alpha + \beta 1 HighSES_{it} \times \boldsymbol{CareType}_{it} + \beta 2 MidSES_{it} \times \boldsymbol{CareType}_{it} + \beta 3 LowSES_{it} \times \boldsymbol{CareType}_{it} + \gamma 1 \boldsymbol{Child}_{it} + \gamma 2 \boldsymbol{Parent}_{it} + \gamma 3 \boldsymbol{Household}_{it} + \gamma 4 \boldsymbol{ParentingStyle}_{it} + \gamma 5 \boldsymbol{LaggedTests}_{it-1} + \varepsilon_{it} \quad (2)$$

## 3. Main Results

Since standardized behavioural scores are not necessarily an intuitive metric for performance, we regress the behavioural scores on the child's age (in years). This returns a coefficient of around 0.2 for the composite and persistence indices, suggesting that around ages 2-3, children gain about $1/5^{th}$ of a standard deviation per year on these tests. Thus an effect of 0.2 for the composite or persistence indices can be viewed as equivalent to one year's development. Unfortunately, the other two indices are not significantly related to the child's age, so we cannot use a simple developmental rule-of-thumb in the case of those measures.

We begin by presenting the results for a specification in which the key independent variable is whether the child is in non-parental care at the time of the age 2-3 interview. In Panel A, we combine centre-based care, family day care and informal care into a single category of 'non-parental care'. The conditional association between nonparental care and the approachability index is positive and significant, while the other three indices are negative, though not significant.

In Panel B, we analyse the three types of care separately. For centre-based care (which is the form of care with perhaps the most policy-relevance, the approachability index is positive and significant, while the reactivity index is negative and significant. This would be consistent with a model in which using centre-based care makes children better able to interact with strangers, but also increases the number of temper tantrums.

**Table 1: Current non-parental care**

| **Dependent variable:** | **Composite index** | **Approachability index** | **Persistence index** | **Reactivity index** |
|---|---|---|---|---|
| **Panel A** | | | | |
| Currently using any non-parental care | -0.012 | 0.095** | -0.056 | -0.056 |
| | [0.042] | [0.044] | [0.043] | [0.043] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |
| **Panel B** | | | | |
| Currently using centre-based care | -0.044 | 0.075* | -0.053 | -0.100** |

| | | | | |
|---|---|---|---|---|
| | [0.039] | [0.040] | [0.040] | [0.040] |
| Currently using family daycare | -0.045 | 0.123* | -0.121* | -0.081 |
| | [0.070] | [0.072] | [0.070] | [0.069] |
| Currently using informal care | -0.02 | 0.039 | -0.032 | -0.042 |
| | [0.041] | [0.042] | [0.042] | [0.044] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

In Table 2, we analyse current use of full-time non-parental care. Pooling centre-based care, family day care and informal care (Panel A), the coefficients on full-time non-parental care are negative, but insignificant for the persistence and reactivity indices, and only significant at the 10 percent level for the composite and approach indices. Separately analysing the three types of non-parental care, the coefficients are generally insignificant and close to zero, with the exception of the composite index for centre-based care (-0.1), and the approachability index for family daycare (-0.2).

To get some sense of magnitudes, this indicates that if we were to interpret this causally, it would suggest that children in full-time centre-based care at the time of the age 2/3 interview score 0.1 standard deviations lower on the composite index than children who were not in any form of non-parental care. Recall from above that 0.2 standard deviations constitutes a year of development on the composite index. Therefore, another way of interpreting this is that children in full-time centre based care are 6 months behind in terms of the composite index. However, these coefficients should not necessarily be interpreted causally, an issue we return to below.

