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Hae-young Hong, Jisoo Hwang, Jongwon Kim, Jungmin Lee

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Authors

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RFBerlin
ROCKWOOL Foundation Berlin –
Institute for the Economy
and the Future of Work

Gormannstrasse 22, 10119 Berlin
Tel: +49 (0) 151 143 444 67
E-mail: info@rfberlin.com
Web: www.rfberlin.com

Parental Responses to Information on Child Developmental Risk: Evidence from National Health Screening

Hae-young Hong
Korea Institute of Public Finance

Jisoo Hwang*
Seoul National University

Jongwon Kim
Seoul National University

Jungmin Lee
Seoul National University

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Abstract

This paper provides the first causal evidence on how developmental health screenings for young children affect parental behavior, leveraging a quasi-experimental change in South Korea's National Health Screening Program. Using a difference-in-discontinuities design and administrative data covering 1.3 million screening records, we find that "high-risk" screening results influence a wide range of parental behaviors, with responses varying significantly by household income. Among lower-income families, adverse results lead to greater use of publicly insured medical care, increased disability registration, and delays in subsequent childbirth. In contrast, higher-income families reduce maternal labor supply and are more likely to relocate, suggesting costly private adjustments to secure additional caregiving time and access to private developmental rehabilitation facilities. These findings highlight how household resources shape both the capacity and nature of parental responses to early health information.

Keywords: developmental disorder, health screening
JEL codes: I18, I14, D13

*Corresponding author. E-mail: jisoohwang@snu.ac.kr

1 Introduction

Advances in medical technology have enabled the early detection and prevention of health conditions through routine screenings. Many countries have implemented preventive screening programs as part of their public health efforts. Such programs have also expanded beyond adults to include children, with some countries mandating regular health checkups for young children.[1]

While preventive screening can yield clear benefits when early detection leads to timely treatment (Hadders-Algra, 2021; Morgan et al., 2021; Nevill et al., 2018), much less is known about how families respond to screening results. In the case of adults, screening is typically followed by medical treatment, and policies often focus on ensuring financial coverage for care. When health concerns are identified in early childhood, however, policy implications are more complex. Financial support may still be relevant, but effective policy design also depends on how parents respond to screening results, as they play a central role in both short-term treatment and long-term developmental support. Despite growing interest, empirical evidence on the effects of early childhood screening remains scarce, largely due to institutional and data limitations. Few countries conduct regular developmental screenings while also maintaining administrative records that link screening results to individual-level data on both children and their parents.

We fill this gap in the literature by providing the first causal evidence on how developmental health screenings for young children affect parental behavior. Our analysis leverages two unique features of South Korea's National Health Screening Program (NHSP): an exogenous policy change in the screening tool and comprehensive administrative panel data. First, we exploit a quasi-random shift in developmental screening classifications resulting from the introduction of a more sensitive screening tool. Prior to 2015, the NHSP relied on the Korean Ages and Stages Questionnaire (K-ASQ) and the Denver Developmental Screening Test II (DENVER-II). On January 1, 2015, these were replaced by the Korean Developmental Screening Test (K-DST), a new tool with improved sensitivity, which led to a sharp increase in the share of children identified as "high-risk" for developmental concerns. We estimate the causal effects of this change, which are identified from children on the margin—those whose classification is more sensitive to the specific screening tool used. This group is of particular interest from a policy perspective, as their outcomes are more likely to be affected by changes in screening policy.

[1] Countries with mandatory health screening programs for children include Japan, France, Sweden, and Denmark. In the U.S., the American Academy of Pediatrics provides guidelines for developmental screening, and Medicaid's Early and Periodic Screening, Diagnostic, and Treatment Program provides mandatory screenings for low-income children.

Second, we use rich administrative panel data from the National Health Insurance Service (NHIS). The data cover the entire Korean population and include linked parent–child records on healthcare utilization, disability registration, employment, and earnings. Our analysis comprises over 1.3 million child health screening records. The large sample size allows us to estimate effects with precision and to detect even modest behavioral responses to screening results. The richness of the data further enables us to explore heterogeneity in responses by parental income.

To identify causal effects, we employ a difference-in-discontinuities (diff-in-disc) design using the child's screening date as the running variable. Specifically, we compare discontinuities in outcomes at the 2014–2015 policy change relative to those at placebo cutoffs in prior years (2012–2013 and 2013–2014). This approach helps control for seasonal trends and potential differences in family characteristics between children screened at the end versus the beginning of the year.

Our analysis reveals that parental responses to the identification of developmental concerns vary substantially by household income. Among lower-income families, adverse screening results lead to increased utilization of public healthcare services and a higher likelihood of registering the child for disability status, thereby gaining access to public assistance. We also find that parents in this group delay subsequent births following a high-risk result, while exhibiting no significant change in parental employment.

In contrast, higher-income families appear to rely more heavily on private adjustments. Mothers reduce their employment by one percentage point (2.5% of the control mean), suggesting increased caregiving time. These households also reduce their use of public-insured healthcare services, likely substituting toward privately funded alternatives, and show no increase in formal disability registration. Instead, they are more likely to relocate, particularly if they previously resided in neighborhoods without developmental rehabilitation facilities.

Our paper contributes to three strands of literature. First, we contribute to the literature on the value of health information from screenings. Prior studies have examined how screening results affect subsequent healthcare utilization and health outcomes, often with mixed findings. For example, Iizuka et al. (2021) show that diabetes warnings increase healthcare use but do not improve health outcomes for the general population, although they report improved health outcomes among individuals with high cholesterol and blood pressure levels. Similarly, Kim et al. (2019) find no overall effect of disease risk information on healthcare use or biomarkers, but find evidence of weight loss around the diabetes threshold when the information is combined with prompts for secondary examination and treatment. Among studies focusing on

the effect of participation in health screening *per se*, Hackl et al. (2015) find that participation increases short-term healthcare costs without significant effects on health status. In contrast, Park (2024) shows that subsidized general health screenings lead to higher rates of disease detection and behavioral modifications and Guthmuller et al. (2023) document that organized screening programs increase mammography rates, improve early cancer detection, and reduce breast cancer mortality.

To our knowledge, we provide the first causal evidence on the impacts of developmental health screenings for young children. This population is particularly important, as early childhood is a critical window during which interventions can yield large and lasting effects on health, education, and labor market outcomes later in life (Currie and Almond, 2011; Heckman and Mosso, 2014). Parents also tend to be particularly attentive to health information during this period, making it a key opportunity for influencing behavior through public health messages or clinical advice. Despite this importance, the effects of early childhood developmental screening remain understudied, largely due to institutional and data limitations. We fill this gap in the literature by providing evidence on how early health information, delivered through a nationwide program, affects not only children's healthcare use but also parental behavior. In doing so, we offer new insights into the broader consequences of early-life public health interventions, complementing prior research focused primarily on adult screenings and direct health effects.

Second, because our setting effectively focuses on children at the margin of being classified as high-risk, we contribute to research on the effects of marginal diagnoses. Prior studies have shown that marginal diagnoses affect individuals directly (Alalouf et al., 2024; Almond et al., 2010; Bos et al., 2021; Zhao et al., 2013), as well as their spouses (Thomas and Mentzakis, 2024) and siblings (Persson et al., 2025). We provide evidence of how parents respond when their child is marginally classified as high-risk in developmental screenings. Our findings show that even marginal classifications—those sensitive to the specific screening tool—influence parental behavior in ways that reinforce or mitigate inequality in the developmental environment.

Lastly, we contribute to the growing literature on how child health shocks affect families. Prior studies have largely focused on parental labor supply adjustments following the onset of child health conditions. While economic theory yields ambiguous predictions—parents may work more to cover medical expenses or work less due to greater caregiving needs—empirical evidence consistently shows that poor child health reduces maternal labor supply, with little effect on fathers (Frijters et al., 2009; Gould, 2004; Kvist et al., 2013). For example, recent work documents long-term labor market consequences for mothers following

child disability (Cheung et al., 2025), hospitalization (Breivik and Costa-Ramón, 2024), type 1 diabetes (Eriksen et al., 2021), and childhood cancer (Kim et al., 2025). Beyond labor markets, child health shocks have been linked to disruptions in family composition, including higher divorce rates and lower fertility (Chen et al., 2022; Kvist et al., 2013; Vaalavuo et al., 2023). While most studies focus on average effects, we show that parental responses vary substantially by income, highlighting how household resources shape families' capacity to act on health information.

2 Institutional Background

2.1 Mandatory Health Screenings for Infants and Children

The Korean National Health Screening Program (NHSP) for infants and children was launched in 2007 to monitor the growth and development of children aged 0–6 years. As of 2025, the NHSP has eight screening rounds at the following age intervals: 14–35 days, 4–6 months, 9–12 months, 18–24 months, 30–36 months, 42–48 months, 54–60 months, and 66–72 months. Take-up rates have been consistently high, with 97% of children receiving at least one screening during our study period. This high compliance is driven by legal requirements: in Korea over 90% of children aged 3–6 attend kindergartens or daycare centers (Korean Educational Development Institute, 2013–2023), and these institutions are required by law to ensure that enrolled children are either screened by the NHSP or receive annual health checkups conducted by the institution itself. As a result, these screenings are effectively mandatory.

2.2 Revision of Screening Instruments

Child developmental assessments are conducted during six of the eight NHSP rounds, beginning with the third round (9–15 months). In the development assessments, caregivers complete a questionnaire, which evaluates children's development status across domains. The responses are converted into domain-specific scores that classify children into three categories: "Normal development," "Follow-up needed," or "Further testing needed." The overall classification is determined by the highest level of need identified in any domain. For example, a child's overall classification is "Further testing needed" if she scores in this range in at least one domain. Only the classification results, both overall and domain-specific, are provided to caregivers, without access to the total or individual domain scores.[2]

[2]See screening report cards in the Appendix A.

The "Normal development" classification indicates that the child's development is progressing without concerns. "Follow-up needed" serves as an early warning for potential developmental concerns. Caregivers receiving this classification are advised to monitor the child's development closely and consult doctors if concerns persist. The "Further testing needed" classification suggests a more substantial deviation from typical developmental trajectories, indicating a higher likelihood of developmental disorder (DD). This classification recommends a comprehensive evaluation such as the Autism Diagnostic Observation Schedule, Bayley Scales of Infant Development. Additionally, children who receive this classification qualify for financial assistance towards further developmental evaluations, provided they meet the household income criteria.[3] In this study, we refer to both "Further testing needed" and "Follow-up needed" as *high-risk* screening results.

