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ORIGINAL PAPER

Risks to Child Development and School Readiness Among Children Under Six in Pakistan: Findings from a Nationally Representative Phone Survey

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Abstract

This paper analyzes the risks to child development and school readiness among children under age 6 in Pakistan. Drawing on a nationally representative telephone survey conducted in the midst of a global pandemic, between December 2021 and February 2022, we present the first nationally representative estimates of child development for children under 3 years of age and school readiness for children 3–6 years of age, using internationally validated instruments. The paper examines how risk factors that were exacerbated due to the COVID-19 pandemic, such as parental distress, lack of psychosocial stimulation, food insecurity, low maternal education, no enrollment in early childhood education, and living in a rural area, are associated with children's outcomes. The data indicate that more than half (57 percent) of parents with children under age 3 were distressed and that 61 percent of households reported cutting down on the size of or skipping meals since the start of the pandemic. The data reveal that over half of parents fail to engage in adequate psychosocial stimulation with their child and enrollment in early childhood education is very low (39 percent). The paper finds that child development outcomes decline rapidly as the number of risks increase. Specifically, for children under 3 years, lack of psychosocial stimulation at home and higher levels of parental distress were most significantly associated with lower child development levels. For a child aged 3–6 years, early childhood education enrollment and the amount of psychosocial stimulation the child received at home had the strongest association with school readiness scores.

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Résumé
Cet article analyse les risques pour le développement de l'enfant et la maturité scolaire chez les enfants de moins de 6 ans au Pakistan. S'appuyant sur une enquête téléphonique représentative à l'échelle nationale menée pendant une pandémie mondiale entre décembre 2021 et février 2022, nous présentons les premières estimations représentatives au niveau national du développement de l'enfant pour les enfants de moins de 3 ans d'âge et de la maturité scolaire pour les enfants de 3 à 6 ans à l'aide d'instruments validés au niveau international. L'article examine comment les facteurs de risque qui ont été exacerbés en raison de la pandémie COVID-19, tels que la détresse parentale, le manque de stimulation psychosociale, l'insécurité alimentaire, le faible niveau d'éducation maternelle, l'absence d'inscription à l'éducation préscolaire et la vie en zone rurale, sont associés au développement des enfants. Les données indiquent que plus de la moitié (57 %) des parents ayant des enfants de moins de 3 ans étaient en détresse et que 61 % des ménages ont déclaré avoir réduit la taille ou sauté des repas depuis le début de la pandémie. Les données révèlent que plus de la moitié des parents ne s'engagent pas dans une stimulation psychosociale adéquate avec leur enfant et que l'inscription à l'éducation préscolaire est très faible (39 %). L'article constate que les résultats du développement de l'enfant déclinent rapidement à mesure que le nombre de risques augmente. Plus précisément, pour les enfants de moins de 3 ans, le manque de stimulation psychosociale à la maison et des niveaux plus élevés de détresse parentale étaient le plus significativement associés à un plus faible niveaux de développement. Pour un enfant âgé de 3 à 6 ans, l'inscription à l'éducation préscolaire et la quantité de stimulation psychosociale que l'enfant recevait à la maison avaient la plus forte association avec les scores de maturité scolaire.

Resumen
Este documento analiza los riesgos para el desarrollo infantil y la preparación escolar entre los niños menores de 6 años en Pakistán. Basándonos en una encuesta telefónica representativa a nivel nacional realizada en medio de una pandemia mundial, entre diciembre de 2021 y febrero de 2022, presentamos las primeras estimaciones representativas a nivel nacional del desarrollo infantil de niños menores de 3 años y la preparación escolar de niños de 3 a 6 años de edad, utilizando instrumentos validados internacionalmente. El artículo examina cómo se asocian los factores de riesgo que se exacerbaron debido a la pandemia de COVID-19, como la angustia de los padres, la falta de estimulación psicosocial, la inseguridad alimentaria, la baja educación materna, la no matriculación en educación de primaria infancia y vivir en una zona rural, con los resultados de los niños. Los datos indican que más de la mitad (57 por ciento) de los padres con niños menores de 3 años estaban angustiados y que el 61 por ciento de los hogares informaron que redujeron el tamaño de las comidas o se las saltaron desde el comienzo de la pandemia. Los datos revelan que más de la mitad de los padres no logran dar una estimulación psicosocial adecuada a sus hijos y que la inscripción en la educación de primera infancia es muy baja (39 por ciento). El docu-

mento encuentra que los resultados del desarrollo infantil disminuyen rápidamente a medida que aumenta el número de riesgos. Específicamente, para los niños menores de 3 años, la falta de estimulación psicosocial en el hogar y los niveles más altos de angustia de los padres se asociaron de manera más significativa con niveles más bajos de desarrollo infantil. Para un niño de 3 a 6 años, la matriculación en la educación de primera infancia y la cantidad de estimulación psicosocial que el niño recibió en el hogar tuvieron la asociación más fuerte con su puntuación de preparación escolar.

Introduction

Pakistan, the fifth most populous country in the world with 221 million people, has a low Human Capital Index of 0.41, indicating that a typical Pakistani child born today can only expect to be 41 percent as productive as they could be if they had access to full education and health. Many of the risks to development occur in the first 5 years of life, when brain development is exceptionally rapid and sensitive (Gilmore et al., 2018) and foundations are laid for attachment, physical growth, and intellectual and social–emotional development over the life course. Children in their early years require nurturing that emerges not only from adequate nutrition and health care, but also from safe environments with engaged caregivers who interact with their young children responsively and provide psychosocial stimulation, defined as sensitive, responsive and developmentally appropriate play and interactions, which occur through everyday activities such as talking and playing (Devercelli et al., 2022; World Health Organization, United Nations Children's Fund, World Bank Group, 2018; Yousafzai et al., 2014).

Across Pakistan, child development before school entry and learning outcomes in school are undermined by widespread geographical, gender, and wealth inequities, and are exacerbated by contemporary acute and chronic stressors, including the global COVID-19 pandemic and widespread flooding. Over 11 million households or 21.9 percent of the population lives below the poverty line, and poverty disproportionately affects young children: 27.0 percent of children aged 0–2 years and 29.6 percent of children aged 3–5 years live in poverty, according to calculations using the 2018 Pakistan Social and Living Standards Measurement (PSLM). Two-thirds (62.8 percent) of the population is rural (World Bank, 2021a), and Pakistan also has one of the lowest gender parity indices (girls' enrollment compared to boys' enrollment) in primary school in the world: 0.88 in Pakistan vs. 0.98 in low- and middle-income countries (LMICs) and 0.99 in South Asia (World Bank, 2021b). Learning poverty, which measures the share of school-age children unable to comprehend a simple text at age 10, on average is higher in Pakistan (75 percent) than in LMICs (53 percent); and the rate is estimated to increase to 79 percent because of COVID-19 setbacks (Geven et al., 2020; Geven & Hasan, 2020). In short, too many vulnerable children, including those living in poverty, in rural areas, and with uneducated or distressed parents, are at risk of starting life at a disadvantage, which has repercussions throughout the life course. Addressing inequities by supporting child development and school

readiness skills, especially among vulnerable populations, is an important step in reducing learning poverty and improving child and human capital outcomes.

