

Child Outcomes and Universal High Quality Child Care

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Abstract:

Exploiting a rich panel data child survey merged with administrative records along with a pseudo-experiment generating variation in the take-up of pre-school across municipalities, we provide evidence on the effects on non-cognitive child outcomes of participating in large scale publicly provided universal pre-school programs, family day care and home care. We find that being enrolled in pre-school at age three does not lead to significant differences in child outcomes at age seven no matter the gender or mother's level of education. Family day care, on the other hand, seems to significantly deteriorate outcomes for boys whose mothers have low levels of education. Finally, increasing hours in family day care from 30-40 hours per week to 40-50 hours per week and hours in pre-school from 20-30 hours per week to 30-40 hours per week leads to significantly poorer child outcomes.

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1. Introduction

This paper investigates the relation between preschool care and child outcomes. Specifically, we consider effects on child outcomes of enrolment in universal publicly subsidized high quality center based child care and family day care for three year olds in Denmark vis-à-vis parental care. Center based care, or pre-school, is the most common type of care for this age group: 63% of all three year olds are enrolled in this type of care in 1999. Furthermore, we investigate the effects of hours – the treatment intensity – given selection into a specific type of non-parental care. See e.g. OECD (2001) for a description of the content and quality of Danish child care.

Because of the high usage of child care, which is not limited to a Scandinavian setting, allowing parents (or, more precisely, mothers) to participate in the labor market, a natural question to ask is how children are affected by this choice. Child care may be viewed as simply ‘taking care’ of children, yet an alternative view is that child care is, in effect, a type of early childhood investment in the development of social and academic skills. Depending on the content of the care program, one may easily imagine a variety of effects from enrollment, which may also vary across children. This study focuses on the development of non-cognitive skills such as measures of emotional symptoms, conduct problems, hyperactivity/inattention problems, peer relationship problems, and pro-social behavior. As our outcome variable we use the psychometric *strength and difficulties questionnaire index* (SDQ); a standard behavioral measure in the child development literature, see e.g. Goodman (1997). We measure outcomes at age seven.

There exists a large literature on child development and non-parental care, especially care for disadvantaged children, see Blau and Currie (forthcoming), Currie (2001), and Ruhm (2004) for excellent surveys, yet as pointed out by Currie (2001), the literature is rather silent about the effects of regimes with universal pre-school and family day care programs such as the Danish or Canadian.¹ This is despite both public and academic interest, see Currie (2001). Firstly, because these programs are not limited to include disadvantaged children, but are offered to the entire population, the results will inform about the effects of modes of care for children within a range of different socio-economic backgrounds. Secondly, *exactly* because the group of children in for

¹ Universal pre-school is also offered in certain states within the US. Examples are Georgia (since 1995), New York (1997), and Oklahoma (1998). California provides a program targeted at low-income children. See Blau and Currie (forthcoming).

example pre-school is not homogenous, the effects may not be the same had pre-school been offered to disadvantaged children only. See e.g. Ammermüller and Pischke (2006) on peer-effects in primary schools. In other words, it may be hard to extrapolate from the findings from the literature on disadvantaged children to a regime with universal care programs, even for the group of children with adverse family backgrounds.

Another important contribution of our paper is the evaluation of effects of hours in non-parental care. Some studies focusing solely on the effects of maternal employment patterns and consider hours of work, see for example Bernal and Keane (2006a), Gregg, Washbrook, Propper, and Burgess (2005), Parcel and Menaghan (1994), and Ruhm (2004) while Blau (1999) investigates the effects of child care characteristics on child outcomes and include a measure of hours in care. Common to these analyses is that they investigate the effect of hours for the pooled sample of children. Whether the studies include hours in a linear fashion or a set of dummies, part of the identifying variation will in this way stem from observations that are ‘far apart’ in terms of hours. The estimates must subsequently be interpreted as the effect of differences in hours *including* all indirect effects stemming from parents’ different (labor market) behavior. Instead, we adopt a strategy similar to Behrman, Cheng, and Todd (2004); we consider the marginal effects on outcome incurred by increasing hours in a given type of non-parental care by a small amount. Performing local comparisons greatly decreases the likelihood of indirect effects and allows us to interpret the resulting estimates as direct effects of changes in hours. The cost is, of course, that we can only speak about the effects of smaller changes in hours relative to a given baseline. Furthermore, the estimator allows for selection *into* non-parental care to be based on unobservables but conditional on choosing non-parental care the choice between hours must be based on observables only.

Estimations are carried out using a rich longitudinal survey following children born in 1995. The survey holds information about children, mothers, and fathers and is linked to highly reliable administrative registers providing us with crucial background information about the parents and their labor market behavior. We use this rich mine of information to estimate our parameters of interest using OLS. Furthermore, we have access to plausible exogenous variation in the take-up of pre-school via a pseudo-experiment generating waiting lists for pre-school in some municipalities while guaranteeing open slots in others. See Simonsen (2006) for an evaluation of similar variation on mother’s employment following child birth.

Our results indicate that being enrolled in non-parental care at age three is neutral compared to home care. However, if one acknowledges that non-parental care is not a well-defined counterfactual, it becomes clear that the first result is not very informative.² We find that being enrolled in pre-school does not lead to significant differences in non-cognitive child outcomes no matter the gender or mother's level of education. Family day care, on the other hand, seems to significantly deteriorate outcomes for boys whose mothers have low levels of education. This last set of results is confirmed using the above pseudo-experiment as an instrument. Finally, increasing hours in family day care from 30-40 hours per week to 40-50 hours per week and hours in pre-school from 20-30 hours per week to 30-40 hours per week leads to significantly poorer child outcomes.

The remainder of the paper is organized as follows: Section 2 provides a description of the data and the institutional set-up, Section 3 discusses child outcomes as well as the linkages between child care enrollment and child outcomes. Section 4 presents our empirical strategy, Section 5 the regression results and Section 6 the IV analysis. Finally, Section 6 concludes.

2. Data and Institutional Framework

We exploit a unique and remarkably rich panel dataset on children's outcomes, modes of care, and parental background information, known as the Danish Longitudinal Child Panel. The data consists of repeated surveys of the primary parent (typically the mother) of about 6,000 children born in 1995. The first survey took place when the children were between 6 months to a year old, the second when they were around 3, and the third when the children had all just started school (age 7 in Denmark). Thus, 3 waves of this data are currently available, 1996, 1999 and 2003.³ The fathers of these children were surveyed separately in some of these waves. In addition, a special segment on children's health and welfare was added to the mother survey in 2003. This panel survey data has been merged to precise information on parents' educational attainment, labor market status, hours of work, wages and income in the period 1994-2002, extracted from Danish administrative

² See also a recent paper by Bernal and Keane (2006) who find significant differences in the effects of child care depending on the type of care.