[Figure 1 here]

Prior to 2015, the NHSP initially employed two assessment questionnaires: the Korean Ages and Stages Questionnaire (K-ASQ) and the Denver Developmental Screening Test II (DENVER-II), with the K-ASQ being used in 99.9% of cases. In response to the need for improved sensitivity, the Ministry of Health and Welfare developed a new tool—the Korean Developmental Screening Test (K-DST; Korea Disease Control and Prevention Agency, 2020). Panel (a) of Figure 1 illustrates the adoption pattern of the K-DST. The NHSP first piloted this new tool from September to December 2014, during which it accounted for only 6% of screenings. Starting in January 2015, the K-DST became the exclusive tool for developmental assessments in the NHSP.

Both K-ASQ and K-DST define their thresholds according to statistics derived from standardized samples constructed during their development. Both classify a child as "Further testing needed" when her score falls below two standard deviations from the mean (Figure A3). However, unlike K-ASQ, which provides no clear criteria for "Follow-up needed," K-DST defines "Follow-up needed" more precisely as scores at or above negative two standard deviations but below negative one standard deviation. With more explicit standards, the adoption of the K-DST increased the rate of high-risk screening results. Panel (b) of Figure 1 illustrates high-risk result trends by screening tool. Between September and December 2014, the share of high-risk results was under 4% with the K-ASQ, compared to over 12% with the K-DST. The higher rate

[3] As of our sample period of 2014–2015, medical aid recipients and those in the bottom 30% based on health insurance premiums could receive up to 400,000 KRW (approx. 350 USD) once within one year from the date of their screening.

of high-risk results with K-DST persisted in 2015 when it became the exclusive tool. As a result, overall high-risk rates increased from 2014 to 2015, jumping from less than 5% to more than 10%.[4]

2.3 Disability Registration

When developmental screening indicates potential concerns, children receive formal diagnostic testing to confirm a DD diagnosis, and some subsequently apply for official disability registration. The benefits of registering a child as having a DD consist mainly of monthly cash allowances and vouchers for treatment services. As of 2015, children under age 18 with severe disabilities are eligible for a disability child allowance of $54–154. Families earning less than 180% of the median income are also eligible for developmental rehabilitation service vouchers worth $108–185 per month, which can be used for therapies. Additional support includes reduced co-payments for medical treatments, tax deductions, utility bill discounts, transportation fare reductions, and disability parking. These benefits make disability registration particularly attractive to lower-income families.

Nonetheless, some parents hesitate to register their children for disability due to concerns about social stigma. Formal labeling may expose their children to discrimination in educational or social settings (Kayama and Haight, 2018; Korea Disabled People's Development Institute, 2022). Economic considerations also play a role, as children with DD diagnoses face difficulties obtaining private insurance, which families rely on to cover co-payments and specialized healthcare services not included in the NHI. A survey of doctors who conduct the NHSP revealed that 86% had received requests from parents to use ICD-10 "R" codes (symptoms and signs) instead of "F" codes (mental and behavioral disorders) in diagnostic documentation, specifically to avoid jeopardizing eligibility for private insurance claims (Ministry of Health and Welfare, 2021).

3 Data and Identification Strategy

3.1 Korean National Health Information Database

The Korean National Health Information Database (NHID) is a population-wide administrative database maintained by the National Health Insurance Service (NHIS), which also operates the NHSP. Because Korea

[4]Panel (a) of Figure A4 shows that the increase was consistent across all developmental domains, suggesting a general tightening of screening criteria rather than a shift in the relative importance of specific domains.

has a universal single-payer system with mandatory enrollment, the NHIS collects data on health screenings, medical utilization, employment, and demographics for the entire population. The data also include parent-child identifiers, allowing us to conduct family-level analysis.

The NHID's claim-level records enable us to examine healthcare utilization related to DD. We identify DD-related visits using ICD-10 codes and define DD to include eight subcategories: autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), language disorders, learning disorders, intellectual disability, sensory disorders, developmental delay, and cerebral palsy.

The rich nature of NHID enables us to examine a wide range of outcomes beyond medical usage. The data include administrative disability registration records, which allow us to track whether health screening results lead to formal disability registration. For parental labor market outcomes, we use information about insurance eligibility: individuals are defined as employed if they are eligible for employee health insurance.[5] Labor income is also available for employed individuals, which we adjust to 2025 values using the Consumer Price Index. We identify subsequent births using mothers' delivery records in the claims data. Finally, we construct residential mobility measures based on changes in neighborhood-level addresses.

Our sample comprises children who participated in the NHSP during three four-month periods (November-February of 2012–13, 2013–14, and 2014–15), along with their parents. We are able to link 93% of screening recipients to both their mother and father.[6] We select these four-month periods to ensure that each child appears in our sample at most once during each four-month period, as the screening rounds are spaced at least six months apart. The choice of sample period involves a trade-off between bias and variance: while a longer period offers greater statistical power, it also increases the risk of including confounding factors. For robustness, we present estimation results using alternative sample periods.

We exclude observations where children had pre-existing developmental issues at the time of screening, in line with the program's objective to serve as an initial assessment rather than a follow-up.[7] This exclusion reduces our sample by 2%.

[5]The NHIS operates three distinct insurance schemes. Regular employees and their dependents are covered under employee health insurance; self-employed individuals, the unemployed, and temporary workers fall under self-employed insurance; medical aid recipients with household income below 40% of the median income receive premium-free coverage.

[6]Children from single-parent households or those with long-term parental separation are likely to be excluded from the sample. Table A1 compares children who could be linked to both parents and those who could not. The linked sample is, on average, one month older, but most differences are not economically meaningful.

[7]Specifically, we exclude children with any of the following conditions: (a) Registered with developmental disabilities before the screening, (b) Ever visited hospitals for DD before the screening (c) Classified as "Need for continuous management" in the screening, indicating an ongoing diagnosis or treatment for developmental concerns.

[Table 1 here]

Table 1 presents summary statistics of our final sample of 1,306,063 screening records. Among those classified as high-risk, 65% are boys, consistent with medical literature indicating that boys typically exhibit slower development (Adani and Cepanec, 2019; Bando et al., 2024). The high-risk group is also younger on average—29.5 months compared to 35.4 months in the normal development group—which largely accounts for differences in anthropometric measures. Children flagged as high-risk incur higher medical expenditures in the year preceding the screening, are less likely to reside in metropolitan areas, and are more likely to be covered by medical aid. While fathers' characteristics are similar across groups, mothers of children in the high-risk group tend to be younger and less likely to be employed in the year prior to screening. These families also report lower parental income: in the previous year, fathers in the high-risk group earned an average of $2,517 per month, compared to $2,687 in the normal development group, while mothers earned $702 versus $802, respectively (1,300 KRW = 1 USD).

3.2 Difference-in-Discontinuities

Our goal is to examine the causal effect of child development screening results on family outcomes. Naive comparisons between children classified as normal development versus high-risk may yield biased estimates due to potential endogeneity of the screening result. For example, reverse causality may exist if parental labor supply affects child health and thus influences screening results (Morrill, 2011). Moreover, confounding factors such as parents' income, educational level, and genetic health predispositions may simultaneously affect both child development and family behaviors.

To address these concerns, we employ an instrumental variable (IV) approach that leverages an exogenous change in the likelihood of high-risk classification. Specifically, we use the timing of screening relative to January 1, 2015, when the NHSP adopted the K-DST as the sole screening tool. We then adopt difference-in-discontinuities (diff-in-disc) method to estimate the effect of adverse health screening results because families receiving screenings year-end vs. early-year may have different characteristics (see Appendix B for details). We estimate the following diff-in-disc model for child i and screening date t,

$$Y_{it} = \beta_0 + \beta_1 \text{Disc}_{it} + f(t - c_t) + \text{Post}_{it}(\beta_2 + \beta_3 \text{Disc}_{it} + g(t - c_t)) + \epsilon_{it} \tag{1}$$

where Y denotes the outcome variable. The relevant threshold c_t is defined as

$$c_t = \begin{cases} \text{January 1, 2013} & \text{if } t \in [\text{November 1, 2012}, \text{February 28, 2013}], \\ \text{January 1, 2014} & \text{if } t \in [\text{November 1, 2013}, \text{February 28, 2014}], \\ \text{January 1, 2015} & \text{if } t \in [\text{November 1, 2014}, \text{February 28, 2015}]. \end{cases}$$

The functions f and g are local polynomials that allow for different slopes around the threshold. Disc_{it} is an indicator that equals 1 if the screening date t is on or after the relevant threshold c_t,

$$\text{Disc}_{it} = \mathbb{1}\{t \geq c_t\}.$$

Post_{it} indicates whether the screening date falls within the treatment window,

$$\text{Post}_{it} = \mathbb{1}\{\text{November 1, 2014} \leq t \leq \text{February 28, 2015}\}.$$

The parameter of interest, β_3, captures the discontinuous change in outcomes induced by the policy shift on January 1, 2015—that is, the effect of an exogenous increase in the likelihood of high-risk classification, net of seasonal confounding factors from year-end versus early-year screenings.

To further ensure covariate balance, we employ age-adjusted weights that create groups for each 15-day interval × screening round combination (recall that screening round depends on child's age). Our weighting strategy is analogous to inverse probability weighting used to address covariate imbalances in regression discontinuity design (RD) (Cattaneo et al., 2022; Peng and Ning, 2021). We obtain similar results when controlling for child's age.

Diff-in-disc estimation requires that confounding factors around cutoffs have constant effects over time (Larsen and Valant, 2023). We verify this assumption by estimating equation (1) using pre-screening child and parent characteristics as outcomes. As shown in Table A2, we observe no significant differences in child characteristics such as age, anthropometric measures, and healthcare utilization, along with parental demographic and labor market outcomes. Although statistically significant differences persist in medical aid recipient status, the coefficient is small in magnitude. These results indicate that our diff-in-disc approach can successfully separate treatment effects from the effects of confounding factors.

Another key assumption of our diff-in-disc design is that families do not systematically manipulate the

timing of their screening around January 1st. For instance, parents might have delayed screening to receive K-DST assessments if they had a preference for this tool. However, this is unlikely because parents are generally unaware of which specific screening tool is used and public awareness of the introduction of the K-DST was minimal.[8] It is also possible that year-end holidays led some parents to postpone December screenings to January. However, panel (a) of Figure A5 shows no evidence of manipulation or bunching: the distribution of screenings around the 2014–2015 cutoff is smooth. Panels (b) and (c), which present analogous plots for the 2013–2014 and 2012–2013 cutoffs, also show continuous distributions. While a slight discontinuity appears to exist at the 2012–2013 threshold, we address this in a robustness check that uses only the 2013–2014 cutoff as the control period. Our main results remain robust to this alternative specification.

[Table 2 here]

Table 2 presents the first-stage estimates from equation (1), using high-risk classification as the outcome variable. Column (1) reports our main specification, while column (2) excludes screenings taken on holidays to address the concern that families attending screenings during holidays may have distinctive characteristics. Both specifications employ a 60-day bandwidth with a linear polynomial and a uniform kernel. Panel A shows consistent first-stage effects of 0.054 for high-risk classifications across both specifications. The F-statistic of 1,046 in the main specification is sufficiently high, indicating a strong instrument. Panel B decomposes this effect by subcategory, showing that the instrument primarily increases "Follow-up needed" classification (0.047), with a smaller effect on "Further testing needed" classifications (0.007); see panel (b) of Figure A4 for a visual representation of trends in classifications by subcategory.