Data on the status of early child development (ECD) in Pakistan are incomplete and, in the case of children under 3 years of age, data are largely missing. ECD data are not collected at the country-wide level, are only available for a small subset of children—those aged 3–4 years—and vary by year, province, and indicators, rendering comparisons difficult. The Early Childhood Development Index (ECDI), the best available measure of child development at scale across provinces, shows substantially lower-than-average scores for children in Pakistan relative to the 75.1 percent average seen across 60 LMICs: 59.4 percent in Punjab (2017–2018), 47.5 percent in Sindh (2018–2019), and 54.6 percent in Khyber Pakhtunkhwa (2019), and 39.0 percent in Balochistan (2019–2020) (Tomlinson et al. 2023). Except for health surveys that provide proxies for ECD, there are no national ECD data sets for children from birth to age 6. Smaller-scale or province-specific studies shed light on patterns and rates of parental distress or depression, psychosocial stimulation, participation in ECE, and similar variables of interest, such as integration of parenting and nutrition interventions in community health settings in Sindh (Yousafzai et al., 2018) and the Idara-e-Taleem-o-Aagahi (ITA)-Early Learning Partnership (ELP) provided some information on the status of ECD during COVID-19 disruptions in Punjab (ITA, 2021). This study aims to broaden the knowledge base by providing nationally representative data.

Young Children in Pakistan are Exposed to a Host of Risk Factors that Impede Development

Child development occurs through a series of biological and psychological processes that are influenced by risk and protective factors that have the potential to alter brain structure and have implications throughout the life course (Nelson & Gabard-Durnam, 2020). Common risk factors include social determinants of health, such as poverty, poor water and sanitation, and lack of maternal education, the health of the caregiver and child, including physical and mental health of the caregiver and malnutrition and infections for the child, and caregiver psychosocial health, including parental distress (Donald et al., 2019; McDonald et al., 2016). Exposure to multiple risk factors reduces children's chances of staying on track developmentally, and the rates of multiple exposure are high in Pakistan. Pre-pandemic, province-level estimates find that approximately one-quarter of households with young children experienced four risk factors—for comparison, the same share of households with young children in the United Kingdom experienced just two risk factors (Sabates & Dex, 2012)—and about 10 percent of young children in Pakistan experience six or more risk factors (Tomlinson et al., 2023). Pandemic experiences of loss and hardship, not accounted for in these data sets, have increased household-level stressors globally but will take the steepest toll on children in LMICs where service provision is characteristically weaker relative to affluent countries; thus, one can expect the disparities to widen. In Pakistan, there is a clear negative association between the number of risks experienced and the likelihood of developing on track. For example, 83.0

percent of young children in Sindh not exposed to risks or exposed to only one risk are developing on track. In contrast, only 44.8 percent of children in Sindh experiencing three risk factors are developing on track (Tomlinson et al., 2023). Reducing the number of risks experienced would increase children's odds of developing to their potential—but again, COVID-19 setbacks have increased the number and severity of challenges families face.

COVID-19 has introduced loss and hardships for families worldwide, including through reduced household resources and increased caregiver distress, which pose direct threats to young children's wellbeing. In Pakistan, the pandemic has severely contracted economic activity, with GDP growth expected to slow to 4.0 percent in FY23 (World Bank, 2022), half of the working population experiencing job or income losses, and an increase in the incidence of poverty from 4.4 to 5.4 percent (World Bank, 2021a). More than 40 percent of Pakistani households experienced moderate-to-severe food insecurity in 2020 (World Bank, 2021a), which is associated with serious psychological distress among parents (Tseng et al., 2017) and obvious repercussions for children's growth and development (Alderman & Fernald, 2017). Global studies have shown that the pandemic may seriously harm young children's development through increased levels of poverty and food insecurity, disruptions in education, healthcare, and social support systems, elevated stress levels, and decreased wellbeing for parents (Yoshikawa et al., 2020). A World Bank report suggests that the pandemic has taken a tremendous toll on parenting programs, child stimulation, and nurturing care programs: 81 percent of countries, including Pakistan, halted such programs, including home visiting and group meetings, which provided important knowledge, skill-development, and social supports to parents (Galevski et al., 2021, p. v).

High Levels of Parental Distress and Lack Of Psychosocial Stimulation

When parents feel stressed, isolated, depressed, and anxious, young children suffer as well. Acute, chronic or cumulative stress is a common antecedent to caregivers' emotional distress, which can include feelings of depression, anxiety, fear, or being unable to cope. High levels of stress among caregivers are a threat to ECD outcomes, correlating with increased child externalizing behaviors (e.g., irritability, temper outbursts, oppositional behaviors), internalizing behaviors (e.g., anxiety, depression, sadness), and later health and academic problems for children (Bufferd et al., 2012; Edil et al., 2020; Hattangadi et al., 2020; Pinquart, 2017).

Maternal depression is a well-recognized risk for young children, associated with poor child cognitive development, child behavioral problems, low-quality caregiver–child interactions, and weak attachment (Howard et al. 2014). These findings have been born out in studies in Pakistan. For example, 53 percent of untreated women in a study in Punjab met the criteria for major depression postpartum (Rahman et al., 2008). In another study, mothers who experienced depression either prenatally, currently, or both were more likely to have children with worse scores on measures of emotional and behavioral problems, compared to mothers who did not experience depression (Maselko et al., 2016). There is a significant treatment gap for

mental health in LMICs generally (Patel et al., 2018), and in Pakistan specifically, which has been described as having a massive treatment gap—an estimated 90 percent of mental health concerns go untreated (Sikander, 2020).

In conjunction with distress, many caregivers are undereducated. In Pakistan, between 42 and 89 percent of children under age 5, depending on the province, have a mother who either did not attend or did not complete primary school (42 percent in Punjab, 65 percent in Sindh, 66 percent in Khyber Pakhtunkhwa, 89 percent in Balochistan) (Tomlinson et al., 2023). These low levels of education are concerning because global evidence across links increased years of parental education with increased caregiver engagement with young children through more stimulating learning activities, improved ECE attendance, and reduced use of harsh discipline (Cuartas, 2022; Hasan et. al, 2020; Jeong et al., 2017; Rao et al., 2021). Maternal education is positively associated with children's language skills, social–emotional responsiveness, and later social competence (Hasan et al., 2020; Huang et al., 2022a,2022b).

