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Early intervention and child physical health: Evidence from a Dublin-based randomized controlled trial

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ABSTRACT

This article investigates the impact of an early intervention program, which experimentally modifies the parenting and home environment of disadvantaged families, on child physical health in the first 3 years of life. We recruited and randomized 233 (115 intervention, 118 control) pregnant women from a socioeconomically disadvantaged community in Dublin, Ireland into an intervention or control group. The treatment includes regular home visits commencing antenatally and an additional parenting course commencing at 2 years. Maternal reports of child health are assessed at 6, 12, 18, 24, and 36 months. Treatment effects are estimated using permutation testing to account for small sample size, inverse probability weighting to account for differential attrition, and both the stepdown procedure and an indices approach to account for multiple hypothesis testing. Following adjustment for multiple testing and attrition, we observe a positive and statistically significant main treatment effect for wheezing/asthma. The intervention group are 15.5 percentage points (pp) less likely to require medical attention for wheezing/asthma compared to the control group. Subgroup analysis reveals more statistically significant adjusted treatment effects for boys than girls regarding fewer health problems ($d = 0.63$), accidents (23.9 pp), and chest infections (22.8–37.9 pp). Our results suggest that a community-based home visiting program may have favorable impacts on early health conditions.

1. Introduction

A steep socioeconomic gradient in adverse health during the early years has been well documented (e.g. Case et al., 2002). Yet there is growing evidence that intervening early in the lifecycle, through targeted home visiting programs for example, is a potential mechanism for reducing this gradient (Avellar and Supplee, 2013). Children facing socioeconomic disadvantage often experience poor physical health outcomes regarding the prevalence and severity of illness, the incidence of disease, and the likelihood of mortality (Chen et al., 2002). They are also at increased risk of developing a number of preventable illnesses later in life such as heart disease, diabetes, respiratory infections, and obesity (Galobardes et al., 2004; Komro et al., 2011; German and Latkin, 2012). Poor health during childhood has also been associated with adverse educational and labor market outcomes (Case et al., 2005; Currie, 2004; Currie and Hyson, 1999).

The child health gradient may be attributed to genetic, psychological, and behavioral factors, as well as the direct

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effect of parental resources (Anderson and Armstead, 1995; Smith, 1999). Income, as a key parental resource, may affect the quality and quantity of health care provided. For example, parents with higher incomes can purchase important health inputs such as nutritious meals, frequent doctor visits, in addition to providing a safe and stimulating home environment (Mayer, 2002). Furthermore, mothers who have attained higher education may combine health inputs more efficiently (Grossman, 1972; Rosenzweig and Schultz, 1982), such as engaging in preventative care and changing health behaviors during pregnancy.

Yet identifying the causal pathways through which socioeconomic status is related to child health is limited by endogeneity, whereby family circumstances and child health are driven by some common unobserved factor, or reverse causality, whereby child illness negatively impacts on parental resources. To overcome these issues this study utilizes random assignment, which experimentally modifies the parenting and home environment of disadvantaged families, to investigate a mechanism for ameliorating poor physical health. Ill health during childhood is costly to society in the short run, in terms of increased demand for health resources, and in the long run, in terms of losses in economic productivity. Thus, identifying effective interventions to reduce inequalities in health by counteracting the socioeconomic risks associated with low family income and education is a key goal for policymakers (Marmot, 2005).

A growing body of evidence demonstrates that early intervention can reduce health inequalities and promote health in adulthood (e.g. see Campbell et al., 2014). Early intervention is considered both biologically and economically efficient as development is more malleable early in life (Halfon et al., 2001), thus investments made in this period are likely to generate larger returns than later remedial interventions (Cunha and Heckman, 2007; Heckman, 2007). In particular, given the importance of the fetal environment and maternal behavior during pregnancy on later childhood health, interventions commencing during pregnancy should yield the highest returns (Doyle et al., 2009).

Home visiting programs (HVPs) are one form of intervention which target disadvantaged families in the first years of their children's lives in order to improve health and development (Sweet and Appelbaum, 2004). In general, HVPs provide parents with information, direct instruction on parenting practices, emotional support, and access to community services (Howard and Brooks-Gunn, 2009). They operate through regular home visits provided by trained workers, either professionals such as nurses or child development specialists, or paraprofessionals, such as mentors. HVPs may improve children's physical health by promoting immunization uptake and appropriate care for illnesses, and reducing preventable injuries. Systematic reviews of the effectiveness of HVPs using experimental designs have identified some positive effects on child physical health, yet the evidence is mixed. For example, Avellar and Supplee (2013) report that five of twelve HVPs identify favorable and significant effects on health care coverage or use, including well-child visits and dental service use, while five of six programs reduce child maltreatment. Another review by Peacock et al. (2013) finds that two of seven HVPs have statistically significant effects on physical growth, including improved birth weight and catch-up growth, and two of six programs have an impact on hospitalizations, illnesses, and injuries, while one study reporting on immunizations also has a positive effect.

However, the existing literature is somewhat limited by the type of methods used to estimate treatment effects. While some experimental HVP studies are derived from large samples, others are constrained by small sample sizes yet utilize large sample test statistics. In addition, many studies estimate treatment effects across multiple health outcomes while failing to adjust for Type-I errors. Attrition is also a common concern in longitudinal trials, and while some studies test for differential attrition, few adequately account for its effect on treatment outcomes. This article investigates the impact of *Preparing for Life* (*PFL*), a community-based HVP in Ireland, on children's physical health within the first 3 years of life utilizing methods which counteract common issues in randomized controlled trials (RCTs) including accounting for small sample inference, differential attrition, and multiple hypothesis testing. Specifically, we investigate program impact on children's general health, number of health problems, hospital stays, accidents, immunizations, wheezing/asthma, and chest infections at multiple time points. As early intervention programs often find differential treatment effects by gender (e.g. Anderson, 2008; Eckenrode et al., 2010; Heckman et al., 2010), we conduct a subgroup analysis for boys and girls separately. We also assess the internal validity of the findings by testing for the presence of contamination and differential misreporting.

2. Methods

2.1. Treatment and setting[1]

This study is a RCT of the Preparing for Life (*PFL*) program. The study enrolled pregnant women from a community in Dublin, Ireland that had above national average rates of unemployment, early school leaving, lone parent households, and public housing (Doyle, 2013). The inclusion criteria included all pregnant women living in the catchment area, regardless of parity. There were no exclusion criteria. Participation was voluntary and recruitment took place between 2008 and 2010 through two maternity hospitals or self-referral in the community. After informed consent was obtained, a computerized unconditional probability randomization procedure assigned 115 participants to an intervention group and 118 to a

[1] The trial was registered with controlled-trials.com (ISRCTN04631728) and was conducted and reported in conformity with CONSORT guidelines. All study procedures were approved by the university and maternity hospitals' respective ethics committees. All participants gave informed consent before taking part in the randomization process.