4 Empirical Results

Figure 2 shows the diff-in-disc estimates (β_3 in equation (1)) for each outcome in an event-study plot, allowing us to examine both short-run and longer-run effects following the screening. Dark lines, markers, and 95% confidence intervals represent the main specification, which uses linear polynomials with a uniform kernel and a 60-day bandwidth. Lighter lines represent estimates from alternative specifications that vary

[8] A keyword search in BIGKinds, a Korean public news database, shows that in 2014, K-DST appeared in only 8 news articles, while the NHSP for infants and children appeared in 220 articles, and infant vaccinations appeared in 4,927 articles. We use the keywords "K-DST," "Korean Developmental Screening Test," "NHSP for infants and children," and "infant vaccinations" (all in Korean).

in bandwidth (50 vs. 60 days), control windows (2012–13 and 2013–14 vs. 2013–2014 only), and sample composition (including vs. excluding holidays).

Because differences in household budgetary and time constraints are likely to generate distinct parental behavioral responses, we present results separately by father's income.[9] Lower-income families, facing tighter budget constraints, are more likely to respond by seeking financial support such as through disability registration. For higher-income families, the key trade-off may lie in allocating parental time—particularly maternal time—between caregiving and market work, making reductions in maternal labor supply a more likely response.

[Figure 2 here]

We first examine changes in healthcare utilization. Panel (a) of Figure 2 shows the effects on the probability of hospital visits for DD. Among children of lower-income households, the probability of a DD-related hospital visits increases by 0.2 percentage points (a 38% increase relative to the control mean) in the year following the January 2015 screening, compared to the same period in prior years (panel A of Table A5). This effect fades in years 2 to 3 but reemerges afterward, potentially indicating initial monitoring followed by delayed follow-up care. In contrast, we find no statistically significant effects for higher-income families, with negative point estimates. These patterns suggest differential responses by income group: lower-income families rely primarily on NHIS-covered services, while higher-income families may shift toward more effective but costly out-of-pocket care when their children are at risk of DD. Note that the NHID only captures medical services covered by the NHIS. Most developmental therapies are not covered.[10] Consistent with this interpretation, data from the 2018–2022 Korean Disability and Life Dynamics Panel show that higher-income households are substantially more likely to be enrolled in private health insurance and spend more on medical care for children with disabilities.[11]

[9] We split the sample at the median of father's earnings (3.3 million KRW, approximately 2,500 USD). We use father's labor income as a proxy for household resources, as fathers are typically the primary earners in Korea. Conditioning on total parental income would make it difficult to isolate the effect of household resources from maternal labor supply. Summary statistics and first-stage results by income group are reported in Table A3 and A4, respectively.

[10] Among the major treatments, for instance, speech therapy, sensory integration therapy, play therapy, and Applied Behavior Analysis (ABA) therapy are not covered, while few items of physical rehabilitation therapy, occupational therapy, and medication therapy are covered. Additionally, most diagnostic assessments are non-reimbursable except for the Bayley Scales of Infant and Toddler Development.

[11] Using a sample of two-parent households with a registered child with developmental disabilities, we define higher-income households as those with combined parental labor income above 3,038 USD (the median in our main sample). In this group, 40% are enrolled in private health insurance and report monthly medical expenditures of 346 USD per child, compared to 33% enrollment and 246 USD in spending among lower-income households.

Next, we examine the effect on formal disability registration. As discussed in subsection 2.3, if a child receives a formal diagnosis of DD, lower-income households are expected to have stronger incentives to register, given both the income-based eligibility criteria and the higher marginal utility they derive from disability-related benefits. The result in panel (b) of Figure 2 supports this prediction. Among lower-income households, the diff-in-disc estimates indicate an immediate increase in child disability registration following the January 2015 screening relative to prior years, with the effect growing over time. In contrast, we detect no significant differential change in child disability registration among higher-income families throughout the five-year follow-up period. Specifically, children in lower-income families are 0.07 percentage points (a 431% increase relative to the control mean) more likely to be registered within the first year after screening, and 0.2 percentage points (75%) more likely by year five (panel B of Table A5).[12]

An important dimension of the parental response to warning about a child's health is the adjustment in labor supply. Parents may increase their labor supply to meet the additional financial demands of caring for a child at risk of DD. Conversely, they may decrease their labor supply to accommodate the caregiving needs that such conditions often require. Panels (c)–(f) of Figure 2 present the estimated diff-in-disc effects on both mother's and father's labor supply at the extensive and intensive margins. Panel (c) shows a substantial decline in mother's employment, but only among households with income above the median. In this group, mother's employment falls by one percentage point (2.5% of the control mean) immediately after the screening relative to control periods, and remains persistently lower over the next five years (Table A7).[13] Panel (d) of Figure 2 shows that labor income, regardless of the group, does not change significantly over five years, indicating no evidence of substantial adjustments at the intensive margin among those who remain employed.[14]

As for fathers, we find little change in employment overall, but significant increases in earnings among the higher-income group beginning around year three (Panels (e)–(f) of Figure 2; Table A9). When combined with the results on maternal labor supply, these patterns suggest differing intra-household dynamics by income group. In higher-income households, mothers exit the labor force to accommodate greater care-

[12]When we disaggregate by developmental disability type, we find that the income gradient in registration is largely driven by the increase in registrations for intellectual disability (Table A6).

[13]We examine whether the decline in maternal employment is driven by job exits or reduced labor market entry. Panel C of Table A8 shows that the effect is concentrated among mothers employed prior to screening, with little to no impact on labor market entry among the previously non-employed (Panel D). Among lower-income families, similar short-run job exits are observed, but previously employed mothers gradually return to work over time (Panel A).

[14]We estimate effects on parental income by Poisson regression following Chen and Roth (2024), which allows the coefficients to be interpreted as percentage changes in the outcome. Larger reductions at the extensive margin than at the intensive margin of labor supply are consistent with findings on child penalties in Korea (Hwang and Yoo, 2025).

giving needs, allowing fathers to specialize more fully in market work and raise their earnings. In contrast, lower-income households appear unable to substantially reallocate labor within the household, likely due to financial constraints.[15]

[Figure 3 here]

Parents may also respond to adverse child health information by reducing fertility, either to concentrate resources on the affected child or due to concerns about the heritability of health conditions. Alternatively, some may increase fertility in hopes of having healthy children who could provide future caregiving or financial support (Wehby and Hockenberry, 2017). Panel (a) of Figure 3 presents the diff-in-disc estimates on subsequent fertility. To distinguish between short-term (postponing births) and long-term (permanent reduction) effects, we examine births within two and seven years after screening, respectively. The latter horizon approximates completed fertility, as the average mother in our sample is over age 40 at that point. Our analysis focuses on screenings at 9–15, 18–24, and 30–36 months, when parents are most likely to consider additional children.[16] We find that the probability of a subsequent birth within two years declines by 0.8 percentage points (3.4% relative to the control mean; panel A of Table A10). While there is heterogeneity by income, these subgroup differences are not robust across specifications. The short-run fertility decline is most pronounced among mothers who were non-employed at the time of screening, with a 1.6 percentage point reduction (6.4%). However, by seven years post-screening, all estimates lose statistical significance at the 5% level, suggesting that the observed effects reflect delayed rather than permanently foregone births (panel B of Table A10).

Lastly, we examine changes in residential location using information on household address. Parents may choose to relocate to access better healthcare services or specialized education for their children. We define "moved" as a change in address at the neighborhood level and report the diff-in-disc estimates in panel (b) of Figure 3.[17] While no effect is observed among lower-income households, higher-income families exhibit a sharp increase in residential mobility, with the probability of moving increasing by 0.9 percentage points (3.0%) in the first year following the 2015 screening relative to control periods (Table A11). The increase among higher-income families dissipates within five years, indicating that the mobility response

[15]The gendered pattern of labor market adjustment is broadly consistent with prior evidence on parental responses to child health shocks (Breivik and Costa-Ramón, 2024; Cheung et al., 2025; Eriksen et al., 2021).

[16]The average interval between the first and second birth in Korea was approximately 33.1 months in 2014 (Yu, 2015).

[17]The smallest available geographic unit in our data is the eup/myeon/dong, which we translate as "neighborhood." There are about 3,500 neighborhoods in Korea, comparable in scale to U.S. census tracts.

is concentrated in the short-run. Using registry data from the Ministry of Health and Welfare and the Ministry of Education, we further examine whether such moves are motivated by access to developmental rehabilitation facilities or special schools.[18] Panel (b) of Figure 3 shows that the short-term increase in moving occurs only among families that lived in areas without local facilities prior to screening. We find no significant heterogeneity by the presence of local special schools (not reported). These findings suggest that higher-income families primarily move to access therapeutic services rather than special schools, consistent with our earlier interpretation that higher-income families turn to non-covered therapeutic care following adverse screening results—services that are primarily provided at developmental rehabilitation facilities.

Overall, we find that an increase in high-risk screening results leads to significant parental responses, though in different ways by household income. Are these responses warranted? The increase in disability registration indicates that the screening tool conveys meaningful information about real developmental concerns. For simplicity, suppose that all lower-income households proceed with registration if their child is diagnosed with DD. Under this assumption, our findings imply that the K-DST detects approximately 3.4% ($= 0.2/5.9$) of marginal cases.[19] If the detection rate is similar for higher-income households, we estimate that an additional 0.17 percentage points ($= 4.9 \times 0.034$) of children may have received a DD diagnosis but did not register in this group, potentially due to stigma-related costs. Instead, these families responded through alternative channels. Notably, the 1 percentage point decline in maternal employment exceeds the estimated increase in DD. While we cannot determine whether these private adjustments are proportional to the information received, the findings underscore that even marginal indications of developmental risk can lead to economically meaningful changes in parental behavior.

5 Conclusion

This paper provides the first causal evidence on how parents respond to adverse developmental screening results in early childhood. We exploit the introduction of a new screening tool in South Korea's National Health Screening Program for infants and children, which led to a sharp increase in the likelihood of children

[18] Developmental rehabilitation facility data are obtained from the 2020 Ministry of Health and Welfare registry of developmental rehabilitation service providers, which include private clinics and therapy centers providing speech, occupational, and behavioral therapies for children with DD. Special school data come from the 2022 Ministry of Education registry of special schools serving students with disabilities. Both datasets provide geographic information at the neighborhood level. We define local availability as having at least one facility within the child's neighborhood at the time of screening.

