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## Abstract:

Preschools offer opportunities to enhance life chances for all children, and especially socially disadvantaged children. In the Nordic universal preschool systems, however, it is not clear if preschools provide equal social and intellectual opportunities for socially disadvantaged children. This paper presents the design and effects of a new Danish Early Childhood Education and Care (ECEC)-intervention program. The intervention program, the Action Competences in Social Pedagogical Work with Socially Endangered Children and Youth (ASP-program), aim at improving all children's well-being and cognitive functioning and specifically the situation for socially disadvantaged children. The ASP-program consists of education and training of ASP staff by means of three elements: presentation of knowledge, opportunities given for reflection on the staff's own experiences of socially disadvantaged children at their preschools and local implementation of improvements that are design by the preschool staff themselves. In a first step, the effect of ASP on all children was studied. In two municipalities 58 preschools were selected, 29 were randomly allocated to an intervention group and 29 to a control group. The preschool staff assesses each child with the Strengths and Difficulties Questionnaire (SDQ). Data was collected from 2369 children at three occasions, at the start of the project in September 2006, in May 2007 and by the end in May 2008. Two statistical methods were used to analyze the data, firstly a non-parametric growth-curve model that take into account the hierarchical nature of the data, and secondly a difference – in – difference method that uses only within-child differences between the intervention group and the control group. Both methods demonstrated statistically significant effects in favor of the intervention group on all five SDQ dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, peer relations and pro-social behavior.

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## 1. Introduction

From educational and social research, we know that socially disadvantaged children struggle with impaired life opportunities during schooling and their later education and with community life (Adamson, 2010; Nordenbo et al, 2008, 2009, 2010; Bennett, 2009, 2006). Effects of this vulnerability appear already in preschool.

Social inequalities are a major determinant of children life opportunities and health (WHO, 2008). Interventions during early childhood are an essential route for reducing these inequalities (Irwin et al., 2007). Such interventions might be directed at living conditions of families, at parents themselves or at settings outside the family. To offer children complementary settings is practicable in both high and low-income countries. The main model is the preschool, which has been demonstrated to improve children's intellectual competences and their socio-emotional development (Esping-Andersen, 2002; Heckmann, 2008; Heckman et al., 2010), which in turn improves their educational, economic and social life chances. Accordingly, preschool has been offered to socially disadvantaged children in many Western countries since the mid 20<sup>th</sup> century. High quality studies of these kinds of interventions started in the 1960s in the US, e.g. studies of the Perry Preschool Programme in Ypsilanti (Michigan). Long-term follow-up of the participating children until age 37 and 40 demonstrate substantial positive effects (Muennig et al., 2009; Schweinhart et al, 2005; Nores & Barnett, 2009). A significant number of studies and reviews of programmes for disadvantaged children in the US have also demonstrated beneficial effects (Barnett, 2008; Barnett & Masse, 2007; Belfield et al., 2005, 2006; Currie & Neidell, 2007; Pianta et al., 2009). During recent decades high-quality studies have been carried out in the UK, which also demonstrate favorable effects (Sylva et al., 2011).

In both the US and UK, preschool interventions have mainly targeted socially-disadvantaged children. This seems to make economic sense since preschools are relatively costly. Yet, the relationship between social disadvantage and health outcomes is continuous (Mielck et al., 2002). That means that at population level, the total effects of the social disadvantage will be larger than the aggregated effect of social disadvantage of the neediest children. In public health, this phenomenon is often termed "the prevention paradox" (Rose, 1998). Therefore, it is favorable to offer large groups of children preschool. This has been the approach in the Nordic countries during recent decades, where more than 90 percent of all children above age two now attend preschools. It is possible that this almost universal preschool system contributes to the internationally relatively low educational inequalities in the Nordic countries (Adamson, 2010), although it is hard to disentangle the contribution of preschools from other national characteristics that also effect children.

Yet, in the Nordic countries, in spite of almost universal preschools, there are still significant inequalities, both in health and educational outcomes (Adamson, 2010). Thus, it is hypothesized that enrichment of ordinary preschools could decrease health inequalities in children. This paper describes a method for enriching preschools, the Action Competences in Social Pedagogical Work with Socially Endangered Children and Youth (ASP-program), it's design and a first analysis of it's effects.

### *Nordic preschools*

The Nordic preschools developed during the 1970s and 1980s and are almost universal today. They have two major functions (Korsvold, 2008). Firstly, by taking care of children, preschool enable both parents to work outside the home. This contributes both to gender equality and to national productivity. Secondly, preschools are expected to enhance

children's competences, which in turn augment their life chances later on. Nordic preschools are highly subsidized by public funding, which enables low parental fees, employment of well-qualified staff and high staff-to-child ratios.

In the Nordic countries, it is customary for employees in the educational sector to have a higher degree of autonomy in their work than in Anglo-Saxon countries, so it is not customary to implement fixed, externally-developed intervention, with a top-down implementation strategy, as has been the case in many American studies. Consequently, an intervention programme which is based on a top-down strategy is hard to transfer to the Nordic context.

A Nordic approach to learning in preschools builds on a social-constructivist and symbolic-interactionistic (Mead, 1934) understanding of children's learning. This understanding is combined with aspects of Dewey's theory that humans learn by inquiring curiously, by being investigative and by thinking critically (Dewey, 1938). Accordingly, children are understood to learn through actual action, inquiry and curious investigation. Thus, the focus is on creating learning situations and learning environments rather than on teaching procedures. Following this conviction, preschool teachers do not simply offer children defined sets of instruction or materials. Instead, teachers have been trained to develop learning environments and situations that stimulate cognitive and socio-emotional learning, wellbeing and resilience (Rutter & Rutter, 1993; Rutter, 2009, Werner, 2009). This child-centred learning approach is designed to be accessible to all children, i.e. both children from disadvantaged and privileged backgrounds.

The US studies were directed at socially disadvantaged children. These studies indicate that early intervention in ECEC ensures lasting benefits for this children (Anderson et al., 2003; Schweinhart, 2006; Schweinhart et al, 2005; Belfeld et al., 2005; Nores & Barnett, 2009; Puma et al., 2010. The Nordic preschools, however, targets all children and not only the socially disadvantaged group. It is not clear how well this universal approach benefits children at risk.<sup>1</sup> Despite well-developed ECEC-facilities in Scandinavia, targeted intervention programs in ECEC have not been tested in Scandinavia..).