**Table 2: Current full-time non-parental care**

| **Dependent variable:** | **Composite index** | **Approachability index** | **Persistence index** | **Reactivity index** |
|---|---|---|---|---|
| **Panel A** | | | | |
| Currently using any FT non-parental care | -0.082* | -0.076* | -0.027 | -0.050 |
| | [0.044] | [0.044] | [0.044] | [0.044] |

| | | | | |
|---|---|---|---|---|
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.13 | 0.14 |
| **Panel B** | | | | |
| Currently using FT centre-based care | -0.103** | -0.085 | -0.049 | -0.060 |
| | [0.052] | [0.052] | [0.051] | [0.051] |
| Currently using FT family daycare | -0.071 | -0.209** | -0.003 | 0.084 |
| | [0.106] | [0.104] | [0.106] | [0.095] |
| Currently using FT informal care | -0.038 | -0.012 | -0.004 | -0.053 |
| | [0.076] | [0.076] | [0.083] | [0.078] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

In Table 3, we use a third measure of non-parental care, which is the child's exposure to non-parental care from the time of the age 0/1 interview until the time of the age 2/3 interview. Where the other variables are indicator variables, this is a continuous measure, ranging from zero (no exposure) to one (60 hours per week exposure for the full duration between the interviews). Although we observe some children that are in care for 60 hours per week at particular points, no child in our sample is in non-parental care for 60 hours per week throughout the two year period. Accordingly, the maximum value that the non-parental care exposure measure takes is 70 percent, the mean is 7 percent, and the standard deviation is 9 percent. This is important to bear in mind when comparing the magnitudes in Table 3 to those in Tables 1 and 2.

The results in Table 3 indicate that greater exposure to non-parental care is associated with significantly lower scores on the reactivity index and the composite index. The associations with the reactivity index are the largest, with a 10 percentage point increase in exposure to non-parental care (approximately one standard deviation) associated with a 0.06 to 0.09 standard deviation drop in the reactivity index. The results for the composite index are also negative and significant (except for informal care); indicating that the lower scores on the reactivity index are not offset by higher scores on the approachability and persistence indices.

| Table 3: Exposure to non-parental care over the previous 2 years | | | | |
|---|---|---|---|---|
| **Dependent variable:** | **Composite index** | **Approachability index** | **Persistence index** | **Reactivity index** |
| **Panel A** | | | | |
| Exposure to non-parental care | -0.430** | -0.122 | -0.046 | -0.626*** |
| | [0.201] | [0.200] | [0.204] | [0.207] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.13 | 0.14 |
| **Panel B** | | | | |
| Exposure to centre-based care | -0.549** | -0.276 | -0.188 | -0.556** |
| | [0.267] | [0.277] | [0.272] | [0.270] |
| Exposure to family daycare | -0.932** | 0.149 | -0.969** | -0.916** |
| | [0.452] | [0.465] | [0.452] | [0.459] |
| Exposure to informal care | -0.394 | -0.147 | 0.116 | -0.703** |
| | [0.378] | [0.330] | [0.375] | [0.342] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

## 4. Robustness Checks

To what extent can our results be interpreted causally? To test this, we use three strategies. First, we re-estimate the results in Panel A of Tables 1 and 2 using nearest-neighbour matching, using as a control group only those individuals with a propensity score between 10 percent and 90 percent. Matched results are shown in Table 4. This specification eliminates about one-fifth of the sample in Panel A, and about two-thirds of the sample in Panel B. While the results are broadly comparable with those in Tables 1 and 2, the standard errors are slightly larger. Consequently, only one coefficient in the matched specifications is significant – the reactivity index is 0.13 standard deviations lower among those using any non-parental care than among a matched control group who are currently only using parental care.