[19] Here, 0.2 refers to the percentage point increase in disability registration among lower-income children due to the new screening tool (Panel B of Table A5), and 5.9 refers to the percentage point increase of children in this group who received a high-risk result (Table A4).

being flagged as "high-risk" for developmental concerns. Leveraging comprehensive administrative data linking all children and their parents, we implement a difference-in-discontinuities design to estimate the causal effects of this change on a broad range of family behaviors.

We document significant heterogeneity in parental behaviors by household income. Among lower-income families, adverse screening results lead to greater use of public health services and a significant increase in formal disability registration, indicating a higher reliance on public support. Parental labor supply remains largely unchanged, though subsequent fertility is delayed. In contrast, higher-income families do not increase their use of publicly insured healthcare services or disability registration. Instead, they adjust through private mechanisms: mothers significantly reduce labor supply while fathers increase theirs, consistent with reinforced intra-household specialization, and families are more likely to move—especially if they lived in areas lacking local developmental rehabilitation facilities.

These results show that child health screening can influence a wide range of family decisions. However, the capacity to act on such information is shaped by household resources. Lower-income families turn to public programs, while higher-income families make costly private adjustments. This underscores a key equity concern: while early identification of developmental risks is essential, its benefits may not be evenly distributed if follow-up depends heavily on families' financial and time resources. Policy efforts to close this gap—such as expanding access to developmental rehabilitation services, providing public support to ease the caregiving burden or financial assistance to facilitate parental caregiving, and reducing the stigma associated with disability registration—may help ensure that all families can translate early warnings into meaningful improvements in child well-being.

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT (OpenAI) to improve the readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full

responsibility for the content of the published article.

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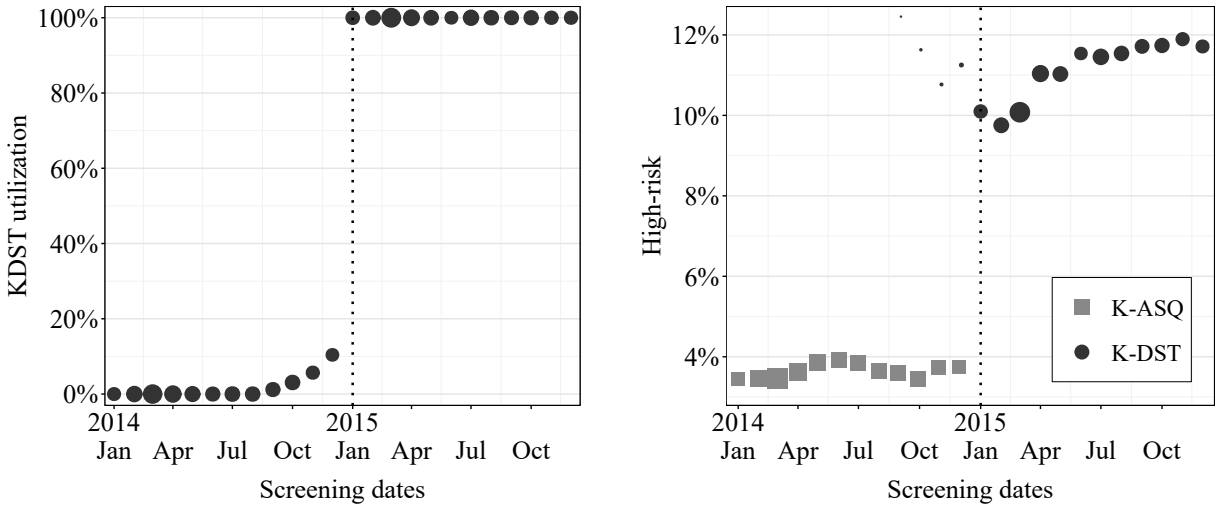
Figures

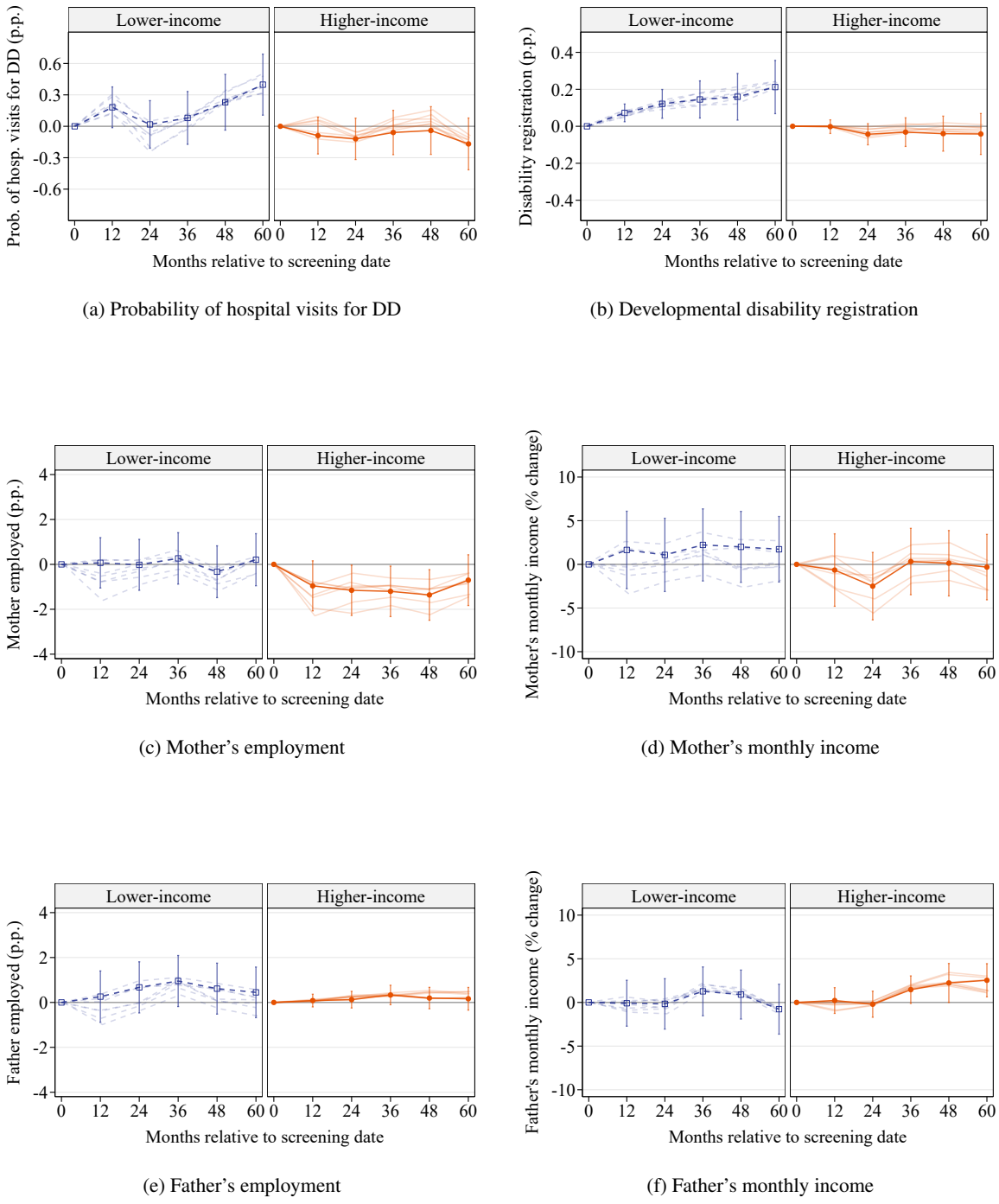


(a) K-DST utilization

(b) High-risk results by screening tool

Figure 1: Trends in K-DST utilization and high-risk classifications

Notes: This figure shows monthly trends in the K-DST utilization and high-risk classifications in the NHSP during 2014–2015. Panel (a) shows the proportion of screenings using K-DST. Panel (b) shows high-risk rates ("Follow-up needed" or "Further testing needed") by screening tool, where the grey squares represent K-ASQ results, the black circles show K-DST results. The vertical dotted line indicates January 2015, when the K-DST was adopted as the sole screening tool. The size of each point is proportional to the number of screenings.



(a) Probability of hospital visits for DD

(b) Developmental disability registration

(c) Mother's employment

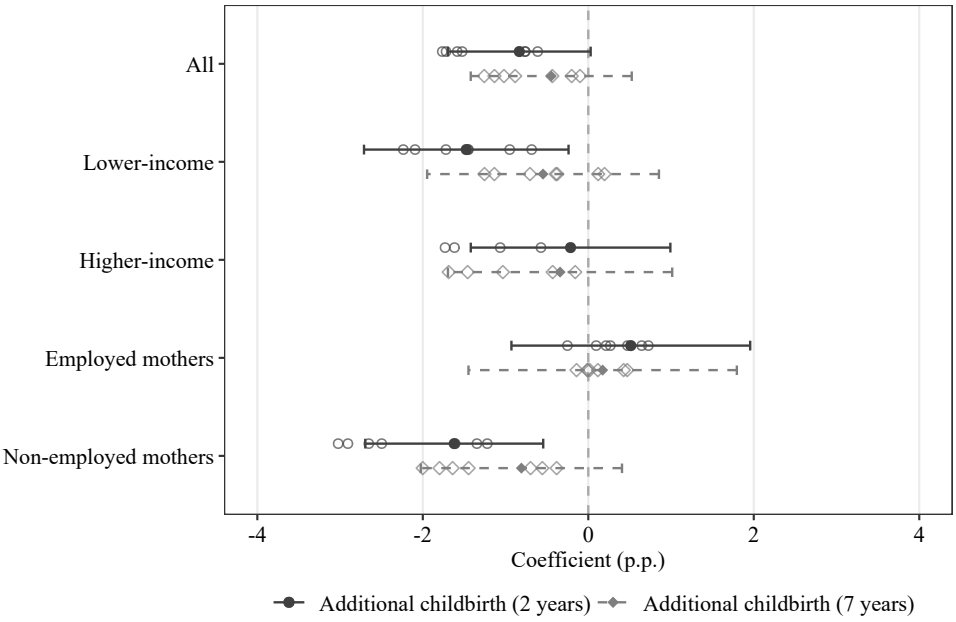
(d) Mother's monthly income

(e) Father's employment

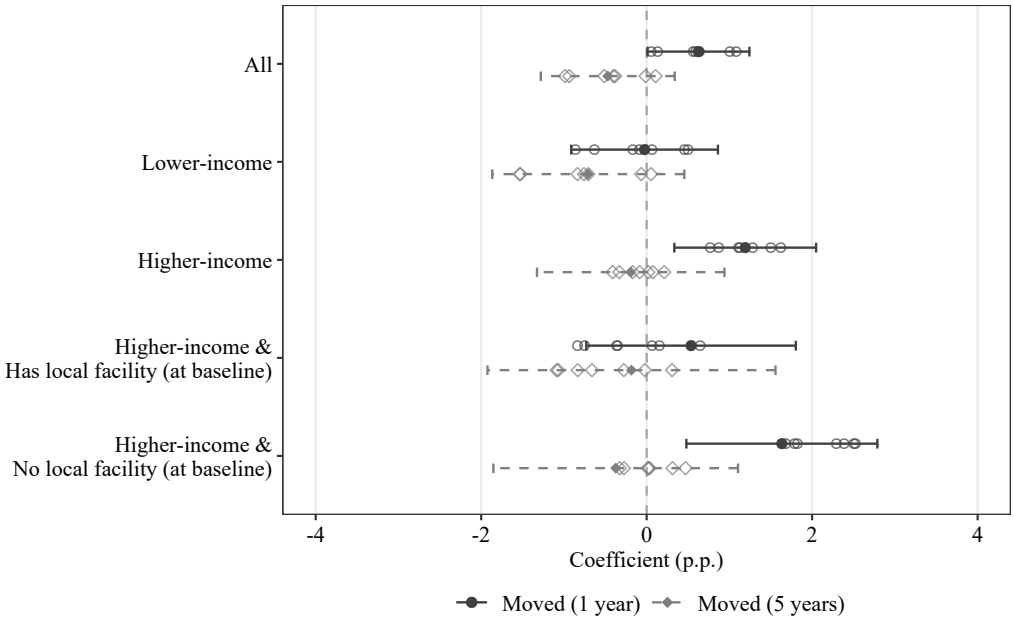
(f) Father's monthly income

Figure 2: Effects on medical utilization, disability registration, and parental labor supply