The rest of this paper is organized as follows: Section 2 presents the intervention program, the ASP-program, including the development of content and training program of preschool staff. Section 3 the design of the evaluation study. Section 4 describes the methods used, data collection and drop out analysis, while section 5 presents the results and section 6 offers a discussion of the findings.

## **2. Enrichment of preschools: ASP, a new inclusive ECEC (Early Childhood Education and Care) programme**

Children are affected both by their environments at home and at preschool. The home environment of socially disadvantaged children is understood to be suboptimal. Socially-disadvantaged children's basis for learning differs widely from more privileged children's (Bernstein, 2003; Bourdieu & Passeron, 1977). Often the most-privileged children have obtained more developed competences at home, 'tools of the culture' (Bruner, 2007) than less-privileged children. Consequently, preschool might be expected to mean more for the development of disadvantaged children.

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<sup>1</sup> Danish day-care facilities are often referred to as high end (reference), because staffing is generous and well trained in international comparison and facilities are often of very high quality. However, until very recently, for all Danish (as well as most Nordic) day-care facilities there was no formal emphasis on learning and education, as they are primarily established to provide day-care facilities. All learning and skill progression that happens to children because of day-care enrollment is based on informal emphasis on non-cognitive skill development, including socio-emotional skills. Most often children are not formally tested or evaluated. Hence, the reader should bear in mind that the traditional emphasis in the Danish ECEC context is on care and not on formal training and education.

Accordingly, general enhancement of the pedagogy of preschools would also be expected to especially benefit disadvantaged children. Building on this premise, the ASP seeks to generally enrich preschool pedagogy with a special focus on the needs, intellectually and socially, of disadvantaged children.

The quality of the pedagogy of preschool seems to be decisive for an effect, both short and long term (Sylva et al., 2011). This quality could be improved in different ways. A common approach in Anglo-Saxon programmes is to offer teachers a fixed set of well-defined modules. This kind of intervention can easily be replicated, which is a major advantage. The effects of a specific module could also be well documented. Yet, it is not given that all modules are appropriate for all settings and all teachers. Therefore, it is advantageous to design quality-enhancing measures in ways that are appropriate for teachers at specific preschools. This approach, however, requires a substantial proportion of academically-trained preschool teachers. In Nordic preschools, in contrast to preschools in the US, this is the case since approximately half of all preschool teachers have at least three years of academic education. Moreover, teachers in the Nordic countries are trained to work autonomously within a framework of general instructions rather than with a given set of procedures. Thus, the common approach of Anglo-Saxon programmes is not optimal for Nordic preschools (see also Jensen, 2011).

A successful Nordic programme must be able to both make use of results from international studies and to build on the autonomous work of teachers in Nordic preschools. A major constraint on most intervention in preschools and in other settings is, however, failing implementation (Guldbrandsson, 2008). Two common explanations are a perception by staff that there is no need for intervention and that intervention is not relevant for their specific setting. These constraints are specifically addressed in ASP. Thus, the core of ASP is to train teachers to address needs they have observed themselves and to use pedagogical methods they have found relevant for their specific setting.

The intervention programme presented here is the ASP Programme, which is a Danish ECEC-governmental programme aimed at improving children's life opportunities through education and through training innovative staff skills. The motivation behind the intervention is that ECEC systems in preschools often fail to provide equal social and intellectual opportunities for all children. It has been shown in Nordic studies that implicit exclusion mechanisms in preschools often have a social gradient. Moreover, some of the mechanisms of social stratification were found in ECEC-systems (Bennett, 2006, 2009; OECD, 2011). Based on these findings, the ASP intervention programme focuses on both learning and social inclusion in preschools.

The ASP-program aims to enhance children's cognitive and 'non-cognitive' competences (Borghans et al, 2008) among the non-cognitive competences of importance in this context are openness, motivation to learn, ability to concentrate, temperament, (Goldberg, 1993 and Digman 1989) and resilience in challenges.

Thus, the design of the ASP-program, inspired by well-known American intervention programs, is novel. Moreover, the design is inspired by the results of research in resilience coping, which call for a program content that seeks to capture a twofold perspective: 1) Stimulation of children's personal and social well-being and capabilities, action competences and learning and 2) an inclusive pedagogical practice that provides children with a sense of attachment to and security in communities. The ASP-program differs from the well-known American programs by applying a broader focus than simply the individual and directs attention to the individual in his/her context while placing emphasis on stimulating children's cognitive and non-cognitive competences through inclusive pedagogy.

Previously described international programs provide us with valuable information and inspiration. Yet, they cannot be directly transferred to the situation and conditions of parents and children today, nor to a modern welfare society such as the ones in which the ASP project are implemented. This is because 95% of all children in Denmark attend preschool. Consequently, the effort must involve all children, i.e. it must be able to include and to stimulate each individual child's learning and social development.

The core of ASP is to educate and train preschool teachers to reflect on their daily practice, in order to enable them to improve children's learning with a focus on disadvantaged children. This way of learning is defined by inquiries and joint commitment rather than by predefined solutions. Thus, instead of uniform materials or routine activities, ASP focuses on pedagogical observations of learning situations that encourage or hinder children's progress. Teacher reflection on ordinary activities is a core concept. In a large number of controlled studies, this approach has been found to be highly effective in promoting children's development (Hattie, 2008).

The teachers' ability to reflect on their own practices is enhanced by learning about the components of successful ECEC programmes that had been carried out internationally. Thus, a part of ASP is to provide teachers with knowledge of these programmes. ASP, however, did not develop pre-fixed materials, which often are used in studies of preschool interventions. Instead, teachers were encouraged to incorporate aspects of these programmes they had found relevant into their own practice. Studies of preschool programmes that aim at disadvantaged children have often been carried out in settings with extra resources. This aspect increased the possibility of detecting statistically-significant effects. Such programmes, however, are difficult to implement on a large scale. Therefore, the ASP programme was designed to work with ordinary resources at regular preschools. In short, ASP incorporates the findings of international studies of preschool intervention into the Nordic setting with near-universal preschools and well-educated staff.

#### ***ASP: Education and training of preschool teachers***

The qualification strategy for staff in ASP consists of education and training through three elements: knowledge, reflection and implementation.