Without sufficient knowledge, skills, and mental health supports in place, caregivers in Pakistan are not providing their young children with the early psychosocial stimulation they need to learn and thrive. As measured in a globally implemented instrument called the Multiple Indicator Cluster Survey (MICS), everyday activities that support learning in young children include reading or looking at picture books, telling stories, singing songs, taking the child outside the home, playing, or naming, counting, and drawing with or for the child (UNICEF, 2023a). MICS results in Pakistan show that, among children aged 3–5, the percentage of children who experienced any stimulation in the prior 3 days was just 35 percent in Punjab (2017–2018), 45 percent in Sindh (2018–2019), 35 percent in Khyber Pakhtunkhwa (2019), and 48 percent in Balochistan (2019–2020) (Tomlinson et al., 2023).

All of these risks operate in conjunction with rising levels of food insecurity, which was estimated to be 37 percent prior to the pandemic and has increased as a result of the pandemic (National Nutrition Survey, 2018; World Bank, 2021a). Many under-resourced households suffer from high rates of malnutrition, leading to high rates of child stunting and wasting, with an estimated 40 percent of children stunted and 29 percent of children underweight (National Nutrition Survey, 2018). These health and nutritional risk factors to development are highly associated with other risk factors, such as living in a rural area, and low maternal educational status (Khan et al., 2019), which leads to a cumulative negative impact on development.

Few Early Learning Opportunities Outside the Home Through Early Childhood Education

There is abundant global evidence that regular attendance in high-quality early childhood education programs is one of the most powerful predictors of favorable ECD outcomes, including improved cognitive skills, social–emotional development, attentiveness, perseverance, and impulse control at the individual level, and higher returns on productivity at the societal level (Heckman, 2012; Rao et al., 2021, World Bank, 2017). Enrollment in ECE is very low for children aged 3–5 in Pakistan,

further curtailing access to early stimulation and learning opportunities for young children that is already in short supply at the household level, in general. Compulsory education in Pakistan starts at age 5, and ECE, or *katchi,* as preprimary classes are commonly called, is supported in theory for all children aged 3–5—although coverage is drastically short of that goal. According to 2019–2020 PSLM data, just 18.9 percent of 3- to 5-year-olds nationally are enrolled in ECE (Tomlinson et al., 2023). There is no system for childcare or education for children under age 3, although some private employers are beginning to experiment with small-scale programs (International Finance Corporation, 2021). The greatest level of coverage is seen in Punjab, where just over one-quarter of eligible children (27.0 percent) are enrolled, whereas in Balochistan, only 5.2 percent of eligible children are enrolled (Tomlinson et al., 2023), putting 95 percent of children in this province at a considerable disadvantage in terms of school readiness. School readiness refers to children's development in several interconnected domains relevant to starting school, including physical and motor development, social–emotional skills, approaches to learning, language development, cognitive development and general knowledge (Global Education Monitoring Report Team, 2006). Globally and in Pakistan, low-income and rural children are especially disadvantaged in terms of access to ECE—and gender inequality begins to emerge as well (Tomlinson et al., 2023; UNICEF, 2022). Children in Pakistan who lack ECE experiences show lower rates of on-track development compared to children who attend ECE programs (e.g., 52 vs. 74 percent respectively in Punjab, 2017–2018) (Tomlinson et al., 2023).

Very little is known about the barriers to ECE enrollment in Pakistan, including at what age parents in Pakistan think their children should enroll and whether that correlates with actual behaviors. It is known through studies elsewhere that parents' beliefs about child development are malleable and, when shifted, improve parents' investments in their children and school readiness levels (Dizon-Ross, 2019). Although ECE enrollment requires more than parental belief in education—for example, program access, which is low in Pakistan, as noted above (18.9% enrollment rates (Tomlinson et al., 2023)), and quality, which is not yet systematically measured in Pakistan—accurate perceptions of what young children need to develop and learn are important, given that beliefs drive investments (List et al., 2021). List et al. (2021) replicated findings that show that not only are parents' beliefs about child development mutable, but that they link to changes in investments in young children and improve parent–child interactions, vocabulary, math skills, and social–emotional skills, all of which are components of school readiness. Compounded by insufficient early stimulation at home, especially for very young children, the absence of enrollment further diminishes access to learning opportunities for young children in Pakistan. Low levels of enrollment may be due to both supply and demand side constraints (e.g., lack of classrooms and trained teachers and lack of awareness of the importance of ECE attendance, respectively). Addressing the lack of knowledge about the importance of young children's learning needs may be a key to behavioral and subsequent outcome change (Dowd et al., 2018). In addition to children's own development, parental beliefs about when to enroll their children in school can drive over- or under-enrolment in the early grades, resulting in system inefficiencies. Evidence from a study conducted across 39 countries

suggests that many countries are paying for an inefficient version of ECE as parents choose to enroll their children in primary school early, with the expectation that they will repeat early primary grades (World Bank, 2019a). However, if children enter primary school at the right age, they are more likely to progress through primary school on time with less repetition and less drop-out, avoiding system inefficiencies and wastage of resources. In Uganda, for example, a recent in-depth analysis and household survey revealed that attending pre-primary school reduced the risk of repetition of Grade 1 by approximately half (World Bank, 2019a). To our knowledge, the relationship between caregiver beliefs about child development and caregiver investment in young children has not been explored in Pakistan; beliefs about appropriate age of entry into educational settings is a missing piece of the puzzle related to parents' awareness of young children's needs.

Current Study

In order to better understand the developmental status of young children in Pakistan, and the impact of various risks on young children's development, we conducted a nationally representative telephone survey of households with children aged 0–6 years. Health protocols precluded in-person interviews during the pandemic. To date, a nationally representative study of ECD among children under age 3 or school readiness for those ages 3–6 has not been conducted in Pakistan. Thus, these data fill critical knowledge gaps.

This study shares the findings from a survey conducted from December 2021 to February 2022. The aims of this study are to describe the current status of ECD and school readiness for children aged 0–6 in Pakistan, and to explore how these outcomes are related to six key risk factors, selected for their known pernicious effects on child development and human capital in LMICs: food insecurity (de Oliveira et al., 2020), living in a rural area (Tomlinson et al., 2023; UNICEF, 2022), low maternal education (Sania et al. 2019), lack of psychosocial stimulation at home (Cuartas et al., 2020; Yousafzai et al., 2014), experiences of parental distress (Donald et al., 2019; Sanner & Neece, 2018; Zhang et al., 2018), and no ECE enrollment (Mizunoya et al., 2019; Rao et al., 2021; UNICEF, 2019).

In short, the study provides new insight into the state of child development in general in Pakistan, especially pertaining to children under age 3, and as it relates to risk factors experienced during the COVID-19 pandemic. This sample is representative of the cell phone owning population of Pakistan—which is roughly 94% of all Pakistanis (Pakistan Bureau of Statistics, 2021). Our approach is likely to have missed the very poorest who are unlikely to own a cell phone. As such, we seek to answer the following questions:

1. How does the distribution of risk factors vary over our key populations of interest (specifically, children aged 0–3 years and children aged 3–6 years)?
2. Which risk factors of interest are significantly associated with child development and school readiness?