Notes: This figure shows diff-in-disc estimates and 95% confidence intervals from equation (1) by income group. Panels show estimates on: (a) probability of hospital visits for DD, (b) probability of developmental disability registration, (c) mother's employment, (d) mother's monthly income, (e) father's employment, and (f) father's monthly income (see Section 3 for definitions). Dark lines, points, and confidence intervals represent the main specification, which uses linear polynomials with a uniform kernel and a 60-day bandwidth. Lighter lines represent seven alternative specifications, which vary bandwidth (50 vs. 60 days), control windows (2012–2013 & 2013–2014 vs. 2013–2014 only), and sample composition (including vs. excluding holidays). All models apply age-adjusted weights from equation (B1). Standard errors are clustered at the individual level.



(a) Effects on additional births



(b) Effects on moving

Figure 3: Effects on additional birth and moving

Notes: This figure presents diff-in-disc estimates and 95% confidence intervals from equation (1) for (a) probability of having an additional child and (b) moving. Solid points with confidence intervals represent the main specification, which uses linear polynomials with a uniform kernel and a 60-day bandwidth. Hollow points represent seven alternative specifications, which vary bandwidth (50 vs. 60 days), control windows (2012–2013 & 2013–2014 vs. 2013–2014 only), and sample composition (including vs. excluding holidays). All models apply age-adjusted weights from equation (B1). Standard errors are clustered at the individual level.

Tables

Table 1: Summary statistics

	All		Normal development		High-risk	
	Mean	SD	Mean	SD	Mean	SD
Panel A: Child characteristics						
Male	0.512	(0.500)	0.506	(0.500)	0.648	(0.477)
Age in months	35.2	(19.1)	35.4	(19.1)	29.5	(16.7)
Firstborn	0.575	(0.494)	0.575	(0.494)	0.596	(0.491)
Height (cm)	93.5	(13.1)	93.6	(13.1)	89.7	(12.0)
Weight (kg)	14.6	(4.13)	14.7	(4.14)	13.5	(3.73)
Head circumference (cm)	48.7	(2.41)	48.7	(2.41)	48.2	(2.39)
Previous screening attendance	0.780	(0.414)	0.781	(0.414)	0.749	(0.433)
Living in the metropolitan areas	0.424	(0.494)	0.425	(0.494)	0.411	(0.492)
Medical aid recipient	0.010	(0.097)	0.009	(0.096)	0.016	(0.127)
Total medical expenditure (USD)	727	(898)	721	(820)	861	(1,943)
Number of hospital visits	59.5	(36.6)	59.6	(36.5)	56.3	(36.8)
Panel B: Parents characteristics						
Mother's age	34.3	(4.11)	34.3	(4.09)	33.8	(4.09)
Father's age	36.8	(4.57)	36.8	(4.55)	36.9	(4.55)
Mother employed	0.358	(0.479)	0.360	(0.480)	0.320	(0.480)
Father employed	0.792	(0.406)	0.792	(0.406)	0.782	(0.406)
Mother on leave	0.103	(0.304)	0.103	(0.304)	0.106	(0.304)
Father on leave	0.005	(0.069)	0.005	(0.069)	0.005	(0.069)
Mother's average monthly income (USD)	798	(1,496)	802	(1,499)	702	(1,499)
Father's average monthly income (USD)	2,680	(2,720)	2,687	(2,727)	2,517	(2,727)
Observations	1,306,063		1,250,644		55,419	

*N*otes: The table presents summary statistics for the final sample screened during November-February of 2012–13, 2013–14, and 2014–15. The sample is restricted to children linked to both parents and excludes children with pre-existing developmental issues. Ages are calculated as of January 1, 2015. Height, weight, and head circumference are measured during the screening examination. Total medical expenditure, hospital visits, and parental average monthly income are measured one year prior to screening. Parental employment and leave status are defined as having the respective status for at least one month in the year prior to screening. All monetary values are converted in USD (1 USD = 1,300 KRW). See Section 3 for detailed definitions.

Table 2: First stage results

	(1) Main	(2) No holidays
Panel A: High-risk ("Follow-up needed" or "Further testing needed")		
Discontinuity×Post	0.054^{***}	0.054^{***}
	(0.002)	(0.002)
Discontinuity	0.000	0.000
	(0.001)	(0.001)
Post	0.010^{***}	0.010^{***}
	(0.001)	(0.001)
Constant	0.026^{***}	0.026^{***}
	(0.001)	(0.001)
F-statistic	1,046	990
Panel B: Decomposition by subcategory		
Follow-up needed		
Discontinuity×Post	0.047^{***}	0.047^{***}
	(0.002)	(0.002)
Further testing needed		
Discontinuity×Post	0.007^{***}	0.008^{***}
	(0.001)	(0.001)
Observations	1,306,063	1,216,491

Notes: This table presents first stage estimation results. Column (1) shows our main specification using linear polynomials with a uniform kernel and a 60-day bandwidth. Column (2) shows results estimated without holiday observations. Both specifications use age-adjusted weights of equation (B1). Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix

A Appendix Figures and Tables

Results of Health Screening for Infants and Children

(For ages 30 to 36 months)

Name		Resident registration number	
Address		Phone	

	Test items	Results	Assessment	Reference values	Notes on results
Physical measure-ments	Height	□□□.□ cm (P)	□ Normal development □ Further testing needed	5~95P	
	Weight	□□.□ kg (P)	□ Normal development □ Further testing needed	5~95P	If a child who was Normal development on the growth chart shows a change of one or two major percentiles by the next screening period : Further testing needed
	Head circumference	□□.□ cm (P)	□ Normal development □ Further testing needed	5~95P	
	BMI	□□.□ (kg/㎡)(P)	□ Normal development □ Further testing needed	5P≤Normal development<95P Overweight : ≥95P	
	※ A percentile (P) refers to the ranking of a child among 100 children of the same gender and age, in ascending order of size.				

Height (cm)	Weight (kg)	Head circumstance (cm)	BMI (kg/㎡)
Months	Months	Months	Months

Physical examination findings					
General conditions	□ Normal development	□ High-risk	Lung	□ Normal development	□ High-risk
Head	□ Normal development	□ High-risk	Heart	□ Normal development	□ High-risk
Face	□ Normal development	□ High-risk	Abdomen	□ Normal development	□ High-risk
Eyes	□ Normal development	□ High-risk	Genitals	□ Normal development	□ High-risk
Nose	□ Normal development	□ High-risk	Limbs	□ Normal development	□ High-risk
Ears	□ Normal development	□ High-risk	Spine	□ Normal development	□ High-risk
Oral, Throat	□ Normal development	□ High-risk	Nervous system	□ Normal development	□ High-risk
			Skin	□ Normal development	□ High-risk

Vision	Questionnaire	□ Normal development □ Further testing needed (Related questionnaire items: □ 5 □ 6 □ 7 □ 8 □ 9)	
	Eye examination	□ Picture chart □ Numerical chart	Left Eye : Right eye : ※ Fill out as written on the vision chart
		□ Normal development □ Further testing needed □ Refusal of Test	
Hearing	Questionnaire	□ Normal development □ Further testing needed (Related questionnaire items: □ 10 □ 11 □ 12 □ 13 □ 14)	
Health Education		□ Accident prevention education □ Nutrition education □ Social skills education	
Developmental assessment results □ K-ASQ □ DENVER-Ⅱ	When using K-ASQ	□ For 30 months □ For 33 months □ For 36 months Guardian's concern : □ N □ Y (Item No.)	
		□ Normal development □ Follow-up needed (□ Communication □ Gross motor □ Fine motor □ Problem-solving □ Personal/social) □ Further testing needed (□ Communication □ Gross motor □ Fine motor □ Problem-solving □ Personal/social) □ Need for continuous management	
Overall assessment		□ Normal development □ Follow-up needed □ Further testing needed	
Findings and actions			
Healthcare provider code		Screening institution name	Examiner's name (Signature)
Screening date			License number

Figure A1: Screening report card with K-ASQ

Notes: This figure shows a result card from the National Health Screening Program for infant and children using the K-ASQ. The English text is translated by the authors from the original Korean.