*The knowledge element* is based on an ASP-qualification folder, which presents evidence-based knowledge about 1) socially disadvantaged children, background variables and the concept of competence in a broad sense related to children's ability to act as active subjects; 2) effects of intervention based on international research; and 3) knowledge about national legislation in the field (national curricula in preschools) (Danish Ministry of Social Affairs, 2004, 2011) Knowledge of these three areas is merged with a fourth field of knowledge, practitioners' experience-based knowledge, which comprises both explicit and implicit experiences from practice, theory and common knowledge from institutions.

*In the reflection and critical analysis element*, the gap between daily practices at individual preschools and knowledge from the ASP-Qualification folder is reviewed. Any divergence between the preschool staff's understanding of their own skills and competences and the children's needs is also discussed. This reflection serves as a tool for the staff to suggest improved practices at preschools. The structure for reflection and critical analysis is quite open. The starting point is observations that surprised staff or do not happen in accordance with expectations. All staff at a given preschool meets regularly in a group to discuss these issues. Weekly meetings are recommended.

*The implementation element* invites individual preschools to develop their own procedures for implementation of new routines. The manager of the individual preschool, together with the preschool staff, organizes the course of the process. The implemented changes are then documented and evaluated. Therefore, in-service training and supervision in documentation and evaluation is offered to the staff. Training processes are based on Dewey's theory of learning as investigation, critical thinking and analysis (Dewey, 1933). This type of organizational model for learning and innovation has been demonstrated to be effective, since it facilitates an organizational learning process (Easterby-Smith, 1997, 2011; Jensen et al, 2007; Lundvall & Nielsen, 2007).

Organizational learning is as defined by Elkjaer & Wahlgren (2006, 21), an integral part of the practice of everyday organizational life and work. From this perspective, learning is not restricted to taking place inside individual minds, but instead is something that comes out of participation in organizational practices. As a result, preschool staff constructs their understanding of children, learning, social disadvantage and health based on their participation in the practices of the preschool. In the ASP programme, staff actively integrates new knowledge and reflections from education and training courses that are offered with their previous practice-based knowledge and experience. The ASP programme thus understands learning as something that emerges from learners' active involvement in practices at preschool (ibid.).

Thus, a starting point could be new perceptions of socially endangered children and their backgrounds. These new perceptions might result in creation of new habits and routines in pedagogical practices. An important tool for these organizational learning processes is critical-reflection groups.

Preschools work with renewal of practice, improving children's learning and well-being seen from an asset perspective and based on five curriculum themes: language, maths, natural science, body and culture. The staff implements new routines through the following activities:

- Adult-initiated learning activities with a range of selected themes;
- Child-initiated learning activities in inclusive learning environments;
- Stimulation of children's wellbeing and learning through active involvement;
- Supporting activities that train children's language and motor skills;
- Stimulation of children's curiosity and concentration through educational games;

Recognition of child progress: Encouragement of child to explore new personal sides and to embark on new activities, independently.

### **3. The design of the evaluation of the intervention**

In order to find out the effect of ASP, a randomized controlled experimental study was carried out in two representative Danish municipalities. Two Danish municipalities, A and B participated with in total in A 37 and in B 200 preschools. In a first step all preschools with at least 39 children were selected, in A 19 and in B 39. The participating 58 preschools were first stratified into three groups, high, medium and low socioeconomic status, based on linked information from Statistics Denmark on the parents of the children, their level of education, use of social welfare and unemployment. Within each of the three strata preschools were randomly selected to either the intervention (29) or the reference (29) group. Each preschool enrolled approximately 50 children and employed a staff of about 10, both educated preschool

teachers and non-educated assistant teachers. At the start of the study in September 2006, in total 2314 3-6 year-old children were enrolled in the experimental and reference preschools.

The intervention was carried out over 21 months, from September 2006 to May 2008. It was initiated and developed by researchers at Aarhus University. The three main activities were: workshops, education and training in reflection groups, and visits by local pedagogical consultants. During the intervention period, two workshops per year in each municipality were held, each with an average of 60 participants (one municipality) and 40 participants (the other municipality) and with an average duration of 6 hours. The main subjects covered were the knowledge elements presented in the ASP-qualification folder.

Each preschool decided on the number of occasions for working with knowledge and reflection and the time devoted to each occasion. Preschools on average set aside 17 hours with an average of 3 hours on each occasion. Thus, the time for reflection was considerably less than the weekly meetings that were recommended. Teachers from university colleges participated in most of these meetings. Each preschool was supported by a consultant from university colleges that participated as teachers in the ASP education and training process. The consultant usually held a candidate degree in pedagogy and some held a master's degree. On average, each preschool was visited by a consultant from a university colleges six times during the study period. Other consultants from municipalities assisted staff in making sense of the knowledge base, in developing the work in the reflection sessions, often once a week, and in implementing the improvements they had decided upon.

Three conferences for all participants were also arranged at the start of the programme in 2006 in the middle, in 2007, and at the end, in 2008. On these occasions, teachers from university colleges, consultants from municipalities and researchers participated. Two seminars for all employees were also arranged by two participating municipalities in the middle of the project in 2007. In order to structure the overall process, project leaders from University of Aarhus specified a number of common goals for all participating preschools that were expected to be reached during the intervention period.

#### **4. Methods, data collection and drop out analysis**

Data was collected from children at three occasions, at the start of the project in September 2006, in May 2007 and by the end in May 2008. The outcome for each child was scored by the day-care center staff based on the Strengths and Difficulties Questionnaire (SDQ) for assessing the psycho-social adjustment of children and adolescents (Goodman 1997). The SDQ scale consists of five sub-scales that measure different aspects of children's personal and social behavior. These sub-scales are a) emotional symptoms, b) conduct problems, c) hyperactivity/inattention, d) peer relational problems and e) pro-social behavior. In the analysis, all five scales are kept separate outcome measures.

Many studies confirm that the SDQ scale is an accurate measure of children's emotional, behavioral and social skills (see e.g. Muris et al., 2003 and Widenfelt et al. (2003)). As discussed by Widenfelt et al. (2003), it is reasonable to assume that the measurement is consistent across day-care center staffs and hence also across preschools in both the intervention and the control groups.