**Table 4: Matching estimates for current care**

| Dependent variable: | Composite index | Approachability index | Persistence index | Reactivity index |
|---|---|---|---|---|
| **Panel A** | | | | |
| Currently using any non-parental care | -0.057 | 0.096 | -0.073 | -0.131** |
| | [0.054] | [0.080] | [0.064] | [0.063] |
| Observations | 2300 | 2300 | 2300 | 2300 |
| **Panel B** | | | | |
| Currently using any full-time non-parental care | -0.080 | -0.017 | -0.044 | -0.091 |
| | [0.058] | [0.085] | [0.065] | [0.071] |
| Observations | 1067 | 1067 | 1067 | 1067 |

Note: Regressions are based on nearest neighbour matching, with the sample restricted to observations with a propensity score between 0.1 and 0.9. Robust standard errors in brackets (boostrapped over 50 replications). * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

Our second robustness check is to apply the approach of Altonji et al. (2005), who employ the novel approach of looking at selection on observables to gauge the potential importance of unobservables bias. For example, in the case of analysing the impact of Catholic school attendance on high school graduation, they observe that omitting observable test scores and parental background would reduce the Catholic high school advantage in graduation rates by one-fifth. In turn, this indicates that unobservables bias would have to be five times larger than observables bias order to wipe out the Catholic schooling effect. In cases where the econometrician observes a large number of important observable characteristics, the Altonji et al. method can be useful. While it can never rule out the possibility of unobservables bias, the method provides a useful rule-of-thumb. For a given set of covariates, a smaller observables bias should make us more confident that unobservables bias is unlikely to completely explain the observed effects. The method is well-suited to a case such as this one, where we have a large number of observable covariates, including socioeconomic characteristics, parenting style, and lagged test scores.

In Table 5, we estimate the degree of observables bias for the estimates in Panel A of Tables 1-3, and express the observables bias as a ratio of the point estimate. For example, in Panel B

of Table 5, we report that children in full-time non-parental care score 0.8 standard deviations lower on the composite index. This is quite close to the estimated bias from observables, suggesting that unobservables bias would have to be around the same size as the observables bias to wipe out the estimated effect. In Panel C of Table 5, the coefficient on exposure to non-parental care is -0.4, while the bias from observables is -0.3. This suggests that selection on unobservables would have to be larger than selection on observables to fully eliminate the observed association between non-parental care and the composite index.

**Table 5: Selection on Observables**

| **Dependent variable:** | **Composite index** | **Approachability index** | **Persistence index** | **Reactivity index** |
|---|---|---|---|---|
| **Panel A** | | | | |
| Currently using any non-parental care | -0.012 | 0.095** | -0.056 | -0.056 |
| | [0.042] | [0.044] | [0.043] | [0.043] |
| Bias from observables | 0.222 | 0.431 | -0.249 | 0.410 |
| Ratio \|β/Bias\| | 5% | 22% | 22% | 14% |
| **Panel B** | | | | |
| Currently using any FT non-parental care | -0.082* | -0.076* | -0.027 | -0.050 |
| | [0.044] | [0.044] | [0.044] | [0.044] |
| Bias from observables | -0.079 | 0.050 | -0.278 | 0.012 |
| Ratio \|β/Bias\| | 104% | 152% | 10% | 417% |
| **Panel C** | | | | |
| Exposure to non-parental care | -0.430** | -0.122 | -0.046 | -0.626*** |
| | [0.201] | [0.200] | [0.204] | [0.207] |
| Bias from observables | 0.303 | 0.805 | -0.983 | 0.975 |
| Ratio \|β/Bias\| | 142% | 15% | 5% | 64% |

Note: Betas are the same as those in Panel A of Tables 1, 2 and 3.

As a third robustness check, we estimate instrumental variables models, in which the use of centre-based care is instrumented using a measure of 'surprise births' in the child's Statistical Local Area. Specifically, our instrument is the percentage change in the birth rate between 2001-02 (two years before the children in our sample were born) and 2003-04. To the extent that this variation is driven by random factors that are exogenous to parents' taste for centre-based care, an increase in the birth rate should reduce the probability that parents use centre-based care. While centres can respond to demand shocks in the medium-run, supply is not perfectly elastic in the short term, since it takes a number of years to obtain the necessary planning permissions to open a new child care centre. However, a limitation of this approach is that increases in the birth rate may also affect child outcomes via their impact on

carer/child ratios in day care centres. Although we believe that these effects are likely to be relatively small, our data on ratios are extremely noisy, so we are not able to fully rule out this causal channel.