Results of Health Screening for Infants and Children

(For ages 30 to 36 months)

Name		Resident registration number			
Physical measurements	Height(cm)	weight(kg)	Head circumference(cm)	BMI(kg/㎡)	
	□□.□ cm (P)	□□.□ kg (P)	□□.□ cm (P)	□□.□ (kg/㎡) (P)	
	□ Normal development □ Further testing needed	□ Normal development □ Further testing needed	□ Normal □ Further testing needed	□ Normal □ Further testing needed	
	※ A percentile (P) refers to the ranking of a child among 100 children of the same gender and age, in ascending order of size. The growth curve of the graph rises from the bottom upwards, representing the percentiles of 5, 10, 25, 50, 75, 90, 95 successively.				
Physical examination findings	General conditions	□ Normal development □ High-risk	Chest	□ Normal development □ High-risk	
	Skin	□ Normal development □ High-risk	Lungs	□ Normal development □ High-risk	
	Head/Face	□ Normal development □ High-risk	Heart	□ Normal development □ High-risk	
	Eyes	□ Normal development □ High-risk	Abdomen	□ Normal development □ High-risk	
	Nose	□ Normal development □ High-risk	Genitals	□ Normal development □ High-risk	
	Ears	□ Normal development □ High-risk	Limbs	□ Normal development □ High-risk	
	Oral	□ Normal development □ High-risk	Spine	□ Normal development □ High-risk	
	Throat	□ Normal development □ High-risk	Nervous system	□ Normal development □ High-risk	
Vision	Questionnaire	□ Normal development □ Further testing needed (Related questionnaire items: □ 10 □ 11 □ 12 □ 13 □ 14)			
	Eye examination	□ Picture chart □ Numerical chart	Left eye: Right eye: Both eyes:		
		□ Normal development □ Further testing needed □ Refusal of test			
Hearing	Questionnaire	□ Normal development □ Further testing needed (Related questionnaire items: □ 10 □ 11 □ 12 □ 13 □ 14)			
Health education		□ Accident prevention education □ Nutrition education □ Social skills education			
Developmental assessment results		□ Normal development □ Follow-up needed (□ Gross motor □ Fine motor □ Communication □ Cognition □ Social interaction □ Self-help) □ Further testing needed (□ Gross motor □ Fine motor □ Communication □ Cognition □ Social interaction □ Self-help) □ Need for continuous management			
Overall assessment		□ Normal development □ Follow-up needed □ Further testing needed			
Findings and actions					
Healthcare provider code		Screening institution name			
Screening date		License number		Examiner's name	

Figure A2: Screening report card with K-DST

Notes: This figure shows a result card from the National Health Screening Program for infant and children using the K-DST. The English text is translated by the authors from the original Korean.

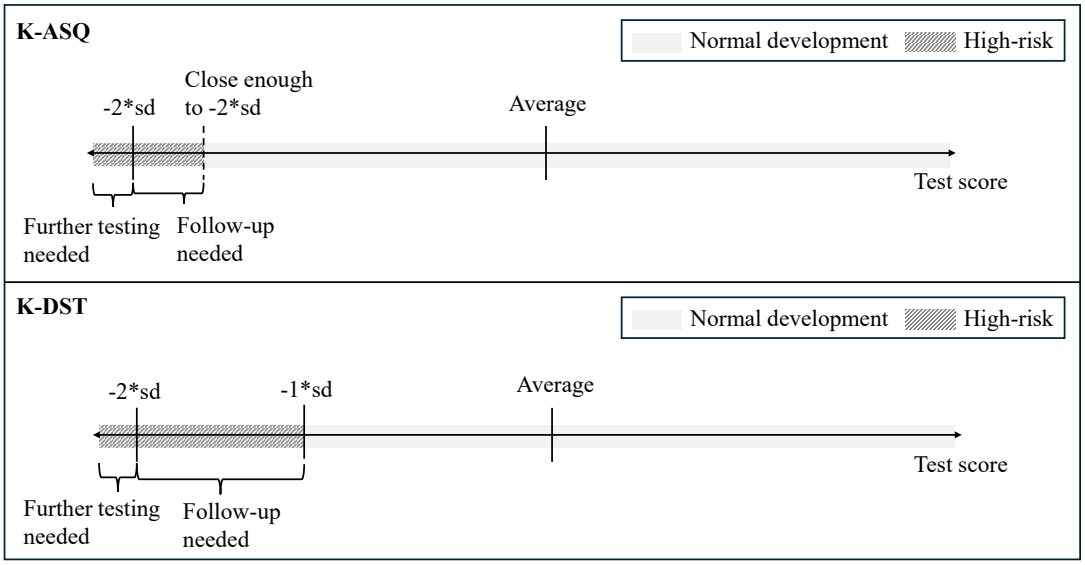
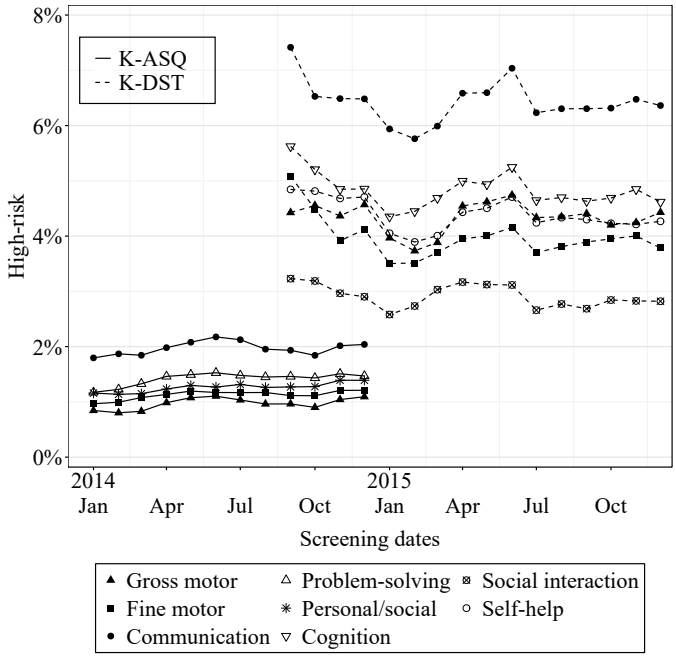
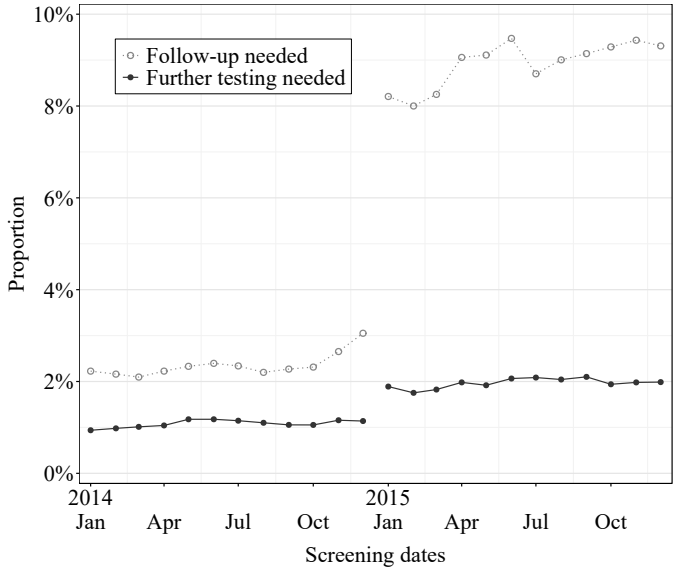


Figure A3: Classification criteria for developmental screening in K-ASQ and K-DST

Notes: This figure illustrates the classification criteria for K-ASQ and K-DST. Vertical lines represent threshold cutoffs. Both tools classify children as "Further testing needed" if scores fall below two standard deviations from the mean. K-DST defines "Follow-up needed" for scores between -2SD and -1SD, while K-ASQ allows physician discretion for cases near the -2SD. Scores above these thresholds are classified as "Normal development." The shaded areas represent "High-risk" category, which includes both "Further testing needed" and "Follow-up needed."



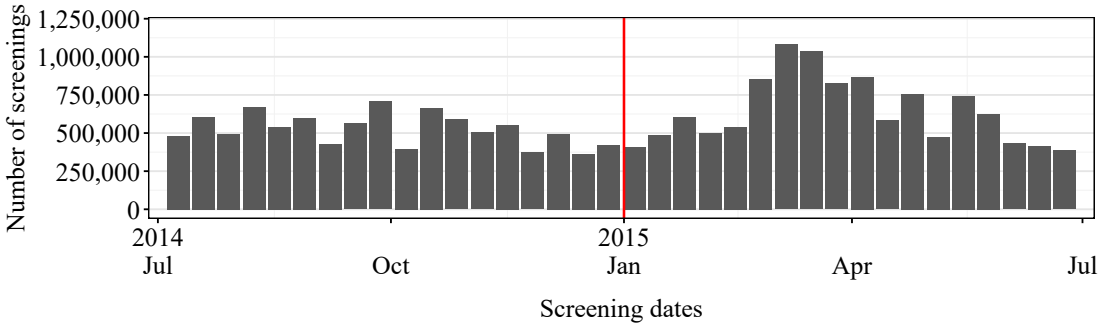
(a) By developmental domain and screening tool



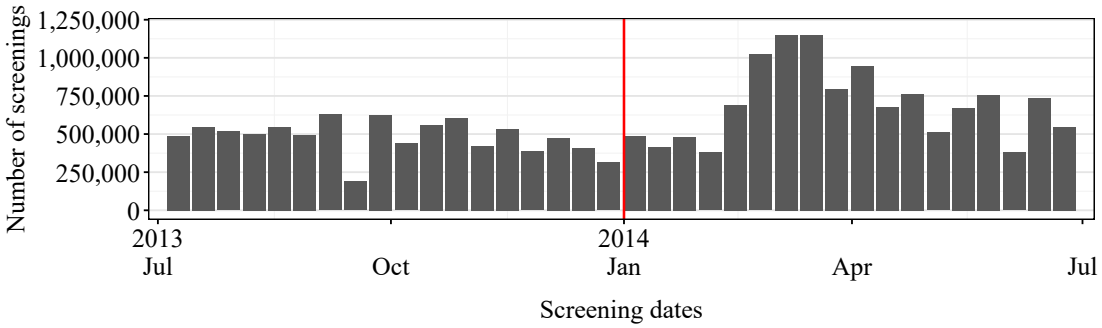
(b) By level of concern

Figure A4: Trends in high-risk classifications

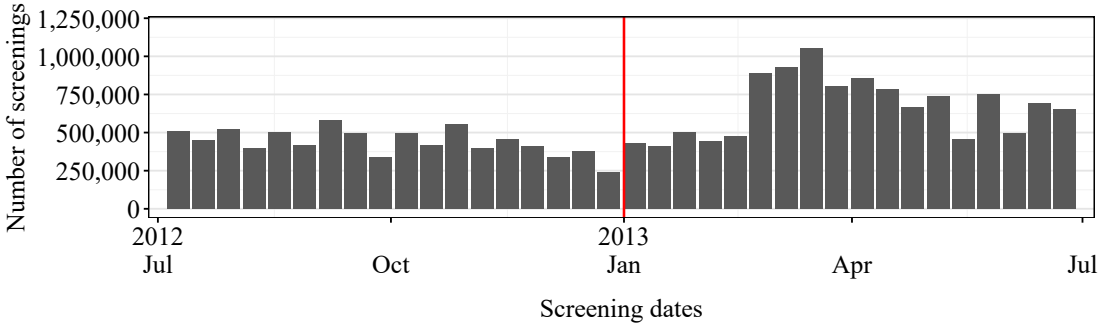
Notes: This figure presents trends in high-risk screening classifications in the NHSP from January 2014 to December 2015. Panel (a) shows monthly trends in the proportion of high-risk classifications across developmental domains for K-ASQ (solid line) and K-DST (dashed line). In panel (a), different symbols represent eight developmental domains: gross motor, fine motor, communication, problem-solving, personal/social, cognition, social interaction, and self-help. The overlapping domains between the two questionnaires are gross motor, fine motor, and communication. Panel (b) shows monthly proportions of high-risk screening results disaggregated into "Follow-up needed" (light dotted line) and "Further testing needed" (dark solid line).