³ A fourth wave will be fielded in 2006.

The regulations of municipality provided child care institutions are described in the Law of Service (Serviceloven). The Law of Service offers general guidelines as to the content of municipality provided care, yet the specific details are decided by the institutions. Overall, institutions must supply care, education, and opportunities to play, all in co-operation with parents. The educational content of municipality provided care involves development of personal, linguistic, and physical skills. Furthermore, children must develop their understanding of nature and culture.

All children are eligible for municipality child care, including children born to unemployed parents.⁴ This means that children's right to child care enrolment is not affected by their parents' transitions in and out of the labor market. Presumably, if child care does contribute to the development of social and academic skills we may expect such disruptions to be detrimental to learning.

Municipalities provide both pre-schools (that may be integrated with nursery centers for 0-2 year olds) and family day care for children within the relevant age group and the local government is free to decide on the distribution of these two types of care within the municipality. Similarly, opening hours may vary across municipalities but must 'cover local needs'. In general, opening hours during week days are between 6.30 am and 5.15 pm.

Pre-schools may be owned by the municipality. No matter the owner status, the municipalities are required by law to monitor the institutions closely regarding educational content as well as safety and hygiene. Evaluation of the former requires ensuring that the personnel have the necessary qualifications, whereas evaluation of the latter includes accident-preventing measures, playgrounds, transport, sleeping positions, toys, hygiene, and insurance schemes.

In contrast, family day care takes place in private homes and the carers are directly employed by the municipality. Again, the municipalities must approve the facilities and the qualifications of the carer. There may be up to five children in each home and in some municipalities the carer's own children under the age of three are allowed to enter into the total number of children in the family day care. The carer will then receive compensation from the municipality for taking care of her own children.

⁴ The only exception occurs if one of the parents takes formal publicly supported maternity or child care leave.

Prices are set at the municipality level and hold throughout the municipality for a given type of care. Parents pay a maximum of 33% of the total costs of providing care and the price is reduced with lower income and number of siblings enrolled in public care.

3. Child Outcomes and Non-Parental Care

There exist two strands of the literature on child outcomes and non-parental care within the field of economics. One focuses largely on the effects of maternal employment in general (see e.g. Ruhm (2004) for a survey) and less on the alternative modes of care,⁵ whereas another branch considers the effects of participating in different modes of care, especially pre-school interventions for disadvantaged children (see e.g. Currie and Thomas (1995), Currie (2001), and Currie, Garces, and Thomas (2002)).

Overall, there is limited consensus in the literature about the effects of child care and maternal employment. Some studies suggest that maternal care during childhood is essential for child development, often measured by the Peabody Picture Vocabulary Test (e.g. Parcel and Menaghan (1994)). A recent study, for example, by Baker, Gruber, and Milligan (2005) considers a large scale change in the child care system in Quebec, Canada. The policy change implied that all five year-olds have access to full-time pre-school and that the out-of-pocket price for child care cannot exceed \$5 per day. Exploiting the before-after, Quebec-versus-other regions variation, the authors find that the effects on child (and parent) outcomes of the transition to a regime with universal highly-subsidized child care are clearly negative. Other studies find negative or mixed effects (Bernal and Keane (2006), Gregg, Washbrook, Propper, and Burgess (2005), Stafford (1987), Waldfogel, Han, and Brooks-Gunn (2002)) of maternal care.

For disadvantaged children, however, the literature suggests that participation in (expensive) programs aimed directly at this group is beneficial to participating children. One example is the Head Start Program, see Currie (2001). This view is also put forward in Knudsen et al. (2006). This paper is a joint venture by an economist, a neurologist, a psychiatrist, and a sociologist. Among the

⁵ An important exception is Bernal and Keane (2006b), who distinguish between formal care (center-based care and pre-school) and informal care.

conclusions from this paper is that interventions aimed at improving the situation for disadvantaged individuals should start as early as possible when the brain is more plastic. This is especially important because early learning is crucial for later learning (see Knudsen et al. (2006), p. 3):

“Both the mastery of skills that are essential for economic success and the development of their underlying neural pathways follow hierarchical rules in a bottom-up sequence such that later attainments build on foundations that are laid down earlier”.

From the literature, therefore, we can infer that for evaluations of the effects of maternal care 1) the counter-factual state matter as does 2) the group under investigation. As described above, here we focus on a large-scale, expensive, publicly funded universal child care program for three year-olds; a much under-researched area, see Currie (2001).

One issue is how modes of care affect child outcomes; another is the effects of the *intensity* of a given treatment. Specifically, one may be interested in assessing how the effect of placing a child in pre-school for 20 hours differs from that of 45 hours. These two scenarios may lead to very different outcomes; one allows for substantial time with both parents *in addition* to time with peers, whereas the other to a higher degree restricts time with parents. Studies (e.g. Blau (1999), Gregg et al., Ruhm (2004)) typically find that the more hours are spend away from the parents, the worse are child outcomes.