The data were collected just before, during (eight months into the intervention) and after the intervention (after 20 months). During the sample period, some children left the study, for example their parents moved the child to another

day-care facility or because the children became eligible for primary schooling. This subsequent child drop-out may be non-random across the intervention and control-groups. Indeed, some preschools had no children that were measured at all three data-collection points and some children could not be followed throughout all three data-collection periods even though they attended day-care center that provided measurements on some children at all three data-collection points. This was mainly because these children became eligible for preschool and subsequently left the preschools. For clarity of the entire drop-out process, we illustrate the data collection process is illustrated in figure one below.

----- figure 1 about here -----

Below is an analysis that shows that although some drop-outs occurred in the study, the intervention and control groups remain, nevertheless, remarkably comparable on pre-treatment SDQ scores. Table 1 below, shows the average SDQ baseline scores and standard deviations within the intervention and control groups by stayers and drop-out groups in the study. Table 1a shows average SDQ scores and Table 1b shows standard deviations on the SDQ scores.

----- Table 1a about here -----

Table 1a shows that within the intervention and control groups, drop-outs had different average pre-treatment SDQ scores than stayers. It also shows that within the group of drop-outs, drop-outs from centers that completely left the study were also different from drop-outs from centers that completed the study. More importantly, across intervention and control groups, average pre-treatment SDQ scores were not different for children that completed the entire study. Based on Table 1a, it can be concluded that drop-outs in the study did not cause selection bias when comparing intervention effects with later outcomes from children in the intervention and control groups, despite the fact that drop-outs are different from non-drop-outs. It turns out that dropping out is unrelated to being in the program or control group. Below is a formal statistical test of the mean pre-treatment SDQ scores among stayers and drop-outs across the intervention and control groups. Preceding the test is a further distributional comparison between the intervention and control groups by comparing standard deviations in pre-treatment SDQ scores among stayers and drop-outs. This is also illustrated in table 1b above.

Similar to the mean comparison in table 1a, these argues show that there were notable differences within the intervention group and the control group in the sense that both drop-out groups have different standard deviations compared to the standard deviations of the stayers. On the other hand, standard deviations of stayers in the intervention and control groups were remarkably equal. Hence, even if drop-outs were different from stayers in terms of heterogeneity, stayers were equally heterogeneous across treated and controls.

Finally, Table 1b shows results from regressing pre-treatment scores on status in the study, i.e. whether children stayed on, or dropped out, and whether the child was in the intervention or control group. The regression analysis was based on the age and the gender in order to entrance statistical efficiency and thereby increase the chances to detect statistical differences.

----- Table 1b about here -----

The multilevel regression analysis on pre-treatment scores formally confirms the pattern from table 1a. There are some differences between stayers in the intervention group (baseline) and other groups in the analysis. However, none seems statistically significant except for pro-social behavior in, non-drop-out centers in the control group, among those children that are not followed in all three periods. The likelihood ratio test statistic on whether all group indicators can be removed from the model is insignificant for all five SDQ sub-scales. Hence, overall there seemed to be no detectable differences between children by drop-out status in the study. We therefore believe that the balanced data is as good as randomly assigned data in spite of drop-outs in both groups.

The next section looks at treatment effects of intervention.

## 5. Results

In a first analysis, the aim was to show a general effect of the intervention; i.e. if there are mean differences in SDQ scores between the intervention and the control groups in the second and third periods, but not in the first baseline measurement period. In analyzes that will follow later on (not presented in this paper), the effect of socially disadvantaged children will be studied.

Two different statistical approaches were used. The first is a non-parametric growth-curve model (Goldstein, 2010), taking into account the hierarchical nature of the data with time-point measurements nested within children, and children nested within preschools. The growth curve models use within children, between children and between preschools variations in the response variable to estimate the effect of intervention. Therefore, the model allows estimation of parameters for independent variables, for example gender, that stay constant. However, in order to obtain consistent estimates of the causal effect of the treatment an independence assumption between the treatment and all error terms in the model is necessary. In case any of these assumptions are violated, the growth-curve model yields biased estimates of the treatment effect. The second method is the difference – in – difference approach, further explained below (see Bertrand et al. 2004) that uses only within-child differences between the intervention group and the control group to estimate the effect of the treatment. This method does not need the error terms of the child and preschools to be independent of the treatment in order to provide unbiased estimates of the treatment. Hence, comparing the growth curve estimates with the difference-in-difference-estimates provides a further robustness check of successful randomization between preschools in the intervention and the control groups. Furthermore, estimates of the treatment-effect parameters using the difference-in difference method have a less restrictive interpretation, because they only represent an estimate of the average treatment effect. Hence, using the difference-in difference method does not need to imply a uniform treatment effect across centers and children (see Wooldridge, 2010).<sup>2</sup> The drawback of the difference- in- difference method is that the effect of all independent variables that do not vary within child, for example gender, cannot be estimated with this approach.

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<sup>2</sup> The growth curve model has been estimated allowing for treatment heterogeneity at both the day-care center and child levels. However, this model involved a large number of error variance and covariance parameters, and estimation of these models turned out to be infeasible given the data.

Formally, the statistical model that contains the parameters of interest and to be estimates is:

$$y_{ijt} = \alpha + \sum_{t=1}^{t=2} \delta_t T_{ijt} + \gamma D_{ij} + \sum_{t=1}^{t=2} \lambda_t T_{ijt} D_{ij} + \beta x_{ij} + \nu_i + \nu_j + \varepsilon_{ijt}. \quad (1)$$

Here  $y_{ijt}$  is the SDQ measurement in the analysis for the  $i$ 'th child in the  $j$ 'th center at time  $t$  ( $t = 0, \dots, 2$ ), where 0 indicates the baseline measurement.  $\alpha$  is the average level of the SDQ measure in the baseline measurement. The coefficients  $\delta_t$ ,  $t = 1, 2$  capture differences in the average SDQ between the baseline and the two following measurements at time 1 and 2.  $T$  is a time dummy variable indicating that time is equal to 1 if the  $i$ 'th child is present in the  $j$ 'th day-care center at time  $t$ .  $D$  is a dummy variable indicating whether the center is in the intervention group, and  $\gamma$  is a coefficient capturing any overall difference between the intervention and control groups, i.e. the effect of the dummy variable,  $D$ . Successful randomization should warrant that  $\gamma$  is zero. The coefficients  $\lambda_t$ ,  $t = 1, 2$ ,<sup>3</sup> indicate any mean difference between centers in the intervention and control groups during intervention (they are switched on and off appropriately in the model by the interaction between time and intervention dummies). If these parameters are statistically different from zero, they indicate that the intervention has an effect on the SDQ score of the children in the intervention group. Finally,  $\nu_i$  and  $\nu_j$  are child and day-care center fixed effects. Randomization ensures that they are independent of placement in the intervention and control groups.