3. How do the risk factors most associated with child development and school readiness vary by parent gender, parent education, and the age parents believe their children should begin school?

Data and Methods

Research Design and Data Collection Strategy

Gallup Pakistan was contracted by The World Bank, Education Global Practice, to conduct a nationally representative survey. As pandemic health protocols precluded in-person interviews, interviews were conducted by telephone. Calls were made from December 2021 to February 2022 using random digit dialing (RDD) of mobile phones using all four telecom providers with active numbers across the country. Landline penetration is extremely limited in Pakistan at less than 3 percent, whereas 94 percent of households have access to a mobile phone (Pakistan Bureau of Statistics, 2021). According to the Pakistan Telecommunication Authority, the market share of the four telecom providers in Pakistan (in terms of active working numbers) are: PMCL Jazz (37.8 percent), Telenor (27.1 percent), CMPAK Zong (22.0 percent), and PTML Ufone (13.1 percent). The market share was used to allocate the sample across providers. For example, 37.8 percent of numbers were randomly chosen from PMCL Jazz. Such an allocation was feasible to make because each of the four telecom providers was assigned a pre-set exchange number followed by an 8-digit mobile number. Despite the high levels of mobile phone access, the 6 percent of the population that does not have access to a mobile phone, likely some of the most disenfranchised, were systematically excluded from our sample. Therefore, the findings may be overly optimistic and not able to capture the full extent of negative outcomes that may exist. Nonetheless, there was no better way than by phone to collect data during the period of social distancing imposed by the pandemic. Further, 79 percent of our respondents were men, with 69 percent of these being fathers, 7 percent being grandfathers, and 24 percent being another male relative. This indicates that although 94 percent of households report having access to a mobile device, there is likely gender inequity in terms of phone ownership and use. Data are disaggregated by parent gender where appropriate.

Computer Assisted Telephone Interviewing (CATI) was used. Interviewers began the survey process by calling a randomly generated number. Each number was called until the phone was answered, or a maximum of three times. Each call was made at a different time of the day. Once an individual was contacted on their mobile phone, consent was obtained, a screening questionnaire was administered, and a study identification number was randomly generated and assigned to the individual. Data collectors entered participants' responses into a tablet, which was collected using Survey CTO, which also hosted the electronic questionnaire with automated skip patterns.

Our study population included caregivers in households with at least one child who was 72 months of age or younger. A selected child served as the focus for interview questions based on two stratification criteria to ensure a 50:50 gender split and a 50:50 age group split (children aged 0–35 months and children aged 36–72 months). SurveyCTO was programmed to randomly select an index child who met these criteria in the child roster. Interviewers asked each participant for the province they lived in to facilitate sample allocation across provinces. Interviewers also noted the status of the interview (refused, partially completed, completed) at the end of the survey form. All data collection was monitored by Gallup Pakistan to ensure that the planned allocation of participants across strata was met. Once a target was reached, no further interviews were conducted with participants from that stratum. Of 3907 individuals contacted, 448 people declined to be interviewed, 438 partially completed the interview, and 3,021 completed the interview in its entirety. Data from Azad Jammu Kashmir ($n = 104$) and Gilgit Baltistan ($n = 21$) was not representative and was therefore excluded from the study. As such, our final study population contained 2,896 households.

To ensure that our study population was generalizable to the national population of Pakistan that has access to a mobile phone, post-stratified weighting was applied. The weighting corrected for differences in the achieved sample's profile and what was expected as per the latest population census (2017). For creation of weights, two strata were used, namely: (1) Province (Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan) and (2) region (urban or rural). Thus, a total of 10 weights were created.

Key Variables and Tools

The study focuses on the following key risk variables: parental distress, psychosocial stimulation, food insecurity, maternal education, ECE enrollment,[1] and living in a rural area. The two main outcome variables were child development for children under 36 months and school readiness for children 36–72 months. The age at which a parent believes their child should begin school was also analyzed to understand the association between parental belief and ECE enrollment.

Outcome Variables

Child Development for Children 0–3

The Caregiver-Reported Early Development Instrument (CREDI) is a globally validated, population-level, developmental assessment tool for children aged 0–3 years (McCoy et al., 2018). It has been used in over 17 countries and is designed to be culturally and linguistically neutral. The short form questionnaire was chosen given

[1] This item is only asked for children old enough to be enrolled in school—i.e., children aged 36–72 months.

that data were collected using a phone survey and respondent fatigue was a concern. The short form is also recommended for population-level surveys. This version of CREDI has 20 questions to be completed by household parents or caregiver[2] about a selected child. The scale captures development across four domains: motor, language, cognition, and social–emotional development. There are 20 items per form, with items representing developmentally appropriate skills for each of six age groups ranging from 0 to 3 years (0–5, 6–11, 12–17, 18–23, 24–29, and 30–35 months). Forms are standardized by age such that a question about social–emotional development looks different for a child under 6 months than a child aged 30 months, and so forth. Differences in child development are interpreted in standard deviation units. A child who scores more than 2 standard deviations below the mean is typically considered to be developmentally "off-track". The internal consistency reliability for each age group ranged between 0.70 to 0.91, indicating acceptable to excellent reliability of the CREDI tool.

School Readiness for Children Aged 3–6

Items from the Measuring Early Learning Quality and Outcomes (MELQO)-Measure of Development and Early Learning (MODEL) Teacher/Caregiver report (UNESCO, 2017) were adapted and embedded in the survey to evaluate school readiness among children ages 36–72 months. We consulted experts in the field to ensure that the questions were culturally sensitive and accurate in Pakistan. The tool uses yes/no response options across 25 items. Three subdomains were evaluated to assess school readiness levels: mathematics knowledge and skills (6 items), language/literacy knowledge and skills (10 items) and social–emotional development (9 items). Mathematics items included questions such as, "Knows that 8 is more than 2," and "Knows that a cow is heavier than a goat." Language/literacy items included questions such as, "Names at least three alphabet letters in Urdu or mother tongue," and "Identifies the direction of Urdu script (right to left)." Examples of social–emotional skills included "Stops an activity when told to do so," and "Gets along with other children." The internal consistency reliability for the mathematics, language, and social emotional domains were 0.80, 0.94, and 0.84, respectively, indicating good to excellent reliability.