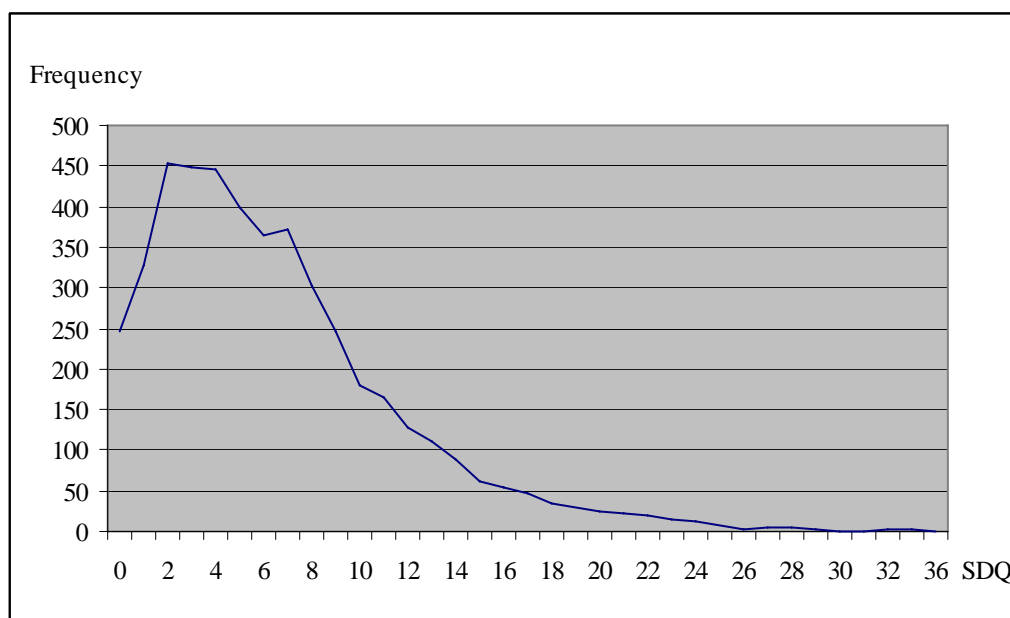
A separate question is how to choose relevant measures of *child outcomes*. Previously, the literature has focused more on cognitive outcomes (measures of IQ), yet Currie (2001) suggests that though they are important predictors of future economic outcomes, such measures are often flawed and point to the use of measures of school readiness instead or in addition. Pre-school teachers, for example, emphasize the importance of non-cognitive skills as prerequisites for learning. The same point is made by Knudsen et al. (2006).⁶ Furthermore, non-cognitive skills are found to be as important for school enrollment decisions as cognitive skills, see Heckman, Stixrud and Urzua (2006).

⁶ Knudsen et al. (2006), p. 4: “Cognitive, linguistic, social, and emotional competencies are interdependent, all are shaped powerfully by the experiences of the developing child, and all contribute to success in the workplace”.

As our outcome of interest we have available a measure of non-cognitive skills based on the so called Strength and Difficulties Questionnaire (SDQ); a standard behavioral measure in the child development literature, see Goodman (1997) for a description of this measure and Andersen, Deding, and Lausten (2006) for a Danish application. In our case the questionnaire is filled out by the primary parent (most often the mother) of the child when the child is seven years old. Importantly, this means that our *outcome* is measured at a different (future) point in time than our *treatment*. Had this not been the case, or had the two types of information somehow been linked in the survey, one may have feared that mothers would be inclined to rationalize their choice of child care and overestimate good child behavior, which could bias our results below. Clearly, even if mothers' responses are biased, as long as this is unrelated to choice of mode of care, it will not cause problems for our identification strategy. Furthermore, all children have started school at age; parents' reference points when (husk Bo Honores kommentar)

The *SDQ* index is based on emotional symptoms, conduct problems, hyperactivity/inattention problems, peer relationship problems, and pro-social behavior. See Appendix, Table A1 for a list of the questions used to construct the *SDQ* index and www.sdqinfo.com for further details. The measure takes on discrete values in the interval between 0-40, where 0 indicates no behavioral problems. Research suggests that the *SDQ* and Rutter questionnaires applied within the economics literature by, for example, Heckman, Stixrud and Urzua (2006), correlate highly and do equally well in terms of classifying behavior, see Goodman (1997). Also, the *SDQ* questionnaire offers additional advantages such as coverage of inattention, peer relationships, and pro-social behavior. Figure 2 below shows the distribution of the *SDQ* index in our sample.

FIGURE 2
DISTRIBUTION OF SDQ INDEX



Source: Data used for estimation purposes.

TABLE 2
TAKE-UP OF CARE 3-YEAR OLDS
AND SDQ INDEX AT AGE 7^a

	Share	Mean SDQ index
Home care	0.15	6.48 (5.29)
Municipality family day care	0.16	6.80 (5.15)
Municipality pre-school	0.66	6.52 (5.04)
Private care	0.03	5.83 (3.93)
Other types of care	0.01	7.15 (5.68)
Mean hours in non-parental care	30.88 (10.96)	

^aSource: Own calculations, data used for estimation purposes

Table 2 above shows the take-up of different modes of care, parental and otherwise, and mean *SDQ* index (measured at age 7) along with mean hours in non-parental care.⁷ We see that around a fifth of the children are taken care of at home and that municipality-run pre-school centers constitute the most common type of non-parental care. Participation in center-based care is high in an international comparison; according to Currie (2001), in 1995 around 31% of American three year-olds received such care. On the outset, there is little variation in child outcomes across types of care and children spend on average 30 hours per week in non-parental care.

Tables with quality of care (to be merged onto data set) – size of institutions, teacher/child ratio

4. Parameters of Interest

This section first discusses potential parameters of interest and then considers identification of these parameters. In this paper, one goal of the evaluation is to measure the effect or impact of mode of care on our outcome variable, the strengths and difficulties index, *SDQ*, relative to some other type of care. More precisely, we consider the effects on child outcomes at age seven of participating at age three in some form of publicly provided child care compared to home care. That is, we ignore the small fraction of children participating in private and other specialized care. We also include only children, whose *mother* filled in the questionnaire.⁸ A second goal of the paper is to evaluate the effects of the intensity of treatment. Put differently, does it matter whether a child is placed in non-parental care in 30 hours compared to 20 hours conditional on choosing some type of publicly provided care such as pre-school?

Consider first participating in a municipality provided child care program, *MP*, relative to home care. Let $MP = 1$ indicate participation in such a program, whereas $MP = 0$ indicates home care. Let SDQ_0 be potential outcome in home care and SDQ_1 the potential outcome in municipality provided care. We are now faced with the fundamental problem that we do not observe the same

⁷ *SDQ* is missing for X percent of the sample. Running mode specific probits, we conclude that the reporting problem is statistically unrelated (at the 5% significance level) to any observable characteristics in our conditioning set, see Table 3 for the list of variables.

⁸ This is the case for 99% of the children in the survey.

child both in home care and municipality provided care at the same point in time. In this paper, we consider the average effect of municipality provided care for the group of participants:

$$(1) \quad E[SDQ_1 - SDQ_0 \mid MP = 1]$$

Other parameters, for example focusing on the probability of abnormal child outcomes, may be of interest as well. The reason for estimating average effects is twofold: firstly, municipality provided care – our treatment - is designed to cover the needs of an average child and not so much children with abnormal behavior and needs. In fact, children with extreme problems are likely sent to special institutions. Therefore, we do not expect much action with regards to child care participation for the latter group. Secondly, (1) should be an extremely important input into the decision rule for parents of ‘average’ children. This group of parents is not necessarily afraid that their child will turn out to have extreme behavior, but that may still care about whether sending their child off to be taken care of outside of the home will move child development in one or the other direction.