Table 2 shows estimates of the parameters in the model using the growth-curve model.

--- Table 2 about here -----

Table 2 illustrates that the parameters capturing the effect of the intervention in period one ( $\gamma_1$  in (1)) all indicate positive effects from the intervention (they are all negative except of pro-social behavior where the coefficient is positive), but only the effect for conduct problems and hyperactivity inattention is statistically significant and only at a ten percent significance level. However, for the effect parameters in period two, there are larger effects compared to period one for both emotional symptoms and conduct problems, which are now significant at the one percent level (note that negative effects for the first four domains of the SDQ indicates less problems in each of these domains). A similar-sized effect for hyperactivity inattention is significant at the five percent level. For peer relationship and pro-social behavior, there were no significant effects for either time period one or two. In sum, the intervention seems to have had a positive and growing effect (i.e. negative parameters) on emotional symptoms, conduct problems and hyperactivity inattention but not on peer relationship and pro-social behavior.

It was also found that girls performed better on all five measurements and that age at the intervention baseline seemed to affect emotional symptoms negatively (i.e. a positive effect in the model) but pro-social behavior positively. The dummy variable indicating baseline differences between the intervention and the control preschools is positive for the first four measurements and negative for the last measurement. This indicates that children in preschools in the intervention group on average performed worse than children in the control group. However, none of the baseline differences are a

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<sup>3</sup> Avoiding child and preschools subscripts on the effect parameters implies uniform treatment effects across both centers and children. However, as mentioned above, this assumption is relaxed when using the difference- in-difference estimator.

statistically significant indication that randomization was successful and thus confirms the analysis of randomization in Table 1a-c in the previous section. It was found that conduct problems increased, peer relationship problems decreased, and pro-social behavior significantly improved across the study period (for both the intervention and the control groups) indicated by the time-dummy variables ( $\delta_1$  and  $\delta_2$  in (1)).<sup>4</sup>

Finally, for all five measurements, by far the largest error variance was within children. This is consistent with an interpretation that SDQ measurements were greatly affected by measurement errors that vary from measurement to measurement, within each child. Hence, it is possible that day-care center staff had problems assessing children using SDQ questionnaires. This has of course no bearing on the ability to estimate treatment effects consistently, but obviously affects accuracy and hence the significance of the results. Furthermore, it was found that for the remaining error variance, the between-child variation was larger than the between day-care center variation.

To check whether flaws in the randomization procedure affected the consistency of the estimated parameters using the growth-curve model, results for the difference-in-difference-estimator are shown. As the difference in difference-estimator might be somewhat unfamiliar, it is explained briefly in the following. The difference-in-difference-estimator proceeds by removing child and day-care center fixed effects by inspecting the within day-care center and within child differences between the intervention and the control group. In practice, this is done by first removing child level fixed effects by calculating within-child differences:

$$y_{ijt} - \bar{y}_{ij} = \sum_{t=1}^{t=2} \delta_t \left( T_{ijt} - \frac{1}{n_{ij}} \right) + \sum_{t=1}^{t=2} \lambda_t \left( T_{ijt} - \frac{1}{n_{ij}} \right) D_j + \beta (x_{ijt} - \bar{x}_{ij}) + v_j + \varepsilon_{ijt} - \bar{\varepsilon}_{ij}$$

Note that (2) has no child-fixed effect as this has been ‘averaged out’. Next day-care center fixed effects are removed by calculating within average day-care center differences on the within-child differences, i.e. calculating within day-care center differences using (2):

$$y_{ijt} - \bar{y}_{ij} - \bar{y}_j = \sum_{t=1}^{t=2} \delta_t \left( T_{ijt} - \frac{1}{n_{ij}} - \frac{1}{n_j} \right) + \sum_{t=1}^{t=2} \lambda_t \left( T_{ijt} - \frac{1}{n_{ij}} - \frac{1}{n_j} \right) D_j + \beta (x_{ijt} - \bar{x}_{ij} - \bar{x}_j) + \varepsilon_{ijt} - \bar{\varepsilon}_{ij} - \bar{\varepsilon}_j \quad (3)$$

(3) is not estimated by ordinary least squares as there are no child or day-care center fixed effects and the twice-differenced observations are now independent across children and preschools. OLS estimates provide estimates of time, treatment effects and regression parameters of the independent variables. Note that no assumptions have been made about the distribution of fixed effects or whether they were correlated with being in the intervention group or with the independent variables. Hence, even if children and preschools were allocated to the intervention based on unobserved child and day-care center fixed effects, the difference-in-difference estimator would still allow consistent estimate of the treatment effects. This is opposed to the growth-curve model, where consistent estimates are conditional on the fixed effects are independent of the allocation process into the intervention. However, the difference-in-difference approach also has a drawback. If the independent variables are constant within each child, e.g. gender, then the difference-in-

<sup>4</sup> In general it is impossible to estimate time, calendar and age effects simultaneously when time and calendar measurements overlap, (see Holford, 1991). Therefore the effects of time dummies in the models could be interpreted both as time, calendar and age effects. It is most natural to think of the time dummies as age effects, i.e. conduct problems worsen and social behavior improve with age.

difference estimator will not provide an estimate of this variable, as they are eliminated when applying the within child differencing procedure.

Table 3 shows the estimation results for the difference-in-difference estimator.

---- Table three about here ----

The Table shows almost identical estimation results for the treatment effect compared to the growth-curve estimator, confirming the conclusions of the initial drop-out analysis in section 3, i.e. that randomization was successful throughout the entire study despite drop-outs. Successful randomization allows the inference of causal estimates from the growth-curve model.

Furthermore, the differences found in difference estimates of the time dummies are similar too.