Independent Variables

Psychosocial Stimulation

The Early Learning Indicator Tool (Hentschel et al., 2021), commissioned by the World Health Organization, was used to quantify psychosocial stimulation in each household, including stimulation with playthings or learning resources, and

[2] The terms "parent" and "caregiver" are used interchangeably in this paper to refer to key adults in a child's household providing care and supervision, including mothers, fathers, grandparents, and other household adults.

stimulation with people. The tool consists of 14 yes/no questions that capture information on the availability of playthings in the home (e.g., items for noisemaking, role playing, reading, or looking at pictures) and the amount of caregiver–provided engaging interactions (e.g., being talked to, singing, read to, visiting others) experienced in the previous 24 hours. The tool takes less than 5 min to administer and has been validated in Pakistan (Hentschel et al., *in preparation*). Scores ranged from 0 to 14, depending on the number of items to which a respondent replied yes. These scores were created for each child included in the survey, and were based on stimulation from any adult caregivers in the household. The internal consistency reliability of the psychosocial stimulation tool was 0.83, indicating good reliability in this population.

Parental Distress

Participants were asked five questions regarding their level of distress in the previous 15 days. The questions asked if the parent had found it difficult to be affectionate to their child, had been more irritated or angry, found it difficult to get enough sleep, had been nervous or anxious, and had been unable to stop or control worrying. A score from 0 to 5 was created for each respondent (typically an adult) using their responses to these five items with a 5 indicating the most distress. The internal consistency reliability of the parental distress tool was 0.99, indicating excellent reliability in this population.

Food Insecurity

Food insecurity was captured by asking about changes relative to the start of the COVID-19 pandemic. Participants were asked "Since March 2020, did you ever cut the size of your meals or skip meals because there wasn't enough money for food?" Answer options included not at all, very little, somewhat, or a great extent. To be classified as "experienced food insecurity" individuals had to have answered very little, somewhat, or to a great extent.

Parental Educational Attainment

Maternal and paternal education levels were grouped into three categories: less than a primary education, completed primary school, and completed secondary school. The questions were asked for both mothers and fathers, regardless of who participated as the survey respondent.

Enrollment in Early Childhood Education

ECE enrollment was determined using an open-ended item administered only if the index child for a given household was between 3 and 6 years of age. Responses included *katchi* (the primary provision of ECE in primary schools), ECE, play group, preprimary (year 1, 2 or 3), nursery, kindergarten, and preparatory class ("prep").

Living in a Rural Area

Determination of living in a rural area was based on the respondent's perception of whether they lived in an urban or rural area as a binary choice.

Parental Beliefs about Appropriate Age for School Entry

In order to capture parents' beliefs on when children should enter an organized learning environment outside the home, parents were asked a single open-ended question: "When do you think a child should start school?" Answers were captured by year of age and ranged from 2 to 10 years of age.

Statistical Analyses

All statistical analyses were performed in Stata v17 (Stata-Corp, College Station, Texas, USA). For three reasons, analyses were run separately for children from 0–35 months and 36–72 months: (a) relative to children aged 3–5 and older ages, children under age 3 are at greater risk when exposed to adversity such as poverty, instability, or abuse, with exposure leading to altered brain development (Dunn et al., 2019); (b) separate instruments were used to measure child development from 0 to 36 months (CREDI) versus 36–72 months (MODEL); and (c) services are generally provided through distinct sectoral pathways according these age divisions, with the Ministry of Health playing a large role in the first three years of life and the Ministry of Education assuming a more dominant role beginning at age 3. First, we investigated the bivariate association between each variable of interest (age of child, child gender, region, province, income loss since March of 2020, psychosocial stimulation, maternal education, paternal education, parental distress, food insecurity, school enrollment, and age parent believes their child should begin school) and our outcomes of interest (child development for children under 36 months of age and school readiness for children 36–72 months of age), using unadjusted Ordinary Least Squares (OLS) linear regression analyses (Tables 2 and 3). Second, we focused on individual risk factors and generated plots that showed the proportion of the population with each specific risk factor (Fig. 1). Third, we generated prevalence plots that showed the share of the population experiencing various risk factors (i.e., experiencing 1 risk factor, experiencing any 2 risk factors, etc.) and the child development/school readiness score among that proportion of the population (Figs. 2 and 3). Fourth, we created two simple OLS linear regression models, one that assessed the relationship

between our key risk factors and child development under 36 months, and one that assessed the relationship between our key risk factors and school readiness 36–72 months (Tables 4 and 5). Region, psychosocial stimulation, maternal education, parental distress, and food insecurity were included in all risk factor assessments with our outcomes of interest. Enrollment in ECE was only included in the risk factor assessment for children aged 36–72 months. Lastly, we selected two risk factors, psychosocial stimulation which was most associated with child development, and enrollment in ECE which was most associated with school readiness and unpacked them by parental gender and educational status. For enrollment in ECE, we also assessed the relationship between ECE enrollment, and the age parents believe their child should begin school (Figs. 5, 6, 7).

Results

Descriptive Tables

Our sample included 2,896 complete cases, with 1,389 children under 36 months and 1,507 children 36–72 months. Table 1 provides the distribution of the key variables in our sample, overall and disaggregated by age-group. Weighted estimates indicated that the majority of our sample reported living in a rural area (64 percent) and lived in Punjab (53 percent). Approximately a quarter of households reported living in Sindh (23 percent), followed by Khyber Pakhtunkhwa (17 percent), and Balochistan (6 percent). Of note, almost half (47 percent) of mothers in our sample and about a third (29 percent) of fathers had less than a primary school education. Most households (55 percent) reported some extent of parental distress, 62 percent reported losing income since the pandemic started, and 61 percent reported skipping or cutting down on food since the pandemic started. Forty-three percent of our sample of 3- to 6-year-olds were reported to be out of school at the time of the survey.

Table 2 provides the average child development *Z*-scores for children 0–35 months by key variables. Consistent with evidence from other LMICs, the average *Z*-score in our sample was 0.03 (95%, CI = −0.02, 0.09). Evidence from the CREDI Short-Form Validation Paper (McCoy et al., 2018) finds similar distributions for India and Nepal. Unadjusted OLS linear regression analyses were run on child-development *Z*-scores by each key variable independently. The *p*-values from these regressions are reported in column 5. Variables found to be positively associated with development included: living in an urban area, receiving high levels of psychosocial stimulation, having a mother with a primary education or above, having parents who experienced no parental distress, and living in a household with no food insecurity. Paternal education and gender were not associated with development.