There is an obvious problem with the parameter defined in (1), however. In particular, (1) will be some weighted average of the effects of being enrolled in pre-school and family day care. Thus, estimating the average effect of being enrolled in some type of municipality provided care does not result in an easily interpretable parameter but does, nonetheless, correspond to the parameters being estimated in much of the literature.

We therefore continue on to investigate whether participation in different types of municipality provided child programs results in different outcomes compared to home care. In order to do this, we need to extend our framework slightly. Let SDQ_j be the potential outcome, $j = 0, 1, 2$:

$$j = \begin{cases} 0 & \text{if home care} \\ 1 & \text{if family day care} \\ 2 & \text{if pre-school} \end{cases}$$

We consider the following parameters:

$$(2) \quad E[SDQ_1 - SDQ_0 \mid DC = 1],$$

where DC indicates family day care participation. Thus (2) is the average effect of participating in family day care compared to home care for the group of children enrolled in family day care. Furthermore, we consider

$$(3) \quad E[SDQ_2 - SDQ_0 \mid PS = 1],$$

where PS indicates pre-school participation. (3) is then the effect of participating in pre-school compared to home care for the group of children enrolled in pre-school.

All three parameters, (1) – (3), discussed above should be interpreted as the effects of a given type of care compared to the alternative home care *including* any effects arising via parents different labor market behavior and income in the two states in the year of treatment. In principle, we would like to adjust for these variables in the year where treatment is taking place to isolate the effect of mode of child care. Yet exactly because such variables are affected by the treatment, this is not possible; see Rosenbaum (1984). This problem is common to all observational studies attempting to evaluate the effects of child care.

Finally, we consider the effects of participating in pre-school compared to family day care for the group of children enrolled in pre-school:

$$(4) \quad E[SDQ_2 - SDQ_1 \mid PS = 1].$$

In considering this latter parameter, we avoid having to deal with the potential non-random selection out of non-parental care.

The parameters presented in (1) – (4) are all concerned with comparing different types of care. As pointed out, another interesting question is whether the intensity of care matters. We follow Behrman, Cheng, and Todd and explore the following parameters:

$$(5) \quad E[SDQ_1(t + \Delta t) - SDQ_1(t) \mid DC = 1, t]$$

and

$$(6) \quad E[SDQ_2(t + \Delta t) - SDQ_2(t) | PS = 1, t].$$

(5) and (6) are the average effects of increasing time in a given type of publicly provided care from t to $t + \Delta t$ conditional in selecting municipality provided family day care or pre-school and spending t hours in this type of care, respectively. Focusing on decisions on the intensive margin allows us to neglect the selection into a specific type of non-parental care. We only consider the marginal and not the cumulative effects of hours; the reason is that while it may be valid to compare children who spend 40 hours in non-parental care with those spending 30 hours (i.e. to perform local comparisons), comparing children spending 40 hours in non-parental care with those spending 10 hours potentially introduces large indirect effects, particularly from the mother's income and labor market status. As above, it is not possible to condition on these variables because they are affected by the choice of child care. The latter set of estimates will therefore be harder to interpret and presumably further away from the direct effects. The cost of our approach is clearly that we can only address effects stemming from local variations in the choice of hours.

TABLE 3
DETAILED DESCRIPTION OF VARIABLES

Variable	Description	Source
Child Care at age three:		
<i>Home care, H</i>	Dummy for being taken care of by parents or grandparents at home	Danish Longitudinal Child Panel
<i>Municipality family day care, DC</i>	Dummy for being enrolled in municipality provided family day care in 1999 (at age three)	Danish Longitudinal Child Panel
<i>Municipality pre-school, PS</i>	Dummy for being enrolled in municipality provided pre-school care in 1999 (at age three)	Danish Longitudinal Child Panel
<i>Municipality provided program, MP</i>	Dummy for being enrolled in either municipality provided family day care or pre-school in 1999	Danish Longitudinal Child Panel
<i>Private care</i>	Dummy for being enrolled in privately provided care in 1999 (at age three)	Danish Longitudinal Child Panel
<i>Other care</i>	Dummy for being enrolled in other types of care in 1999 (at age three)	Danish Longitudinal Child Panel
<i>Hours in non-parental care</i>	Number of hours per week in non-parental care	Danish Longitudinal Child Panel
<i># prior non-parental care facilities</i>	Number of different care facilities a child has been enrolled in before the current at age three	Danish Longitudinal Child Panel
Child Characteristics:		
<i>Girl</i>	Dummy for being a girl	Danish Longitudinal Child Panel
<i>Siblings</i>	Number of siblings	Statistics Denmark
<i>Breast fed</i>	Dummy for being breast fed	Danish Longitudinal Child Panel
<i>Birth weight (in 1000 grams)</i>	Birth weight in 1000 grams	Danish Longitudinal Child Panel
<i># hospitalizations</i>	Number of hospitalizations before age three	Danish Longitudinal Child Panel
<i>Physically disabled</i>	Dummy for being physically disabled	Danish Longitudinal Child Panel
<i>Full term birth</i>	Dummy for full term birth	Danish Longitudinal Child Panel
<i>Arranged for care</i>	Dummy for having care arrangements at age six months	Danish Longitudinal Child Panel
<i>Waiting list</i>	Dummy for being subject to waiting list for municipality provided child care at age six months (may occur even within <i>GADK</i> municipality)	Danish Longitudinal Child Panel
Mother's Characteristics:		
<i>Age</i>	Mother's age in years	Statistics Denmark
<i>High school or below</i>	Dummy taking the value one if the mother has a high school degree or less education	Statistics Denmark