#### Hawthorne effects

This section briefly touches upon whether the intervention effect might be due to Hawthorne effects, i.e. effects from being allocated to the intervention or control group and not the intervention per se (Mayo, 1949, McCartney et al. (2007)). It was not expected that children were aware of taking part in intervention and thus that have their behavior was influenced by being observed. But it could be imagined that day-care staff, rather than reporting the actual behavior of children across time, instead reported a change in their perception of how to report child behavior. Although some researchers have cast doubt on the mere existence of a Hawthorne effect reanalyzing the original data from Mayo (1949), Jones (1992), and Levitt and List (2009), investigation seems warranted.

To do so, the analysis is focused whether there are significant differences in SDQ scores between those children that were observed and reported by day-care staff throughout the entire sample period and those children that entered preschools in the last period. The latter were not exposed to intervention in the same magnitude as the children who have been in the day care centers for the entire treatment period. Therefore, if the effect from long term exposure to the intervention is a true change in child behavior, it should be expected that there would be significant differences between those who were in the sample for the entire sample period and therefore receive the full intervention and those who entered in the last period. On the other hand, if changes are not happening at the child level but rather in the mind of the day care center staff there should be no difference between fully treated children and later entrants. In the control group, there should be no differences between the children that were in the sample the entire period and those who entered in the last period.

Table 4a shows multi-level regression results from the intervention group.

---- Table 4a Here ----

The table illustrates that, conditional on age<sup>5</sup> and gender that there are large differences in SDQ scores between late entrants and children that went through the entire intervention. Although the differences are only significant for

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<sup>5</sup> Note that in table 4a and b both age and age squared are used. In these analyses weak evidence was found of a non-linear relationship between SDQ scores and age – probably because in this analysis there were on average much younger entrants compared to somewhat older children that were present in the entire sample period, creating more variation in age compared to the previous analysis, which only covered children present in the entire sample period.

emotional problems and peer relationship problems, it is revealing that there are large differences for the first four SDQ variables and not for the last variable, pro-social behavior. Thus, the analysis in table 4a shows that for the four first SDQ variables there are differences between late entrants and children that were in the intervention in the entire sample period. For the last SDQ variable, there is no difference between the two groups. This was also the SDQ variable that showed no impact from the intervention. It should therefore not be expected that this variable differs between late entrants and fully treated children. This suggests that treated and late entrants differ due to real differences at the child level and not because day-care center staff changed their perception of children's behavior.

Table 4b shows multi-level regression results from the control group. In this group there should, conditional on age and gender, be no difference between fully treated children and late entrants, as none has received the intervention.

---- table 4b here ----

The table shows no significant differences between late entrants and the children that were in the study the entire sample period. This indicates that day-care staff makes no observational differences between the two groups of children. Thus, conditional on age and gender, each group of children scores on average the same on all SDQ scores whether they have been in the sample during the entire study or whether they enter at the end of the study.

In summary, it can be concluded that the intervention creates real differences in SDQ at the child level and that the reported treatment effects in tables 2 and 3 are not Hawthorne effects created by day-care center staff in the intervention group being invited to get a more holistic and inclusive view of disadvantaged children.

## **6. Discussion**

The study demonstrates that it is feasible to enrich preschools with a focus on socially disadvantaged children. A randomized controlled study was carried out collecting information on child behavior and competences before, during and after the intervention. A first analysis of the overall effect of the intervention demonstrates statistically significant effects in favor of the intervention group on all five SDQ dimensions: emotional symptoms, conduct problems, hyperactivity/inattention, peer relations and pro-social behavior. The result seems to be very valid since they cannot be explained by differences at baseline, different dropout rates or a Hawthorne effect.

Because the intervention is delivered through training of the day care staff and not directly aimed at the children there are several obstacles in securing and measuring improvement at the child behavior and competence level. First it could be imagined that even though some or all the staff take in the principles of the intervention they might not be able to deliver this further on the children, either because they have no guidelines as how to implement the principles of the intervention or because daily routine yield practical obstacles in implementing the new pedagogical approaches in dealing with the children. In addition one could expect that the principles of the intervention leads to a new way of interpreting child behavior and competences (a Hawthorne effect) without any real changes in the approach of the staff towards the children.

Lack of implementation would yield no differences between the treatment group and the control group because even though the day care center staff knows that they should deliver a new pedagogical approach they cannot do this. This

would results in that children in the treatment group and control group should have the same behavior and competences. Our analysis of the SDQ data show that this is not the case, unless the scoring of the children is affected by a re-interpretation of child behavior and competences among the day care center staff in the treatment group (because of the treatment). However, we have also demonstrated that this is unlikely as the day care center staff in the treatment group discriminate their scoring of fully treated children and new entrants. Thus if the treatment effect was only a reinterpretation of the children they should perceive new and fully treated children equally. As this is not the case we believe that we have shown that the treatment has a causal effect on child behavior and competences.

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Table 1. Average and standard deviation baseline SDQ measures by classification of day care centers

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Relationship Problems	Pro-social Behavior
<b>Treatment group</b>					
- Followed in all three periods	1.65 (2.09) N=524	2.76 (1.47) N=524	2.63 (2.88) N=524	1.41 (1.93) N=524	7.06 (2.47) N=524
- In non-drop-out centers, but not followed in all three periods	1.77 (2.07) N=584	3.07 (1.68) N=585	2.48 (2.93) N=584	1.50 (1.99) N=584	7.06 (2.64) N=584
- Drop -out centers	1.78 (2.09) N=32	3.22 (2.25) N=32	2.94 (2.59) N=32	1.09 (1.35) N=32	7.31 (2.38) N=32
<b>Control group</b>					
- Followed in all three periods	1.57 (1.91) N=521	2.71 (1.39) N=521	2.55 (2.68) N=520	1.53 (1.99) N=521	6.77 (2.75) N=520
- In non-drop-out centers, but not followed in all three periods	1.67 (1.99) N=605	2.99 (1.68) N=605	2.44 (2.90) N=605	1.56 (2.13) N=605	7.57 (2.62) N=604
- Drop -out centers	1.72 (2.21) N=47	2.89 (1.59) N=47	1.94 (2.11) N=47	1.47 (1.86) N=47	6.94 (2.51) N=47

Note: Standard deviation in parenthesis.

Table 1c. Multilevel regression analysis of mean differenced in the pre-treatment measurement by drop out statue. Children followed in all three periods in the treatment group is baseline.