The average overall school readiness score in our sample was 17.95 (out of a maximum of 25), indicating that on average, children had achieved 72 percent of age-appropriate math, language/literacy, and social–emotional school readiness knowledge and skills. Table 3 provides the average school readiness scores for children 36–72 months by our key risk factors of interest. OLS linear regression

Table 1 Distribution of key variables by child age

	Children 0–35 months (N = 1389)	Children 36–72 months (N = 1507)	All children (N = 2896)
Average CREDI *Z*-Score	0.03	N/A	N/A
School readiness score (percent correct)	N/A	67.76	N/A
Age of child (months)			
Mean (SD)	13.42 (0.29)	54.77 (0.35)	35.04 (0.48)
Median (IQR)	12 (5, 24)	60 (48, 60)	36 (12, 60)
Child gender			
Male	55.26	55.34	55.30
Female	44.74	44.66	44.70
Region			
Urban	38.88	34.18	36.43
Rural	61.12	65.82	63.57
Province			
Punjab	52.24	54.58	53.46
Sindh	24.34	22.30	23.27
Khyber Pakhtunkhwa	17.58	16.98	17.27
Balochistan	5.84	6.14	6.00
Income loss since March 2020			
Experienced income loss	59.35	63.70	61.62
Did not experience income loss	38.39	31.61	34.85
Did not know/did not respond	2.26	4.69	3.53
Psychosocial Stimulation (Min=0, Max=14)			
Mean (SD)	6.41 (0.12)	8.00 (0.10)	7.24 (0.08)
Median (IQR)	6.5 (3, 10)	8 (6, 11)	7 (5, 10)
Low stimulation (0–4 items)	34.06	16.88	25.08
Low–medium stimulation (5–7 items)	23.43	27.89	25.76
Medium–high stimulation (8–10 items)	24.63	27.98	26.38
High stimulation (11–14 items)	17.88	27.25	22.78
Maternal education			
Less than primary	43.47	49.38	46.56
Primary	19.88	20.12	20.02
Secondary or greater	36.64	30.50	33.43
Paternal Education			
Less than primary	26.97	31.02	29.09
Primary	20.97	21.94	21.48
Secondary or greater	52.06	47.04	49.44
Parental Distress Sum Score (Min=0, Max=5)			
Mean (SD)	1.67 (0.06)	1.71 (0.06)	1.69 (0.04)
Median (IQR)	1 (0, 3)	1 (0, 3)	1 (0, 3)
No parental distress	43.22	47.08	45.24
Some parental distress	56.78	52.92	54.76

Table 1 (continued)

	Children 0–35 months (N = 1389)	Children 36–72 months (N = 1507)	All children (N = 2896)
Cut the size of meals or skip meals since March 2020			
Not at all	39.91	38.96	39.42
Very little/Somewhat	44.98	43.39	44.16
A great extent	15.10	17.65	16.42
School enrollment			
Out of school	N/A	43.40	N/A
Enrolled in ECE	N/A	39.11	N/A
Enrolled in Primary	N/A	17.49	N/A
Age parent believes child should begin school			
Mean (SD)	4.53 (0.03)	4.48 (0.03)	4.50 (0.02)
Median (IQR)	5 (4, 5)	5 (4, 5)	5 (4, 5)

All estimates weighted. Psychosocial stimulation ranges from 0 to 14. Parental distress sum score ranges from 0 to 5. The age parents believe children should begin school is open-ended and represents the child's year of age.

analyses were run on school readiness sum scores by each key risk factor of interest, controlling for age. Variables found to be positively correlated with school readiness levels included: living in an urban area, receiving high levels of psychosocial stimulation, having a mother with a secondary education or above, having parents who experienced parental distress, and being enrolled in ECE or primary school. Paternal education, food insecurity and gender of the child were not associated with school readiness.

Risk Factor Prevalence

Risk factor prevalence is similar in households with children 0–35 months and those with children 36–72 months. The three most prevalent risk factors in all households were: experiencing some level of food insecurity, living in a rural area, and parental distress (Fig. 1). Households with children aged 0–35 months, compared to 36–72 months, experienced much higher levels of parental distress (57 percent to 53 percent, respectively) and less psychosocial stimulation (12 percent compared to 3 percent experience no psychosocial stimulation, respectively). Households with children 36–72 months experienced slightly higher levels of food insecurity (61 percent to 60 percent, respectively), lived in rural areas at higher rates (66 percent to 61 percent, respectively), and were more likely to have a mother with low levels of maternal education (49 percent to 44 percent, respectively), but none of these age–group differences were statistically significant. Approximately 43 percent of

Table 2 Bivariate relationships of development for children under 3 years of age and key variables (N = 1389)

	N (unweighted)	Average CREDI *Z*-Score	95% CI	Linearized Standard Error	*p*-value
	(1)	(2)	(3)	(4)	(5)
All children under 3					
0–35 months	1389	0.03	(−0.02, 0.09)	0.03	
Age (REF ≤ 6 months					
<6 months	390	−0.16	(−0.29, −0.02)	0.07	
6–11 months	269	0.34	(0.19, 0.47)	0.07	*<0.001*
12–17 months	201	0.13	(0.01, 0.26)	0.06	*0.002*
18–23 months	114	−0.32	(−0.45, −0.20)	0.06	*0.075*
24–29 months	304	0.09	(0.03, 0.15)	0.03	*0.001*
30–35 months	111	−0.02	(−0.08, 0.04)	0.03	*0.072*
Child gender					*0.155*
Male	774	0.07	(0.00, 0.14)	0.04	
Female	615	−0.01	(−0.10, 0.08)	0.04	
Region					*<0.001*
Urban	615	0.16	(0.08, 0.24)	0.04	
Rural	774	−0.04	(−0.12, 0.03)	0.04	
Province (REF= Punjab)					
Punjab	611	0.06	(−0.02, 0.14)	0.04	
Sindh	215	0.14	(0.01, 0.26)	0.06	*0.303*
Khyber Pakhtunkhwa	436	−0.26	(−0.36, −0.15)	0.05	*<0.001*
Balochistan	104	0.26	(0.06, 0.46)	0.10	*0.069*
Psychosocial stimulation (REF= low stimulation)					
Low stimulation (0–4 items)	476	−0.73	(−0.82, −0.63)	0.05	
Low–medium stimulation (5–7 items)	332	0.24	(0.16, 0.33)	0.04	*<0.001*
Medium–high stimulation (8–10 items)	323	0.46	(0.38, 0.54)	0.04	*<0.001*
High stimulation (11–14 items)	258	0.60	(0.51, 0.70)	0.05	*<0.001*
Maternal Education (REF= Less than primary)					
Less than primary	609	−0.08	(−0.17, 0.01)	0.04	
Primary	261	0.22	(0.10, 0.34)	0.06	*<0.001*
Secondary or greater	519	0.07	(−0.02, 0.15)	0.04	*0.020*
Paternal Education (REF= Less than primary)					
Less than primary	375	−0.02	(−0.13, 0.08)	0.05	
Primary	274	0.07	(−0.06, 0.20)	0.06	*0.258*
Secondary or greater	740	0.05	(−0.02, 0.12)	0.04	*0.244*
Parental distress sum score					*<0.001*
No parental distress	589	0.23	(0.16, 0.31)	0.04	
Some parental distress	800	−0.12	(−0.19, −0.04)	0.04	

Table 2 (continued)

	N (unweighted)	Average CREDI *Z*-Score	95% CI	Linearized Standard Error	*p*-value
	(1)	(2)	(3)	(4)	(5)
Cut the size of meals or skip meals since March 2020 (REF= Not at all)					
Not at all	545	0.11	(0.03, 0.20)	0.04	
Very little/Somewhat	603	0.04	(−0.04, 0.13)	0.04	*0.244*
A great extent	211	−0.15	(−0.27, −0.02)	0.06	*0.001*

All estimates weighted except for the N, which is unweighted. Psychosocial stimulation ranges from 0 to 14. Parental distress sum score ranges from 0 to 5

36–72-month-old children are currently not enrolled in any type of ECE or primary school. There was also a high level of co-occurrence of risk factors in our sample overall. For example, 64 percent of households lived in a rural area; of those, for 13 percent, living in a rural area was an isolated risk factor, whereas the remaining 87 percent of those households also experienced parental distress, experienced food insecurity, or both.