Table continues on next page

TABLE 3 CTD
DETAILED DESCRIPTION OF VARIABLES

Mother's Characteristics:		
<i>Vocational degree</i>	Dummy taking the value one if the mother has a vocational degree	Statistics Denmark
<i>Short further</i>	Dummy taking the value one if the mother has a short further education	Statistics Denmark
<i>Long further</i>	Dummy taking the value one if the mother has a long further education	Statistics Denmark
<i>Labor market experience</i>	Mother's labor market experience before giving birth (1995) measured in years	Statistics Denmark
<i>Degree of year employed in 1996</i>	Degree of the employment one year after giving birth	Statistics Denmark
<i>Degree of year employed in 1997</i>	Degree of the employment two years after giving birth	Statistics Denmark
<i>Degree of year employed in 1998</i>	Degree of employment three years after giving birth	Statistics Denmark
<i>Smoker</i>	Dummy taking the value one if the mother is a smoker	Danish Longitudinal Child Panel
<i>Single</i>	Dummy for being a single mother	Danish Longitudinal Child Panel
<i>Non-native speaker</i>	Dummy for being a non-native speaker	Danish Longitudinal Child Panel
<i>Disposable income in 1996</i>	Income after tax in 1996	Statistics Denmark
<i>Disposable income in 1997</i>	Income after tax in 1997	Statistics Denmark
<i>Disposable income in 1998</i>	Income after tax in 1998	Statistics Denmark
Municipality and Regional Characteristics:		
<i>Region 1</i>	Residing in county of Copenhagen, 1999	Statistics Denmark
<i>Region 2</i>	Residing in counties of Frederiksborg and Roskilde, 1999	Statistics Denmark
<i>Region 3</i>	Residing in counties of Western Sealand and Storstrøm, 1999	Statistics Denmark
<i>Region 4</i>	Residing in county of Fuen, 1999	Statistics Denmark
<i>Region 5</i>	Residing in counties of Southern Jutland and Ribe, 1999	Statistics Denmark
<i>Region 6</i>	Residing in counties of Vejle and Ringkøbing, 1999	Statistics Denmark
<i>Region 7</i>	Residing in counties of Aarhus and Viborg, 1999	Statistics Denmark
<i>Region 8</i>	Residing in county of Northern Jutland, 1999	Statistics Denmark
<i>Unemployment rate</i>	Share of unemployed among women in municipality, 16-49 years of age, 1999	Ministry of Interior
<i>Single parent children</i>	Share of single parent children 0-17 years old in municipality, 1999	Ministry of Interior
<i>Asylum seekers</i>	# of asylum seekers per 10,000 inhabitants in municipality, 1999	Ministry of Interior
<i>Third world immigrants</i>	# of third world immigrants per 10,000 inhabitants in municipality, 1999	Ministry of Interior

5. Regression Results

In order to determine what type of conditioning set is necessary for our regression results to be unbiased, we rely on the literature on child development and demand for child care for guidance. In the literature, a child's development is proposed to be a function of current as well as past mode and intensity of care, purchased inputs, and exogenous determinants (production shocks), see Ruhm (2004) for a sketch of such a production function approach. Furthermore, from the literature on demand for child care, e.g. Blau and Hagy (1998), we know that mothers' employment and the costs related to a given type of care are crucial factors.

Together, these models imply that we need a rich conditioning set describing firstly the types and the quality of available modes of child care. Furthermore, we need information about number of hours in non-parental care. That is, we must have information about the treatment. Here we use both information from the child panel about type and intensity of the chosen mode of care and municipality specific information from the Ministry of the Interior on quality of child care as measured by for example number of teachers per child, see Currie (2001). To proxy purchased inputs, mothers' employment, and costs related to a given type of care, we include detailed information on income and labor market history – also prior to giving birth – for the parents in our sample, see also Gregg (2005). Presumably, including such information stemming from before the child is born informs both about attachment to the labor market but also about ability. In principle, we also need information about past choices of child care. Unfortunately, we do not observe enrolment status before age 3, but we do condition on the parents' labor market behavior during this period. Thus, effectively, we condition on being enrolled in non-parental care: If both parents are full-time employees, the child must be exposed to some form of child care not exercised by the parents. Finally, we need information about the catch-all category of 'production shocks'. Here, we use a variety of information correlated with both child outcome and choice of care. We include information about the child measured at time of birth (birth weight, breast fed, gender, disabilities, number of siblings etc.), parents (geographic location, level of education, smoking behavior, immigrant status, /*to be included: whether the father took leave, whether the mother had postpartum depression*/), and municipalities (level of unemployment, number of immigrants /*age composition, winner of most recent local government election, change in birth cohort size*/). See

Table 3 above for a detailed description of the variables and Table A2 in the Appendix for means of the conditioning set across modes of care.

Having discussed our conditioning set, we next present our estimation results. The first column in Table 4 shows selected coefficient estimates from estimating the effect of municipality provided care vs. home. That is, we attempt to uncover (1) above. We see that the parameter estimate to municipality provided program participation is positive indicating that being enrolled in municipality provided care increases the SDQ index with 0.7 points, yet the estimate is not statistically significant. This is line with the findings from Andersen, Dedding, and Lausten (2006), who, using the same data set as we do, investigate the effects of parents' labor market behavior on child outcomes.

As pointed out, however, (1) is not easily interpretable and given the very different structures and content of the two types of programs, we might expect the effects of the two to differ. To accommodate this, we shift attention to the effect of being enrolled in family day care relative to home care, (2), and the effect of pre-school vis-à-vis home care, (3). Again, we estimate these parameters using OLS in a pooled model. The results are shown in the second column in Table 4. We see that family day care and pre-school are indeed *not* the same and does not have the same effect on child outcomes. More precisely, being enrolled in pre-school seems neutral compared to home care; the estimated effect is small, 0.35 SDQ points, and insignificant, whereas being enrolled in family day care significantly increases SDQ with 1.8 points.

Consistent across the two models is that being breast fed, having high birth weight, not being disabled, and being born to a relatively older mother who does not smoke and who is not single is negatively correlated with SDQ. Put differently, these characteristics are correlated with better child outcomes.