(a) July 2014 - June 2015 (K-DST implementation)



(b) July 2013 - June 2014 (Pre-implementation)



(c) July 2012 - June 2013 (Pre-implementation)

Figure A5: Distribution of screening dates around January 1st cutoffs

Notes: This figure shows histograms of screening frequency around January 1st cutoffs. Panel (a) shows the number of screenings around the 2014—2015 cutoff, panel (b) around the 2013-–2014 cutoff, and panel (c) around the 2012-–2013 cutoff. The numbers of screenings are aggregated into 10-day bins. The red vertical lines indicate January 1st for each year.

Table A1: Summary statistics of
child-parent linked sample and unlinked sample

	Parents linked		Parents unlinked	
	Mean	SD	Mean	SD
High-risk	0.048	(0.214)	0.053	(0.224)
Male	0.515	(0.500)	0.514	(0.500)
Age in months	35.4	(19.1)	34.5	(18.9)
Height (cm)	93.6	(13.1)	93.1	(13.1)
Weight (kg)	14.6	(4.15)	14.5	(4.13)
Head circumference (cm)	48.7	(2.42)	48.6	(2.45)
Previous screening attendance	0.779	(0.415)	0.747	(0.435)
Living in the metropolitan areas	0.425	(0.494)	0.448	(0.497)
Medical aid recipient	0.010	(0.099)	0.047	(0.211)
Total medical expenditure (USD)	746	(1,078)	740	(1,025)
Number of hospital visits	59.8	(36.8)	56.9	(36.7)
Observations	1,333,056		107,028	

Notes: This table compares sample characteristics between children linked to both parents versus children not linked to parents through the NHID Family Tree Database. Age is calculated as of January 1, 2015. Height, weight, and head circumference are measured during the screening examination. Total medical expenditure and hospital visits are measured one year prior to screening. All monetary values are converted in USD (1 USD = 1,300 KRW). See Section 3 for detailed definitions.

Table A2: Covariate balance check

	Discontinuity×Post
Panel A: Child characteristics	
Male	−0.001
Age in months	−0.009
Firstborn	0.001
Height (cm)	−0.015
Weight (kg)	0.026
Head circumference (cm)	−0.001
Previous screening attendance	−0.004
Living in the metropolitan areas	0.006
Medical aid recipient	0.005***
Total medical expenditure (USD)	−1.20
Number of hospital visits	0.334
Panel B: Parents characteristics	
Mother's age	0.020
Father's age	0.054
Mother employed	0.000
Father employed	−0.003
Mother on leave	0.001
Father on leave	0.000
Mother's average monthly income (USD)	−0.010
Father's average monthly income (USD)	−0.014
Observations	1,306,063

Notes: This table presents diff-in-disc estimates with age-adjusted weights of equation (B1) applied. Total medical expenditure, hospital visits, and parental average monthly income are measured one year prior to screening. Parental employment and leave status are defined as having the respective status for at least one month in the year prior to screening. All monetary values are converted in USD (1 USD = 1,300 KRW). All estimates use a uniform kernel with a 60-day bandwidth and linear polynomials. Standard errors are clustered at the individual level. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A3: Summary statistics by income group

	Lower-income		Higher-income		Difference
	Mean	SD	Mean	SD	
Panel A: Child characteristics					
High-risk	0.045	(0.208)	0.040	(0.195)	0.006***
Male	0.511	(0.500)	0.512	(0.500)	−0.001
Age in months	34.9	(19.1)	35.5	(19.0)	−0.627***
Firstborn	0.574	(0.494)	0.577	(0.494)	−0.003***
Height (cm)	93.2	(13.2)	93.7	(13.0)	−0.524***
Weight (kg)	14.6	(4.21)	14.6	(4.05)	−0.020***
Head circumference (cm)	48.6	(2.43)	48.8	(2.38)	−0.178***
Previous screening attendance	0.767	(0.423)	0.792	(0.406)	−0.026***
Living in the metropolitan areas	0.418	(0.493)	0.431	(0.495)	−0.013***
Medical aid recipient	0.017	(0.129)	0.002	(0.046)	0.015***
Total medical expenditure (USD)	733	(921)	721	(873)	12.0***
Number of hospital visits	58.7	(36.6)	60.3	(36.6)	−1.66***
Panel B: Parents characteristics					
Mother's age	34.0	(4.50)	34.6	(3.66)	−0.602***
Father's age	36.6	(5.10)	37.0	(3.95)	−0.346***
Mother employed	0.320	(0.467)	0.395	(0.489)	−0.075***
Father employed	0.583	(0.493)	1.00	(0.000)	−0.417***
Mother on leave	0.068	(0.251)	0.139	(0.345)	−0.071***
Father on leave	0.003	(0.058)	0.006	(0.079)	−0.003***
Mother's average monthly income (USD)	579	(1,154)	1,016	(1,746)	−436***
Father's average monthly income (USD)	927	(960)	4,432	(2,781)	−3,504***
Observations	653,031		653,032		

Notes: This table presents summary statistics by income group for our final sample screened during November-February of 2012–13, 2013–14, and 2014–15. The sample is restricted to children linked to both parents and excludes children with pre-existing developmental issues. Ages are calculated as of January 1, 2015. Height, weight, and head circumference are measured during the screening examination. Total medical expenditure, hospital visits, and parental average monthly income are measured one year prior to screening. Parental employment and leave status are defined as having the respective status for at least one month in the year prior to screening. All monetary values are converted in USD (1 USD = 1,300 KRW). See Section 3 for detailed definitions. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A4: First stage results by income group

	(1) Lower-income	(2) Higher-income
Discontinuity×Post	0.059^{***}	0.049^{***}
	(0.003)	(0.002)
Discontinuity	0.000	0.000
	(0.001)	(0.001)
Post	0.012^{***}	0.009^{***}
	(0.002)	(0.001)
Constant	0.028^{***}	0.023^{***}
	(0.001)	(0.001)
F-statistic	548	501
Observations	653,031	653,032

Notes: This table presents first stage estimation results by income group. Column (1) presents results for the higher-income group and column (2) for the lower-income group. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A5: Effects on hospital visits for DD
and developmental disability registration

	(1) 1 Year	(2) 2 Years	(3) 3 Years	(4) 4 Years	(5) 5 Years
Panel A. Probability of hospital visits for DD					
Lower-income					
Control mean	0.005	0.008	0.009	0.010	0.013
Discontinuity×Post	0.002*	0.000	0.001	0.002*	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Higher-income					
Control mean	0.005	0.007	0.008	0.009	0.010
Discontinuity×Post	−0.001	−0.001	−0.001	0.000	−0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Panel B. Developmental disability registration					
Lower-income					
Control mean	0.0002	0.0005	0.0011	0.0020	0.0028
Discontinuity×Post	0.0007***	0.0012***	0.0015***	0.0016**	0.0021***
	(0.0002)	(0.0004)	(0.0005)	(0.0006)	(0.0007)
Higher-income					
Control mean	0.0001	0.0004	0.0008	0.0015	0.0021
Discontinuity×Post	0.0000	−0.0004	−0.0003	−0.0004	−0.0004
	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0006)

Notes: This table reports diff-in-disc estimates from equation (1) by income group. Columns correspond to effects in years 1–5 after screening. "DiscontinuityxPost" rows report the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. Sample sizes and first-stage results are reported in Table A4. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A6: Effects on developmental disability registration by disorder type

	(1) 1 Year	(2) 2 Years	(3) 3 Years	(4) 4 Years	(5) 5 Years
Panel A. Lower-income					
All type	0.0007^{***}	0.0012^{***}	0.0015^{***}	0.0016^{**}	0.0021^{***}
Intellectual disability	0.0005^{**}	0.0008^{***}	0.0009^{**}	0.0010^{**}	0.0013^{**}
ASD	0.0001	0.0002	0.0004	0.0003	0.0005
cerebral palsy	0.0000	−0.0001	−0.0001	−0.0001	0.0000
language disorders	0.0002	0.0004^{**}	0.0003	0.0004	0.0004
Panel B. Higher-income					
All type	0.0000	−0.0004	−0.0003	−0.0004	−0.0004
Intellectual disability	0.0001	0.0001	−0.0001	0.0000	0.0000
ASD	0.0000	−0.0001	0.0002	0.0000	−0.0001
cerebral palsy	0.0000	0.0000	−0.0001	−0.0001	−0.0001
language disorders	-0.0001^{*}	-0.0004^{**}	-0.0004^{*}	−0.0003	−0.0003

Notes: This table reports diff-in-disc estimates from equation (1) by income group. Columns correspond to effects in years 1–5 after screening. The "All type" row reports the estimated effects on overall developmental disability registration. Results by specific disability types are reported below. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A7: Effects on mother's labor supply

	(1) 1 Year	(2) 2 Years	(3) 3 Years	(4) 4 Years	(5) 5 Years
Panel A. Mother's employment					
Lower-income					
Control mean	0.349	0.374	0.398	0.422	0.445
Discontinuity×Post	0.001	0.000	0.003	−0.003	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Higher-income					
Control mean	0.405	0.418	0.433	0.449	0.467
Discontinuity×Post	−0.010*	−0.012**	−0.012**	−0.014**	−0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Panel B. Mother's monthly income					
Lower-income					
Control mean	646	710	770	838	919
Discontinuity×Post	0.017	0.011	0.022	0.020	0.017
	(0.023)	(0.021)	(0.021)	(0.021)	(0.019)
Higher-income					
Control mean	1,072	1,145	1,209	1,282	1,367
Discontinuity×Post	−0.007	−0.025	0.003	0.001	−0.003
	(0.021)	(0.020)	(0.019)	(0.019)	(0.019)

Notes: This table reports diff-in-disc estimates from equation (1) by income group. Columns correspond to effects in years 1–5 after screening. "DiscontinuityxPost" rows report the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. For monthly income, means are reported in raw units (USD), while the estimated effects are obtained from Poisson regressions. Sample sizes and first-stage results are reported in Table A4. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A8: Effects on mother's employment by subgroup