Risk Factors and Average Child Development and School Readiness Scores

Figure 2 shows the average child development *Z*-scores for children under age 3 by the number of risk factors experienced. Error bars indicate 95 percent confidence around each average. As such, there are minimal differences in average child development among children experiencing up to three risk factors, but sharp declines in development appeared for those experiencing four or five risk factors. For example, a child who experienced no risk factors—that is, experienced no parental distress or food insecurity in their household, had a mother with a primary school education or greater, experienced some amount of psychosocial stimulation at home and lived in an urban area—on average had a development *Z*-score 0.26 standard deviations (SDs) above the mean. A child who experienced any two risk factors on average scored 0.29 SDs above the mean. This is in sharp contrast to a child who experienced three risk factors (0.01 SD below the mean), four risk factors (0.50 SDs below the mean) or all five risk factors (1.49 SDs below the mean).

Comparing the children who were in the top 75th percentile of child development *z*-scores to those in the bottom 25th percentile, those in the top quartile experienced higher rates of maternal education (53 percent of mother completed primary school compared to 49 percent, respectively), lower rates of parental distress (52 percent of households compared to 67 percent, respectively) and higher rates of psychosocial stimulation (97 percent of households reported some psychosocial stimulation compared to 65 percent, respectively).

Figure 3 shows the average age-standardized school readiness sum score for children aged 3–6 by the number of risk factors experienced. Error bars indicate

Table 3 Bivariate relationships of school readiness for children aged 3–6 years by key variables (maximum= 25 points) ($N = 1507$)

	N (unweighted)	Weighted Sum score	Weighted percent correct	95% CI	Linearized standard error	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)
All children 3–6						
3–5 years (36–72 months)	1507	17.95	71.80	(16.54, 17.35)	0.21	
Age (REF= 3 years)						
3 years (36–47 months)	352	12.60	50.40	(11.82, 13.38)	0.39	
4 years (48–59 months)	372	15.36	61.44	(14.55, 16.18)	0.42	*<0.001*
5 years (60–71 months)	494	18.92	75.68	(18.28, 19.56)	0.32	*<0.001*
6 years 1 month (72 months)	289	20.77	83.08	(20.10, 21.43)	0.33	*<0.001*
Child gender						*0.139*
Male	847	16.84	67.36	(16.28, 17.40)	0.28	
Female	660	17.07	68.28	(16.48, 17.67)	0.30	
Region						*0.012*
Urban	620	17.52	70.08	(16.90, 18.13)	0.31	
Rural	887	16.63	66.52	(16.10, 17.16)	0.26	
Province (REF= Punjab)						
Punjab	690	17.32	69.28	(16.76, 17.89)	0.29	
Sindh	210	16.66	66.64	(15.66, 17.66)	0.50	*0.168*
Khyber Pakhtunkhwa	467	16.20	64.80	(15.49, 16.91)	0.36	*0.065*
Balochistan	119	16.65	66.60	(15.07, 18.23)	0.80	*0.092*
Psychosocial stimulation (REF= Low stimulation)						
Low stimulation (0–4 items)	245	13.04	52.16	(11.91, 14.17)	0.58	
Low–medium stimulation (5–7 items)	414	16.06	64.24	(15.30, 16.81)	0.38	*<0.001*
Medium–high stimulation (8–10 items)	429	17.38	69.52	(16.67, 18.10)	0.36	*<0.001*
High stimulation (11–14 items)	419	19.45	77.80	(18.80, 20.10)	0.33	*<0.001*

Table 3 (continued)

	N (unweighted)	Weighted Sum score	Weighted percent correct	95% CI	Linearized standard error	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)
Maternal education (REF= Less than primary)						
Less than primary	732	16.30	65.20	(15.69, 16.91)	0.31	
Primary	290	16.88	67.52	(15.96, 17.80)	0.47	*0.151*
Secondary or greater	485	18.02	72.08	(17.37, 18.67)	0.33	*<0.001*
Paternal Education (REF= Less than primary)						
Less than primary	455	16.11	64.44	(15.33, 16.91)	0.40	
Primary	311	16.60	66.40	(15.70, 17.49)	0.45	*0.158*
Secondary or greater	741	17.66	70.64	(17.11, 18.21)	0.38	*<0.001*
Parental distress sum score						*0.047*
No parental distress	704	16.54	66.16	(15.97, 17.12)	0.29	
Some parental distress	803	17.30	69.20	(16.73, 17.88)	0.29	
Cut the size of meals or skip meals since March 2020 (REF= Not at all)						
Not at all	586	16.97	67.88	(16.33, 17.62)	0.32	
Very little/Somewhat	593	16.76	67.04	(16.09, 17.44)	0.51	*0.252*
A great extent	259	16.90	67.60	(15.90, 17.90)	0.45	*0.536*
School enrollment (36–72 months) (REF= Out of school)						
Out of school	621	12.58	50.32	(11.99, 13.16)	0.30	
Enrolled in ECE	508	19.79	79.16	(19.25, 20.33)	0.27	*<0.001*
Enrolled in Primary	193	21.85	87.40	(21.21, 22.50)	0.33	*<0.001*

All estimates weighted. Psychosocial stimulation ranges from 0 to 14. Parental distress sum score ranges from 0 to 5. The age parents believe children should begin school is open ended and represents child year of age. Linearized standard error is based on the weighted sum score variation.