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Problems	Relationship	Prosocial Behaviour
Constant	1,96 (0,26)***	3,55 (0,20)***	5,29 (0,34)***	2,79 (0,26)***	3,57 (0,33)***	
Gender (girl =1)	-0,02 (0,08)	-0,57 (0,06)***	-1,20 (0,11)***	-0,36 (0,08)***	1,22 (0,10)***	
Age	0,05 (0,06)	0,13 (0,04)***	-0,30 (0,08)***	-0,22 (0,06)***	0,49 (0,07)***	
Ethnicity	-0,08 (0,06)	0,02 (0,05)	0,52 (0,09)***	0,26 (0,06)***	-0,31 (0,08)***	
Mothers education	-0,01 (0,00)***	-0,01 (0,00)***	-0,02 (0,00)***	-0,01 (0,00)***	0,01 (0,00)***	
Register-dummy	-0,34 (0,15)**	-0,33 (0,11)***	-0,73 (0,20)***	-0,41 (0,15)***	0,35 (0,18)*	
Treatment group, drop out centers	0,17 (0,58)	0,41 (0,40)	0,25 (0,59)	-0,55 (0,58)	0,50 (0,80)	
Control group, drop out centers	0,10 (0,54)	0,28 (0,37)	-0,05 (0,53)	0,11 (0,54)	-0,35 (0,77)	
Intervention group, followed in all three periods.	0,13 (0,18)	0,08 (0,13)	0,18 (0,19)	-0,15 (0,17)	0,25 (0,24)	
Treatment group, non-drop-out centers, but not followed in all three periods.	0,08 (0,18)	0,22 (0,13)*	0,24 (0,20)	0,14 (0,18)	-0,15 (0,25)	
Control group, non-drop-out centers, but not followed in all three periods.	-0,01 (0,14)	0,13 (0,11)	0,16 (0,18)	0,12 (0,14)	0,41 (0,17)**	
Random-effects Parameters						
Day-care center level standard deviation	0,44 (0,06)	0,29 (0,05)	0,32 (0,09)	0,45 (0,06)	0,66 (0,09)	

Child level standard deviation	1,97 (0,03)	1,51 (0,02)	2,68 (0,04)	1,91 (0,03)	2,41 (0,04)
N	2313	2314	2312	2313	2311

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Note: Standard errors in parenthesis. \*, \*\* and \*\*\* denotes statistical significance at the 10, 5 and 1 % level respectively.

Table 2. Multilevel model for treatment effects. Fully balanced data.

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Relationship Problems	Pro-social Behavior
Constant term	1,49 (0,37)***	3,49 (0,31)***	4,70 (0,47)***	2,11 (0,35)***	4,32 (0,44)***
Gender (Girl = 1)	-0,03 (0,11)	-0,54 (0,09)***	-1,11 (0,14)***	-0,27 (0,11)**	1,26 (0,13)***
Age at baseline	0,16 (0,09)*	0,12 (0,08)	-0,11 (0,12)	-0,05 (0,09)	0,23 (0,11)**
Ethnicity	-0,04 (0,09)	0,05 (0,07)	0,51 (0,12)***	0,21 (0,09)**	-0,18 (0,11)*
Mothers education	-0,01 (0,00)**	-0,01 (0,00)***	-0,03 (0,00)***	-0,01 (0,00)***	0,01 (0,00)**
Register dummy	-0,33 (0,19)*	-0,22 (0,16)	-0,65 (0,26)**	-0,23 (0,19)	-0,02 (0,23)
Time = 1	-0,09 (0,14)	0,12 (0,12)	0,06 (0,13)	-0,23 (0,13)*	0,22 (0,15)
Time = 2	0,63 (0,14)***	0,96 (0,12)***	0,02 (0,13)	0,29 (0,13)**	1,72 (0,15)***
Intervention dummy	0,20 (0,22)	0,14 (0,16)	0,22 (0,21)	-0,05 (0,19)	0,22 (0,24)
Intervention dummy Time = 1	-0,07 (0,19)	-0,04 (0,17)	-0,27 (0,19)	-0,14 (0,18)	0,13 (0,22)
Intervention dummy Time = 2	-0,64 (0,19)***	-0,68 (0,17)***	-0,71 (0,19)***	-0,55 (0,18)***	-0,54 (0,22)**

Random-effects Parameters

Standard deviation, day-care center level	0,51 (0,09)	0,31 (0,07)	0,32 (0,12)	0,40 (0,08)	0,51 (0,11)
Standard deviation, Child level	1,17 (0,06)	0,92 (0,06)	1,93 (0,06)	1,13 (0,06)	1,51 (0,07)
Residual standard deviation	2,18 (0,03)	1,98 (0,03)	2,17 (0,03)	2,10 (0,03)	2,48 (0,04)
N	3135/1045	3135/1045	3134/1045	3135/1045	3130/1045

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Note: Standard errors in parenthesis. \*, \*\* and \*\*\* denotes statistical significance at the 10, 5 and 1 % level respectively.

Table 3. Treatment effect, Difference in difference. Fully balanced data.

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Relationship Problems	Pro-social Behavior
Constant term	0,00 (0,03)	0,00 (0,03)	0,00 (0,03)	0,00 (0,03)	0,00 (0,04)
Gender (Girl = 1)	- -	- -	- -	- -	- -
Age at baseline	- -	- -	- -	- -	- -
Ethnicity	- -	- -	- -	- -	- -
Mothers education	- -	- -	- -	- -	- -
Register dummy	- -	- -	- -	- -	- -
Time = 1	-0,09 (0,11)	0,12 (0,10)	0,06 (0,11)	-0,23 (0,11)**	0,23 (0,13)*
Time = 2	0,63 (0,11)***	0,96 (0,10)***	0,02 (0,11)	0,29 (0,11)***	1,72 (0,13)***
Intervention dummy	- -	- -	- -	- -	- -
Intervention dummy Time = 1	-0,07 (0,16)	-0,04 (0,14)	-0,27 (0,16)*	-0,14 (0,15)	0,12 (0,18)
Intervention dummy Time = 2	-0,64 (0,16)***	-0,68 (0,14)***	-0,72 (0,16)***	-0,55 (0,15)***	-0,54 (0,18)***
N	1045	1045	1045	1045	1045

Note: Standard errors in parenthesis. \*, \*\* and \*\*\* denotes statistical significance at the 10, 5 and 1 % level respectively.

Table 4a. Differences between fully treated and late entrants. Intervention group.