	(1) 1 Year	(2) 2 Years	(3) 3 Years	(4) 4 Years	(5) 5 Years
Panel A. Lower-income & Employed mothers					
Control mean	0.853	0.787	0.765	0.754	0.752
Discontinuity×Post	−0.002	−0.013*	−0.013	−0.009	−0.005
	(0.007)	(0.008)	(0.009)	(0.009)	(0.009)
First stage	0.047	0.047	0.047	0.047	0.047
Observations	209,246	209,246	209,246	209,246	209,246
Panel B. Lower-income & Non-employed mothers					
Control mean	0.109	0.178	0.224	0.263	0.299
Discontinuity×Post	−0.009*	−0.002	0.003	−0.007	0.000
	(0.005)	(0.006)	(0.006)	(0.006)	(0.007)
First stage	0.066	0.066	0.066	0.066	0.066
Observations	443,785	443,785	443,785	443,785	443,785
Panel C. Higher-income & Employed mothers					
Control mean	0.891	0.835	0.811	0.799	0.793
Discontinuity×Post	−0.007	−0.011*	−0.013*	−0.014*	−0.011
	(0.005)	(0.007)	(0.007)	(0.007)	(0.007)
First stage	0.040	0.040	0.040	0.040	0.040
Observations	258,263	258,263	258,263	258,263	258,263
Panel D. Higher-income & Non-employed mothers					
Control mean	0.086	0.143	0.184	0.219	0.253
Discontinuity×Post	−0.002	−0.004	−0.005	−0.007	0.001
	(0.004)	(0.005)	(0.006)	(0.006)	(0.007)
First stage	0.055	0.055	0.055	0.055	0.055
Observations	394,769	394,769	394,769	394,769	394,769

Notes: This table reports diff-in-disc estimates from equation (1) by income group and mother's employment. Columns correspond to effects in years 1–5 after screening. The "DiscontinuityxPost" row reports the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A9: Effects on father's labor supply

	(1) 1 Year	(2) 2 Years	(3) 3 Years	(4) 4 Years	(5) 5 Years
Panel A. Father's employment					
Lower-income					
Control mean	0.604	0.616	0.624	0.629	0.636
Discontinuity×Post	0.003	0.007	0.010*	0.006	0.004
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Higher-income					
Control mean	0.985	0.974	0.964	0.955	0.948
Discontinuity×Post	0.001	0.001	0.003	0.002	0.002
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Panel B. Father's monthly income					
Lower-income					
Control mean	1,095	1,226	1,330	1,424	1,519
Discontinuity×Post	−0.001	−0.002	0.013	0.009	−0.008
	(0.013)	(0.015)	(0.014)	(0.014)	(0.015)
Higher-income					
Control mean	4,573	4,700	4,830	4,971	5,107
Discontinuity×Post	0.002	−0.002	0.015*	0.022**	0.025***
	(0.008)	(0.008)	(0.008)	(0.011)	(0.010)

Notes: This table reports diff-in-disc estimates from equation (1) by income group. Columns correspond to effects in years 1–5 after screening. "DiscontinuityxPost" rows report the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. For monthly income, means are reported in raw units (USD), while the estimated effects are obtained from Poisson regressions. Sample sizes and first-stage results are reported in Table A4. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A10: Effects on fertility by subgroups

		Household income		Mother's employment	
	All	Low	High	Employed	Non-employed
	(1)	(2)	(3)	(4)	(5)
Panel A. Additional childbirth within two years					
Control mean	0.233	0.230	0.236	0.250	0.250
Discontinuity×Post	-0.008^{*}	-0.015^{**}	-0.002	0.005	-0.016^{***}
	(0.004)	(0.006)	(0.006)	(0.007)	(0.005)
Panel B. Additional childbirth within seven years					
Control mean	0.354	0.341	0.368	0.384	0.384
Discontinuity×Post	-0.004	-0.005	-0.003	0.002	-0.008
	(0.005)	(0.007)	(0.007)	(0.008)	(0.006)
First stage	0.070	0.075	0.065	0.057	0.078
Observations	780,409	394,003	386,406	279,579	500,830

Notes: This table presents diff-in-disc estimates of equation (1) on fertility by subgroup using screening rounds 2nd–4th. Column (1) shows results for the full sample. Columns (2)-(3) show results by income group. Columns (4)-(5) show results by mother's pre-screening employment status. The "DiscontinuityxPost" row reports the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table A11: Effects on moving by subgroups

		Household income		Among higher-income households	
	All	Low	High	With facilities	Without facilities
	(1)	(2)	(3)	(4)	(5)
Panel A. Moving within one year					
Control mean	0.305	0.305	0.304	0.316	0.316
Discontinuity×Post	0.005	0.000	0.009*	0.000	0.014**
	(0.004)	(0.005)	(0.005)	(0.008)	(0.007)
Panel B. Moving within five years					
Control mean	0.503	0.511	0.496	0.525	0.525
Discontinuity×Post	−0.005	−0.007	−0.002	−0.002	−0.004
	(0.004)	(0.006)	(0.006)	(0.009)	(0.008)
First stage	0.054	0.059	0.049	0.054	0.045
Observations	1,306,063	653,031	653,032	268,765	384,267

Notes: This table presents diff-in-disc estimates of equation (1) on moving by subgroup. Column (1) shows results for the full sample. Columns (2)-(3) show results by income group. Columns (4)-(5) show results for the higher-income group by the presence of local developmental rehabilitation facilities in their neighborhoods. The "DiscontinuityxPost" row reports the estimated effects. "Control mean" refers to the mean of the dependent variable for the normal development group. All models apply age-adjusted weights from equation (B1) and use linear polynomials with a uniform kernel and a 60-day bandwidth. Standard errors clustered at the individual level are in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

B Difference-in-Discontinuities

This appendix provides detailed illustration of our difference-in-discontinuities (diff-in-disc) identification strategy. We exploit the policy change in January 2015 when the K-DST became the sole screening tool and use the resulting variation in the probability of receiving high-risk classifications based on the date of screening.

A potential threat to this strategy arises if the screening timing around January 1st is systematically correlated with family characteristics. We assess this concern by testing for continuity in covariates around the cutoff. Column (1) of Table A2 presents a covariate balance check using standard regression discontinuity (RD) estimation at the 2014–2015 cutoff. Children screened early in the year are, on average, approximately 1.3 months younger than those screened later in the year, and accordingly have lower height, weight, and head circumference. They are also more likely to live in metropolitan areas, less likely to be medical aid recipients, and more likely to have attended previous screenings. While prior-year medical expenditures do not differ significantly, children screened after the cutoff had more hospital visits in the previous year. Parental characteristics also differ across the 2014–2015 threshold: parents of children screened just after the cutoff are younger, mothers are less likely to have taken parental leave in the previous year, and fathers are more likely to have done so.[20] These systematic differences in observable characteristics around the cutoff indicate that a standard RD design is not appropriate in this context.

We therefore adopt difference-in-discontinuities (diff-in-disc) method to estimate the effect of health screening results while addressing seasonality. Diff-in-disc, first devised by Grembi et al. (2016), is an effective method to handle situations where there is a confounding discontinuity around the cutoff. This method combines elements of RD and difference-in-differences (DiD) by subtracting the discontinuity at a control cutoff (where only confounding factors change) from the discontinuity at the treatment cutoff (where both treatment status and confounding factors change). In our context, we subtract the discontinuity observed at previous year transitions (control cutoffs) from the discontinuity at the 2014–2015 year transition (treatment cutoff), thereby controlling for seasonal patterns.

Even with the diff-in-disc approach, confounding factors unique to the 2014–2015 transition may remain. For instance, the discontinuity in child age is slightly larger between 2014 and 2015 than in prior years. To isolate the treatment effect from this age-related factor, we apply a weighting scheme that adjusts

[20] Parental age is defined as of January 2015, not at the screening date.

for child's age.

We set weight w_{it} for child i and screening date t,

$$\frac{1}{w_{it}} = \sum_{j,s} \frac{\mathbb{1}\{\lfloor (t - c_t)/15 \rfloor = j\}\mathbb{1}\{S_{it} = s\}}{\sum_{i,t} \mathbb{1}\{\lfloor (t - c_t)/15 \rfloor = j\}\mathbb{1}\{S_{it} = s\}}, \tag{B1}$$

where $\lfloor . \rfloor$ is the floor function and S_{it} denotes the screening round that child i takes on date t. This weighting approach creates groups for each 15-day interval $\times$ screening round combination and assigns weights as the inverse of observations within each group. Recall that screening round depends on child's age, which allows our estimates to adjust for age differences across time periods.

Our combined use of diff-in-disc estimation with age-adjusted weighting effectively addresses the covariate imbalance. Column (2) of Table B1 presents unweighted diff-in-disc estimates, where differences in parental characteristics are notably smaller and no longer statistically significant, compared to column (1). However, several child characteristics——particularly age and anthropometric measures——still show imbalances. Column (3) presents diff-in-disc estimates with age-adjusted weights. The adjustment eliminates the significant difference in child age and anthropometric measurements. While minor differences remain in medical aid receipt and medical expenditures, the coefficients are small in magnitude.

Table B1: Covariate balance check

	RD	Diff-in-disc	
	Age-unadjusted	Age-unadjusted	Age-adjusted
	(1)	(2)	(3)
Panel A: Child characteristics			
Male	-0.004	-0.002	-0.001
Age in months	-1.343^{***}	-0.955^{***}	-0.009
Firstborn	-0.001	0.000	0.001
Height (cm)	-0.911^{***}	-0.651^{***}	-0.015
Weight (kg)	-0.234^{***}	-0.162^{***}	0.026
Head circumference (cm)	-0.127^{***}	-0.089^{***}	-0.001
Previous screening attendance	0.009^{***}	0.000	-0.004
Living in the metropolitan areas	0.012^{***}	0.007^{*}	0.006
Medical aid recipient	-0.003^{***}	0.004^{***}	0.005^{***}
Total medical expenditure (USD)	6.62	4.55	-1.20
Number of hospital visits	0.936^{***}	0.142	0.334
Panel B: Parents characteristics			
Mother's age	-0.089^{***}	-0.027	0.020
Father's age	-0.134^{***}	-0.016	0.054
Mother employed	-0.005	0.000	0.000
Father employed	0.007^{***}	0.000	-0.003
Mother on leave	0.008^{***}	0.006^{**}	0.001
Father on leave	0.000	0.000	0.000
Mother's average monthly income (USD)	-52.2^{***}	-16.5	-0.010
Father's average monthly income (USD)	37.2^{***}	-13.4	-0.014
Observations	455,924	1,306,063	1,306,063

Notes: This table presents covariate balance checks around the January 1st cutoffs. Column (1) shows RD estimates using only the 2014–2015 cutoff. Column (2) presents unweighted diff-in-disc estimates comparing the 2014–2015 cutoff with control cutoffs (2012–2013 and 2013–2014). Column (3) shows diff-in-disc estimates with age-adjusted weights of equation (B1) applied. Ages are calculated as of January 1, 2015. Height, weight, and head circumference are measured during the screening examination. Total medical expenditure, hospital visits, and parental average monthly income are measured one year prior to screening. Parental employment and leave status are defined as having the respective status for at least one month in the year prior to screening. All monetary values are converted in USD (1 USD = 1,300 KRW). All estimates use a uniform kernel with a 60-day bandwidth and linear polynomials. Standard errors are clustered at the individual level. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.