TABLE 4
OLS COEFFICIENT ESTIMATES^a
OUTCOME: SDQI, MUNICIPALITY PROVIDED PROGRAMS VS. HOME

Variable	Model I		Model II	
	Coefficient	Std. Error	Coefficient	Std. Error
<i>Child care at age 3</i>				
Municipality provided program	0.733	0.534	•	•
Family Day Care	•	•	1.766	0.615
Pre-school	•	•	0.350	0.543
# prior non-parental care facilities	0.111	0.090	<i>0.203</i>	0.097
<i>Child characteristics</i>				
Girl	-0.095	0.545	-0.091	0.545
Siblings	-0.001	0.101	0.006	0.101
Breast fed	-1.656	0.374	-1.645	0.373
Birth weight (in 1000 grams)	-0.377	0.127	-0.375	0.127
# hospitalizations	-0.064	0.245	-0.074	0.245
Physically disabled	1.047	0.402	1.028	0.402
Full term birth	-0.001	0.149	-0.003	0.149
Arranged for care	-0.207	0.184	-0.180	0.185
Waiting list	0.176	0.207	0.197	0.207
<i>Mother's characteristics</i>				
Age	-0.138	0.023	-0.140	0.023
Vocational degree	-0.430	0.615	-0.439	0.614
Short further	-0.663	0.769	-0.685	0.768
Long further	-0.156	1.781	-0.323	1.780
Labor market experience	-0.021	0.017	-0.019	0.017
Degree of year employed in 1996	0.146	0.321	0.164	0.321
Degree of year employed in 1997	-0.228	0.342	-0.246	0.341
Degree of year employed in 1998	-0.294	0.292	-0.314	0.292
Smoker	1.222	0.170	1.225	0.170
Single	1.329	0.449	1.324	0.449
Non-native speaker	0.934	0.659	1.001	0.659
# observations	4343		4343	
R ²	0.088		0.09	

^aThe conditioning set also includes cross terms between municipality provided program and mothers level of education, cross terms between municipality provided program and gender, municipality level information, and regional dummies. Bold coefficients are significant at the 5% level and italic indicates significance at the 10% level.

As discussed above, a general finding in the literature is that children with poor socio-economic backgrounds benefit from being enrolled in high-quality programs. If treatment effects are heterogeneous, we will not expect the parameters in Table 4 above to be representative for all groups. To address this, we investigate whether the estimated effects differ with mothers' level of education. Similarly, girls may be affected differently from participation compared to boys. Table 5

shows the effects of family day care and pre-school compared to home care for different subgroups of the population.

TABLE 5
SELECTED OLS COEFFICIENT ESTIMATES^a
OUTCOME: SDQI, MUNICIPALITY PROVIDED PROGRAMS VS. HOME

	Family Day Care		Pre-school	
	Coefficient	Std. Error	Coefficient	Std. Error
Girls of mothers with high school or below	0.253	0.740	-0.317	0.701
Boys of mothers with high school or below	2.460	0.867	1.165	0.815
Girls of mothers with vocational degree	-0.048	0.768	0.451	0.796
Boys of mothers with vocational degree	1.679	0.797	0.525	0.778
Girls of mothers with further education	-0.769	0.901	-0.090	0.851
Boys of mothers with further education	-0.336	0.835	-0.850	0.767

^aThe conditioning set is the same as that of Table 4. Bold coefficients are significant at the 5% level and italic indicates significance at the 10% level.

Interestingly, there does seem to be important differences in *who* is affected by being placed in non-parental care. The result that pre-school works as well as parental care holds true across all subpopulations considered. But the result that family day care cause child outcomes to deteriorate is clearly only significant in the case for boys and then only when the mother has relatively low education (high school or below or vocational degrees). Boys born to mothers with a high school degree or below will observe an increase in SDQ of 1.2 points compared to being taken care of at home. Similarly, boys born to mothers with a vocational degree experience a 0.5 point increase in SDQ. The literature on the effects of early maternal employment on child outcomes does not agree on whether boys fare better or worse from this compared to girls; see Ruhm (2004). Presumably, part of explanation is the lack of information about the type and quality of non-parental care.

Another interesting question is whether parents should choose pre-school over family day care *given* that the child is not in parental care. If in fact the parametric linear model is correct and our

conditional independence assumption holds true, we could easily answer this question and uncover (4) by comparing the two treatments in Table 5 above. Alternatively, one could restrict the sample to include only children in either family day care or pre-school. If our conditioning set does a poor job of explaining the selection out of home care we will expect these estimates to differ. The results are shown in Table 6 below. We see that boys born to mothers with lower levels of education would benefit from being enrolled in pre-school compared to family day care. The results are not different from what one finds from Table 5. Thus so far, there does not seem to be evidence that our conditional independence assumption is violated.

TABLE 6
SELECTED OLS COEFFICIENT ESTIMATES^a
OUTCOME: SDQI, MUNICIPALITY PROVIDED PRE-SCHOOL VS. FAMILY DAY CARE

	Kindergarten	
	Coefficient	Std. Error
Girls of mothers with high school or below	-0.485	0.543
Boys of mothers with high school or below	-1.308	0.624
Girls of mothers with vocational degree	-0.368	0.481
Boys of mothers with vocational degree	-1.236	0.532
Girls of mothers with further education	0.745	0.544
Boys of mothers with further education	-0.500	0.499

^aThe conditioning set is the same as that of Table 4. Bold coefficients are significant at the 5% level and italic indicates significance at the 10% level.

Finally, we consider the effects of hours in family day care (5) and pre-school (6) conditional on choosing a specific type of municipality provided care. We split hours in care into six categories: 10 hours or less, 10-20 hours, 20-30 hours, 30-40 hours, 40-50 hours, and above 50 hours. Unfortunately, because we are performing comparisons at the margin (comparing, for example, the group of children spending 20-30 hours in family day care with those spending 30-40 hours), the size of our data set does not allow us to construct estimates specific to gender and mother's level of

schooling while maintaining power. Table 7 below shows these results. We see that increases in hours from 0-10 to 10-20 and 10-20 to 20-30 are benign no matter the choice of care. This is maybe not surprising since spending less than 30 hours in non-parental care allows for significant time both with the parents and with peers. Further increasing hours, however, seems to significantly worsen child outcomes.

TABLE 7
EFFECTS OF HOURS IN CARE^a
OUTCOME: SDQI, MUNICIPALITY PROVIDED PROGRAMS

	Family Day Care		Pre-school	
	Coefficient	Std. Error	Coefficient	Std. Error
10-20 hours compared to 0-10 hours	•	•	0.183	1.543
20-30 hours compared to 10-20 hours	0.023	1.965	-0.545	0.586
30-40 hours compared to 20-30 hours	0.407	0.500	0.832	0.222
40-50 hours compared to 30-40 hours	0.833	0.404	0.640	0.220
Above 50 hours compared to 40-50 hours	3.553	3.896	0.434	1.352

^aThe conditioning set is the same as that of Table 4. Bold coefficients are significant at the 5% level and italic indicates significance at the 10% level.

6. Instrumental Variable Results

An alternative strategy for uncovering our parameters of interest is to look for variation in the take-up of child care which is unrelated to child outcomes. In this section we exploit that some municipalities have waiting lists for pre-school but not for family day care. This leads some municipalities to provide guaranteed access to pre-school (*GAK*), a policy which we use to estimate the effect of participating in pre-school compared to family day care, see (4) above.