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Relationship Problems	Prosocial Behaviour
Constant	1,53 (0,80)*	3,32 (0,72)***	4,12 (0,81)***	1,57 (0,75)**	5,75 (0,77)***
Sex	-0,01 (0,26)	-0,38 (0,24)	-1,05 (0,27)***	-0,41 (0,25)	1,12 (0,26)***
Age	-0,30 (0,51)	0,17 (0,47)	-0,70 (0,53)	-0,07 (0,49)	0,43 (0,50)
Age^2	0,12 (0,11)	-0,02 (0,10)	0,16 (0,11)	0,05 (0,11)	-0,03 (0,11)
Late entrants	1,01 (0,46)**	0,69 (0,41)	1,12 (0,47)**	1,38 (0,43)***	0,13 (0,45)
Random-effects Parameters Estimate					
Standard deviation, day-care level	0,00 (0,00)	0,00 (0,00)	0,00 (0,00)	0,00 (0,00)	0,00 (0,00)
Standard deviation, Child level	3,90 (0,09)	3,54 (0,08)	4,00 (0,10)	3,69 (0,09)	3,80 (0,09)
N	875	875	875	875	875

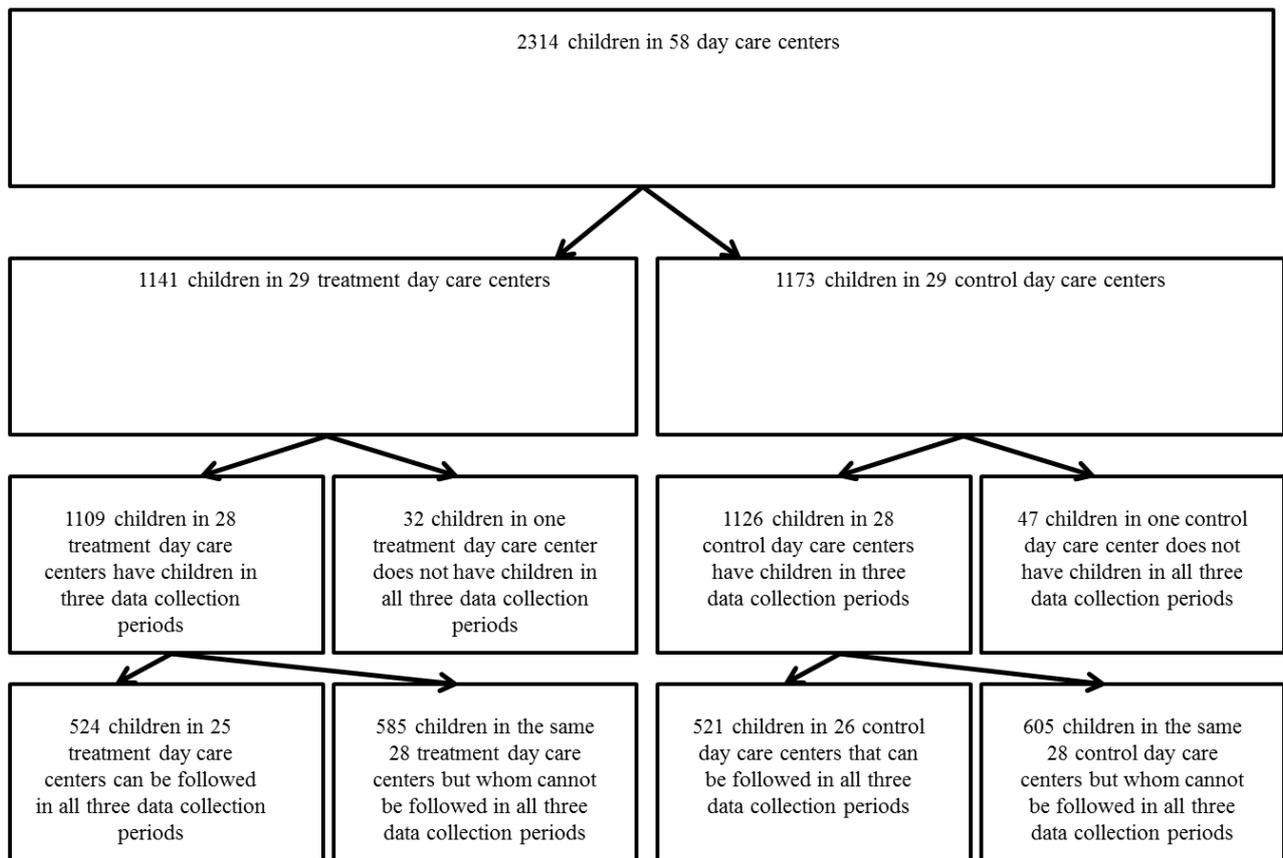
Note: Standard errors in parenthesis. \*, \*\* and \*\*\* denotes statistical significance at the 10, 5 and 1 % level respectively.

Table 4b. Differences between full compliers and late entrants. Control group.

	Emotional symptoms	Conduct Problems	Hyperactivity Inattention	Peer Relationship Problems	Prosocial Behaviour
Constant	2,71 (0,87)***	4,16 (0,83)***	5,55 (0,84)***	2,97 (0,85)***	5,86 (0,93)***
Sex	-0,19 (0,28)	-0,70 (0,27)**	-1,25 (0,28)***	-0,20 (0,28)	1,18 (0,30)***
Age	-0,38 (0,54)	0,33 (0,52)	-0,88 (0,53)*	-0,52 (0,54)	0,95 (0,58)
Age^2	0,10 (0,12)	-0,06 (0,12)	0,15 (0,12)	0,06 (0,12)	-0,23 (0,13)*
medxx3	0,38 (1,16)	0,24 (1,01)	0,24 (1,00)	-0,05 (0,96)	-0,52 (1,14)
Random-effects Parameters Estimate					
Standard deviation, day-care center level	1,02 (0,25)	0,87 (0,23)	0,85 (0,25)	0,80 (0,24)	0,98 (0,28)
Standard deviation, Child level	4,23 (0,10)	4,08 (0,10)	4,12 (0,10)	4,20 (0,10)	4,53 (0,11)
N	911	911	911	911	911

Note: Standard errors in parenthesis. \*, \*\* and \*\*\* denotes statistical significance at the 10, 5 and 1 % level respectively.

Figure 1. Flowchart of the data sampling process.



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