The results from this IV strategy are shown in Table 6. Across the four dependent variables, centre-based care is only significant for the approachability index, and then only at the 10 percent level. However, the standard errors are sufficiently large in the IV specification that we cannot reject reasonably large effects of centre-based care in either direction.

**Table 6: Instrumenting centre-based care usage with 'surprise births'**

| **Dependent variable:** | **Composite index** | **Approachability index** | **Persistence index** | **Reactivity index** |
|---|---|---|---|---|
| Currently using centre-based care (instrumented) | -1.621 | -2.766* | -0.275 | 0.05 |
| | [1.348] | [1.680] | [0.952] | [1.024] |
| Currently using family daycare | -0.822 | -1.277 | -0.229 | -0.007 |
| | [0.672] | [0.834] | [0.474] | [0.509] |
| Currently using informal care | -0.086 | -0.079 | -0.042 | -0.035 |
| | [0.075] | [0.098] | [0.059] | [0.061] |
| Observations | 2646 | 2651 | 2655 | 2651 |
| F-statistic on excluded instrument | 4.25** | 4.44** | 4.49** | 4.32** |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour. Use of centre-based care is instrumented using the percentage change in births in the respondent's Statistical Local Area from 2001-02 to 2003-04.

Unfortunately, the instrumental variables approach is only useful for estimating the impact of centre-based care, and requires us to assume that the other two types of non-parental care are exogenous. Moreover, while the F-statistic on the excluded instrument is significant at the 5 percent level when we use current care as the endogenous variable, the first-stage is much weaker if we use full-time care or exposure as the endogenous variable. Accordingly, we only present results here for current care.

In addition, we experimented with instrumenting for centre-based care using measures of supply (eg. the change in the number of centres in a local area). However, this variable turned out to be very weak in the first stage equation. Similarly, when we interact the 'surprise births' instrument with the parental socioeconomic status measures used in the next section of the paper, the first stage F-statistics for the three endogenous variables are close to zero and statistically insignificant.

## 5. Heterogeneous treatment effects

In the previous tables, we have estimated the mean relationship between of non-parental care and child outcomes. But from a theoretical perspective, we might expect this relationship to differ substantially across parents. On average, children from high-SES families achieve higher scores on the four behavioural indices. Although there could be a variety of explanations for this, there is some evidence that the difference is due to higher-quality parenting among richer and better-educated households. For example, Bianchi and Robinson (1997) report that children of higher-educated parents are more likely to read books, and less likely to watch television. In this context, we would expect non-parental care to have a larger adverse effect (or a smaller positive effect) in high-SES households.

To test this, we create two measures of socioeconomic status: household income and the education of the primary parent (who is usually the mother. We then interact these with the measure of exposure to non-parental care (the main effects of SES are already included as controls). The results from this specification are shown in Panel A of Tables 7 and 8. Consistent with theory, we find that the largest negative associations between behavioural outcomes and non-parental care are for high-SES parents. For example, a 10 percentage point increase in exposure to non-parental care for high-SES children is associated with a 0.07 standard deviation drop in the reactivity index, but no significant change in the reactivity index for low-SES children.

Although we do not find positive effects of care on low-SES children, it is possible that this is because our low-SES grouping is not particularly disadvantaged. In particular, our results are not inconsistent with those from US randomised evaluations such as Perry Preschool, the Abecedarian Program, or the Early Training Project, since Australian children in a household

with an income of $40,000 in 2004 are still substantially better off than children in US households that were below the poverty line in the 1960s.

In Panel B of Tables 7 and 8, we interact the three types of non-parental care separately with the three measures of SES. At this level of disaggregation, the standard errors for most estimates approximately double, so it is difficult to discern patterns as clearly as in Panel A. The clearest pattern appears to be in Panel B of Table 8, where SES is defined by parental education. In this case, the relationship between the composite index and family day care indicates that the greatest negative association is for high-educated parents. A similar pattern can be seen in Panel B of Table 8, in the case of informal care.