The *GAK* policy applies to all preschool children within a municipality, yet the parents cannot themselves decide on a specific pre-school. In case of waiting lists, open slots in child care are

allocated according to length of time on the waiting list and age. Note that waiting lists may occur even in municipalities that do provide *GAK* if parents do not accept the offers they are given. Centers may, for example, be placed further away from the home than the parents would prefer. Table 8 shows the distribution of *GAK* across the counties of Denmark.

TABLE 8
DISTRIBUTION OF *GAK* ACROSS REGIONS

Counties	Share with <i>GAK</i>
Copenhagen	0.701
Frederiksborg and Roskilde	0.278
W. Sealand and Storstrøm	0.032
Fuen	0.056
S. Jutland and Ribe	0.189
Vejle and Ringkøbing	0.211
Aarhus and Viborg	0.418
N. Jutland	0.437

If parents value pre-school over and above family day care, we should expect *GAK* to increase the take-up of pre-school. This can, of course, be tested with our data.

Not only does the instrument have to affect the take-up of pre-school, it also needs to provide us with variation in the take-up of non-parental care, which is (conditionally) unrelated to child outcomes. Importantly, *GAK* information provides us with potential variation in the take-up of pre-school, which is not a parental choice variable and it has, for sure, no causal effect on child outcomes (unless spill-over effects on other children... assumed to be negligible, SUTVA) . The problem, therefore, is that of ensuring that the conditioning set is rich enough.

Of course, it would invalidate our instrument if parents with more to gain from *GAK* settle accordingly. Firstly, according to Simonsen (2006), there is very limited movement to and from *GAK* municipalities (find corresponding numbers for this data set). Secondly, there is municipality specific variation in the provision of *GAK* over time (info about this??). A couple can therefore not be sure that a municipality will not change its policy. This does, of course, not exclude the possibility that people settle because of child care policies but it decreases the probability. Thirdly, it is unlikely that the child care policy is the main driver for settlement when compared to job opportunities and prices of real property. Furthermore, we condition on the number of older

siblings, which is expected to capture part of the expected gains from living in a municipality with *GAK*. We realize, of course, that child care policy is likely to be correlated with other municipality specific characteristics, which may affect, on the one hand, the woman's (or couple's) decision of where to live and, on the other hand, the municipality's capability of providing services in general. To counter this, our conditioning set includes municipality characteristics as in Gustafsson and Stafford (1992). Elections...

As pointed out earlier, treatment effects likely vary across individuals. For us to identify a meaningful parameter by using IV, we need an additional assumption, *monotonicity*, see Imbens and Angrist (1996). This assumption implies that the instrument must affect individuals' behavior in one direction only. Because we have excluded the group of parents choosing home care from our analysis, we need an extended version of monotonicity. In particular, we need it to be the case that

- 1) parents who use pre-school under a *GAK* regime must not use home care in the absence of *GAK*,
- 2) parents who use family day care under a *GAK* regime must not use either pre-school or home care in absence of *GAK* and
- 3) parents who choose home care under a *GAK* regime must not use either pre-school or family day care in the absence of *GAK*.

This information is summarized in Table 9 below along with the shares of our sample choosing each mode of care across the two regimes. We clearly see that more children are in pre-school under the *GAK* regime and, similarly, fewer children are in family day care. These trends along with the fact that the share of children in home care under the *GAK* regime is not significantly different from the share in home care under the *no GAK* regime offer tentative evidence that the monotonicity assumption is fulfilled.

TABLE 9
STATES RUINING MONOTONICITY ^a

		GAK=1			
		Kindergarten	Family day care	Home care	
GAK=0	Kindergarten		no	no	0.58
	Family day care			no	0.22
	Home care	no	no		0.16
		0.81	0.04	0.12	

^a 'no' indicates a state that must not occur under extended version of monotonicity

Given heterogenous treatment effects and the monotonicity assumption, our IV procedure will estimate a *local* average treatment effect, not the average treatment effect:

$$(4') \quad E[SDQ_2 - SDQ_1 \mid K(GAK) - K(no\ GAK) = 1]$$

i.e. the difference in child outcome with and without pre-school exposure for the group of children who would be enrolled in pre-school if they live in a municipality that guarantees access to pre-school but not otherwise. In other words, these are children of parents who are truly affected by a limited supply of slots. Clearly, some children may not enroll in pre-school under either regime, for example, if their parents are very selective in their choice of center or, along the same line, if one of the parents has strong preferences for staying at home. Similarly, some children may always be enrolled in pre-school. This may occur by sheer luck (there is a probability that a child is always granted a slot). Always- and never-takers in the terminology of Angrist, Imbens, and Rubin (1996) do not contribute with any variation and therefore do not affect the parameter estimate.

Table 10 below shows the results from estimating (4') using 2SLS. Firstly, note that the instrument is highly significant in all regressions⁹ and works in the expected direction. We see that, qualitatively, the conclusions from our regression analysis are largely confirmed: pre-school participation significantly improves child outcomes for the entire sample though only at the 10% level. Allowing these effects to vary across gender and according to mothers' level of education demonstrates again that this is driven by the group of boys born to mothers with lower levels of education. Here, as opposed to the regression analysis, boys born to mothers with a high school

⁹ The t-statistic to the instrument is 11.00 in the regression using the entire sample and around 4 in all sub-population regressions.

degree or less seem unaffected by the choice of mode of care. All standard deviations are large, however.

TABLE 10
IV COEFFICIENT ESTIMATES^a
OUTCOME: SDQI, MUNICIPALITY PROVIDED PRE-SCHOOL VS. FAMILY DAY CARE

	First Stage		Pre-school	
	Coefficient	Std. Error	Coefficient	Std. Error
Full Sample	0.151	0.014	-2.200	1.294
Girls of mothers with high school or below	0.164	0.040	-2.733	3.505
Boys of mothers with high school or below	0.171	0.034	-0.869	4.289
Girls of mothers with vocational degree	0.143	0.035	1.565	2.791
Boys of mothers with vocational degree	0.130	0.033	-6.340	3.148
Girls of mothers with further education	0.137	0.031	2.200	3.162
Boys of mothers with further education	0.154	0.035	-3.890	2.787

^aThe conditioning set is the same as that of Table 4. Bold coefficients are significant at the 5% level and italic indicates significance at the 10% level.