**Table 7: Exposure to non-parental care over the previous 2 years, interacted with parental income**

| Dependent variable: | Composite index | Approachability index | Persistence index | Reactivity index |
|---|---|---|---|---|
| **Panel A** | | | | |
| Exposure to non-parental care × Low SES | -0.524 | 0.22 | -0.672 | -0.489 |
| | [0.451] | [0.432] | [0.525] | [0.456] |
| Exposure to non-parental care × Mid SES | -0.34 | -0.241 | 0.173 | -0.562* |
| | [0.299] | [0.330] | [0.311] | [0.332] |
| Exposure to non-parental care × High SES | -0.467 | -0.159 | 0.024 | -0.735** |
| | [0.319] | [0.297] | [0.305] | [0.315] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |
| **Panel B** | | | | |
| Exposure to centre-based care × Low SES | -0.485 | -0.405 | -0.064 | -0.405 |
| | [0.667] | [0.653] | [0.743] | [0.569] |
| Exposure to centre-based care × Mid SES | -0.639* | -0.359 | -0.559 | -0.278 |
| | [0.388] | [0.470] | [0.404] | [0.426] |
| Exposure to centre-based care × High SES | -0.483 | -0.168 | 0.078 | -0.814* |
| | [0.413] | [0.391] | [0.409] | [0.416] |
| Exposure to family day care × Low SES | -1.106 | 0.504 | -1.329 | -1.213 |
| | [0.911] | [0.946] | [0.920] | [1.096] |
| Exposure to family day care × Mid SES | -1.825*** | -0.37 | -1.782** | -1.284** |
| | [0.671] | [0.734] | [0.736] | [0.644] |
| Exposure to family day care × High SES | -0.021 | 0.396 | 0.003 | -0.441 |
| | [0.762] | [0.761] | [0.752] | [0.701] |
| Exposure to informal care × Low SES | -0.982 | 0.335 | -0.516 | -1.653** |
| | [0.871] | [0.736] | [1.003] | [0.734] |
| Exposure to informal care × Mid SES | 0.279 | 0.037 | 1.047** | -0.554 |
| | [0.499] | [0.485] | [0.530] | [0.607] |
| Exposure to informal care × High SES | -0.74 | -0.408 | -0.408 | -0.568 |
| | [0.584] | [0.497] | [0.535] | [0.464] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

**Table 8: Exposure to non-parental care over the previous 2 years, interacted with parental education**

| Dependent variable: | Composite index | Approachability index | Persistence index | Reactivity index |
|---|---|---|---|---|
| **Panel A** | | | | |
| Exposure to non-parental care × Low SES | 0.052 | 0.556 | -0.473 | 0.005 |
| | [0.410] | [0.439] | [0.452] | [0.471] |
| Exposure to non-parental care × Mid SES | -0.36 | -0.222 | 0.302 | -0.745** |
| | [0.358] | [0.322] | [0.323] | [0.353] |
| Exposure to non-parental care × High SES | -0.691** | -0.317 | -0.175 | -0.783*** |
| | [0.275] | [0.291] | [0.309] | [0.291] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |
| **Panel B** | | | | |
| Exposure to centre-based care × Low SES | -1.146 | -0.617 | -0.986 | -0.6 |
| | [0.723] | [0.676] | [0.699] | [0.645] |
| Exposure to centre-based care × Mid SES | -0.394 | -0.405 | 0.127 | -0.436 |
| | [0.383] | [0.443] | [0.407] | [0.437] |
| Exposure to centre-based care × High SES | -0.482 | -0.088 | -0.152 | -0.642 |
| | [0.395] | [0.405] | [0.409] | [0.395] |
| Exposure to family day care × Low SES | 0.307 | 1.403 | -0.951 | 0.127 |
| | [0.912] | [0.986] | [1.061] | [0.912] |
| Exposure to family day care × Mid SES | -1.025 | 0.237 | -0.376 | -1.803*** |
| | [0.690] | [0.745] | [0.615] | [0.656] |
| Exposure to family day care × High SES | -1.511** | -0.592 | -1.582** | -0.606 |
| | [0.740] | [0.743] | [0.750] | [0.760] |
| Exposure to informal care × Low SES | 0.301 | 0.444 | -0.14 | 0.208 |
| | [0.811] | [0.952] | [1.136] | [1.015] |
| Exposure to informal care × Mid SES | 0.036 | 0.353 | 0.423 | -0.701 |
| | [0.696] | [0.539] | [0.575] | [0.574] |
| Exposure to informal care × High SES | -0.934** | -0.725* | -0.099 | -0.908** |
| | [0.446] | [0.430] | [0.538] | [0.451] |
| Observations | 2648 | 2653 | 2657 | 2653 |
| R-squared | 0.18 | 0.13 | 0.14 | 0.14 |

Note: Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a set of child controls (Indigenous, born in a non-English speaking country, gender, age), parental controls (Indigenous, non-English speaking, born in a non-English speaking country, age, age$^2$, education, present at interview), household controls (household income, number of siblings, family size, parents' relationship), parenting style controls (self-assessment of parenting quality and style at the previous interview, parents' mental wellbeing at the previous interview), and lagged test score controls (standardized scores for three STSI indices based on a parental questionnaire administered at the previous interview). All dependent variables are scaled as z-scores, and coded so that higher numbers denote better behaviour.

## 6. Conclusion

The debate over the impact of non-parental care on children has one that has attracted the attention of sociologists, psychologists and economists alike. But for many parents, the impact of paid child care is more than an esoteric academic debate. With the large-scale entry of women into the paid labour force, the use of non-parental care has inevitably risen. As a consequence, many parents feel guilty about their choice to use non-parental care.

Our results can potentially shed some light on this question. Controlling for a large number of child, parental and household variables, we observe a negative association between the reactivity index and non-parental care, and between the composite index and non-parental care. This result is significant when we define care as full-time current care and as exposure over the previous two years. The results based on matching and IV approaches generally point in the same direction, though they are not accurately estimated. Across SES groups, the negative association between outcome indices and non-parental care is largest among low-SES households.

A possible explanation for these results includes that low-SES parents choose center-based care of low quality. While these findings contrast the positive effect of randomized demonstration projects on outcomes of disadvantaged children, given differential levels of funding and staff quality (Blau and Currie, 2004), this discrepancy might be explained by the quality of childcare used by low-SES parents. We plan to extend this research by investigating whether this negative relationship is concentrated among children who use center-based care of low quality, using quality measures such as the proportion of qualified staff and the national accreditation system.

## Appendix 1: Coding Exposure to Non-Parental Care

We know the current child care arrangement and the first child care arrangement in the child's life.

- If current arrangement and first arrangement are not formal childcare, we set exposure to zero.

- If the current arrangement is formal care and this is the first formal care arrangement, then we code exposure as the number of days the child has attended that care, divided by the child's age (in days).

- If the current arrangement is formal care and the child was in another formal care arrangement previously, we do not know when the first arrangement ended. So we assume that there are no gaps between the arrangements, and calculate exposure as the number of days since the start of the first care arrangement, divided by the child's age (in days).

- If the child does not currently use formal care, but used some type of formal care in the past, we assume that the duration of the first care arrangement was the same as the mean for the previous group.

- All exposure measures are adjusted for the number of hours per week, with a maximum of 60. For example, if a child has been in continuous formal care since birth, for an average of 15 hours per week, the exposure measure is 0.25. Similarly, if a child has been in formal care for one-quarter of his or her life, but for 60 hours per week, the exposure measure is also 0.25.

- We also look at a second exposure measure - % of hours currently in care (60 hours=100%).

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