7. Discussion

This paper provides important new evidence on the effects on non-cognitive child outcomes of being enrolled in publicly provided care compared to home care. We find that, on average, participating in non-parental care is neutral compared to home care. Distinguishing between different types of non-parental care demonstrates, however, that pre-school and family day care result in very different outcomes compared to home care. Pre-school is found to be as good as home care no matter the gender and mother's level of education. Family day care, on the other hand, seems to reduce non-cognitive skills for boys born to mothers with low levels of education. Furthermore, increases in hours enrolled in both family day care and pre-school above the mean of 30 hours deteriorates child outcomes.

Our findings are not fully in line with the (rather sparse) literature on universal child care such as Baker et al. (2005). There are, however, good reasons for that. Firstly, Baker et al. (2005) evaluate the transition from one regime to another. As such, the study provides crucial information about the costs of switching from one regime to another but the effects of a transition may not be a good indicator of the effects of the end-regime. For example, in the Baker et al. (2005) set-up, the number of slots is increased by 400% in three years and though the child/staff ratios were only decreased slightly (1:8 to 1:10 for 4-5 year olds), the increase in slots generated huge demand for new staff. Newly hired staff is likely less experienced and may also be drawn from the lower end of the skill distribution. (Furthermore, it may be a completely different – and traumatizing - experience for a 4 year old who is used to being taken care of at home to suddenly be exposed to public child care than for a...) Similarly, a large number of mothers are induced by the policy change to participate in the labor market. Presumably, this group consists of women with lower labor market outcomes and greater attachment to their homes (otherwise they would have participated before the policy was implemented). This group may not be representative of the population in general and their experiences of the transition from being a stay-at-home mother to being an employee are therefore probably not representative either.

Things to do and think about:

ADD FATHER INFO, ADD MORE INFO ABOUT THE MOTHER, ADD QUALITY OF CARE MEASURES, ADD INFO ON POST-PARTUM DEPRESSION

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Appendix

TABLE A1
LIST OF QUESTIONS USED TO
CONSTRUCT THE SDQ INDEX^a

Considerate of other people's feelings
Restless, overactive, cannot stay still for long
Often complains of headaches, stomach-aches or sickness
Shares readily with other children, for example toys, treats, pencils
Often loses temper
Rather solitary, prefers to play alone
Generally well behaved, usually does what adults request
Many worries or often seems worried
Helpful if someone is hurt, upset or feeling ill
Constantly fidgeting or squirming
Has at least one good friend
Often fights with other children or bullies them
Often unhappy, depressed or tearful
Generally liked by other children
Easily distracted, concentration wanders
Nervous or clingy in new situations, easily loses confidence
Kind to younger children
Often lies or cheats
Picked on or bullied by other children
Often offers help to others (parents, teachers, other children)
Thinks things out before acting
Steals from home, school or elsewhere
Gets along better with adults than with other children
Many fears, easily scared
Good attention span, sees work through to the end

^aParents answer "not true", "somewhat true", or "certainly true". See www.sdqinfo.com for the score sheets.

TABLE A2
MEANS OF VARIABLES BY MODE OF CARE^a

	Home		Pre-school		Family Day Care	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Child Care at age three:						
<i>Hours in non-parental care</i>	4.41	11.88	33.02	7.14	34.37	7.21
<i># prior non-parental care facilities</i>	1.82	0.87	2.75	0.80	1.95	0.71
Child Characteristics:						
<i>Girl</i>	0.47	0.50	0.48	0.50	0.49	0.50
<i>Siblings</i>	1.04	1.03	0.77	0.83	0.81	0.85
<i>Breast fed</i>	0.95	0.22	0.96	0.20	0.95	0.21
<i>Birth weight (in 1000 grams)</i>	3.48	0.65	3.50	0.60	3.53	0.58
<i># hospitalizations</i>	0.89	0.32	0.88	0.32	0.91	0.28
<i>Physically disabled</i>	0.02	0.13	0.04	0.19	0.04	0.20
<i>Not born too early</i>	0.45	0.50	0.45	0.50	0.46	0.50
<i>Arranged for care</i>	0.29	0.45	0.32	0.47	0.34	0.47
<i>Waiting list</i>	0.16	0.37	0.22	0.41	0.20	0.40
Mother's Characteristics:						
<i>Age</i>	27.84	4.90	28.37	4.61	28.23	4.34
<i>Vocational degree</i>	0.33	0.47	0.37	0.48	0.42	0.49
<i>Short further</i>	0.14	0.35	0.23	0.42	0.20	0.40
<i>Long further</i>	0.04	0.21	0.07	0.26	0.05	0.21
<i>Labor market experience</i>	6.19	5.88	7.37	5.81	7.15	5.50
<i>Degree of year employed in 1996</i>	0.40	0.35	0.55	0.35	0.57	0.34
<i>Degree of year employed in 1997</i>	0.44	0.42	0.64	0.40	0.65	0.39
<i>Degree of year employed in 1998</i>	0.46	0.43	0.67	-0.39	0.70	0.38
<i>Smoker</i>	0.34	0.47	0.30	0.46	0.31	0.46
<i>Single</i>	0.06	0.24	0.04	0.19	0.02	0.15
<i>Non-native speaker</i>	0.03	0.17	0.02	0.13	0.00	0.07
Municipality and Regional Characteristics:						
<i>Region 1</i>	0.20	0.40	0.23	0.42	0.03	0.17
<i>Region 2</i>	0.07	0.26	0.13	0.33	0.05	0.22
<i>Region 3</i>	0.12	0.33	0.10	0.29	0.08	0.27
<i>Region 4</i>	0.10	0.29	0.08	0.27	0.14	0.35
<i>Region 5</i>	0.09	0.28	0.10	0.31	0.09	0.29
<i>Region 6</i>	0.12	0.32	0.11	0.31	0.23	0.42
<i>Region 7</i>	0.21	0.41	0.17	0.37	0.23	0.42
<i>Region 8</i>	0.10	0.30	0.10	0.30	0.14	0.35
<i>Single parent children</i>	13.19	4.42	14.27	4.26	11.48	3.32
<i>Asylum seekers</i>	22.57	64.77	19.81	71.65	26.21	78.47
<i>Third world immigrants</i>	288.17	219.15	327.98	218.36	214.72	143.25

^aBold coefficients indicate that means are significantly different (at the 5% level) from those of home care.