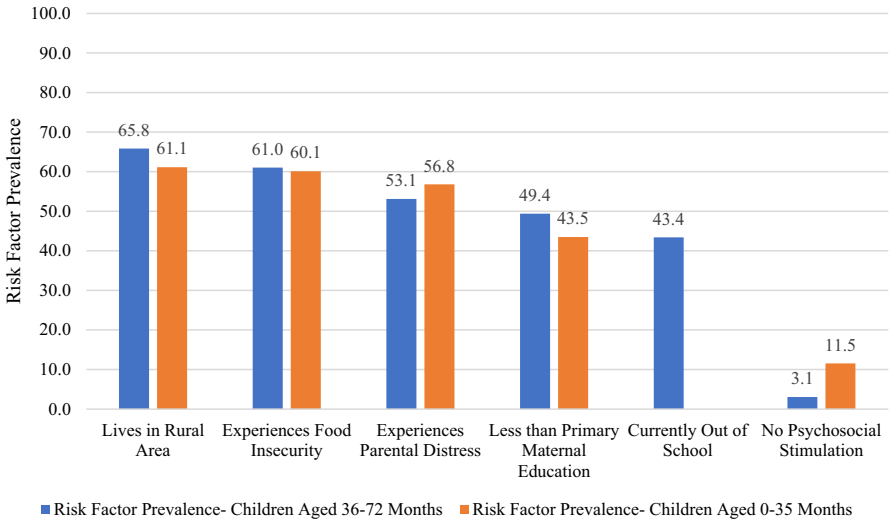

Fig. 1 Prevalence of Risk Factors by Child Age ($N = 28{,}96$). Note: All estimates are weighted. "Experiences parental distress" indicates a score of 1 or higher. "Experiences food insecurity" indicates cutting back on meals since March 2020 due to insufficient funds to some extent. Data on school attendance is only measured for children 36+ months. "No psychosocial stimulation" indicates that the child did not have access to any learning materials nor did they participate in any stimulating activities with adult caregivers in the past 24 hours. Statistically significant differences by age group are bolded and include the experience of parental distress and lack of psychosocial stimulation

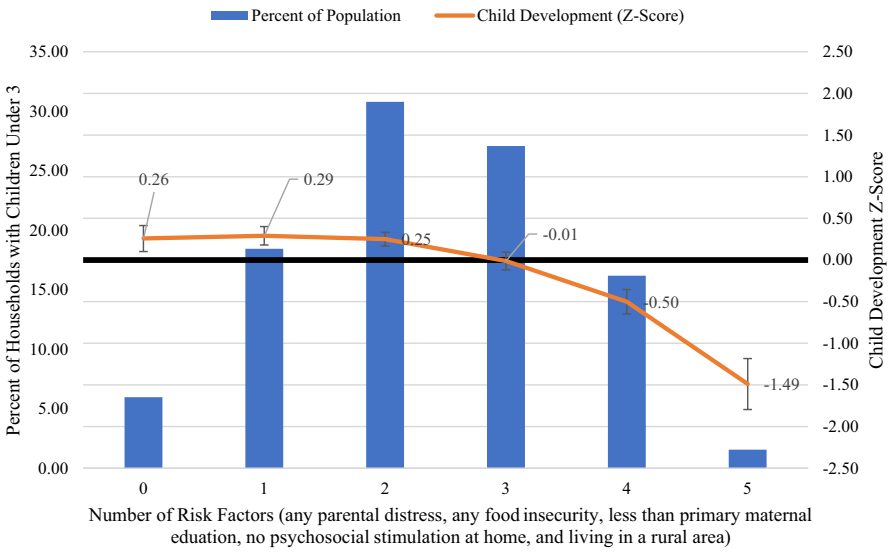

Fig. 2 Development for Children Less than 3 Years of Age by the Number of Risk Factors Experienced. Note: All estimates weighted. Sample includes 1389 children who are 0–35 months of age. "Experiences parental distress" indicates a score of 1 or higher." Experiences food insecurity" indicates cutting back on meals since March 2020 due to insufficient funds to some extent. "No psychosocial stimulation" indicates that the child did not have access to any learning materials nor did they participate in any stimulating activities with adult caregivers in the past 24 hours

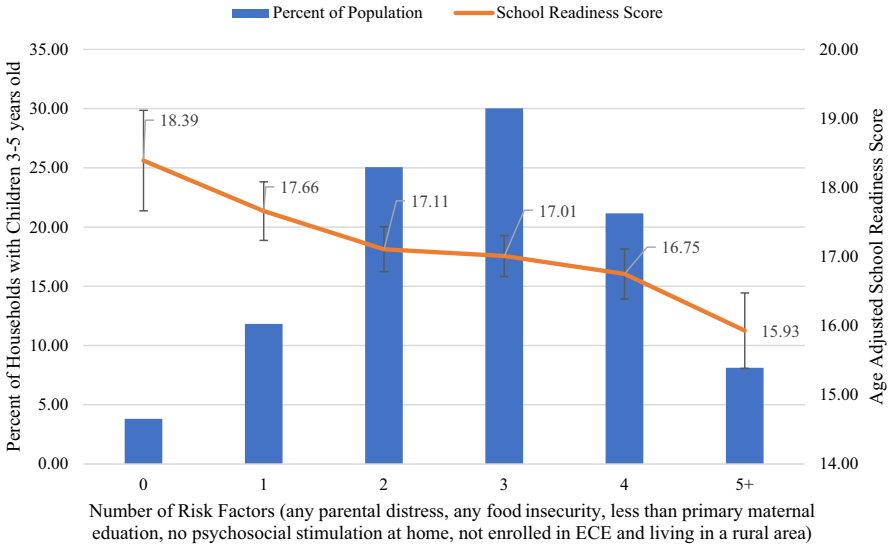

Fig. 3 School Readiness Among Children Aged 3–6 Years by the Number of Risk Factors Experienced. Note: All estimates weighted. Sample includes 1389 children who are 0–35 months of age. "Experiences parental distress" indicates a score of 1 or higher." Experiences food insecurity" indicates cutting back on meals since March 2020 due to insufficient funds to some extent. "No psychosocial stimulation" indicates that the child did not have access to any learning materials nor did they participate in any stimulating activities with adult caregivers in the past 24 hours

95 percent confidence around each average. As such, there was a steady decline in average school readiness among children experiencing zero to three risk factors, but a sharp decline in school readiness was evident for those experiencing four or more risk factors. For example, a child who experienced zero risk factors—that is, the child experienced no parental distress or food insecurity in their household, had a mother with at least a primary school education or greater, experienced some amount of psychosocial stimulation at home, was enrolled in ECE, and lived in an urban area—would have an average school readiness score of 18.4 out of a possible 25 points, or score a 74 percent in terms of school readiness. This is in sharp contrast to a child who experienced five or six risk factors, who on average would score a 15.9 out of a possible 25 points or score a 64 percent in terms of school readiness.

Comparing the children who were in the top 75th percentile of school readiness sum scores to those in the bottom 25th percentile, those in the top quartile attended school at higher rates (74 percent compared to 18 percent enrolled in school), and experienced higher rates of maternal education (55 percent completed primary school compared to 42 percent, respectively).

Table 4 Regression results for risk factors on child development under 3 years of age ($N = 1389$)

Variable	Beta coefficient	Linearized standard error	*P*-Value
Constant	−0.48	0.11	*<0.001*
Psychosocial Stimulation	0.15	0.01	*<0.001*
Child Age	−0.01	0.00	*<0.001*
Parental Distress Sum Score	−0.07	0.01	*<0.001*
Province (REF = Punjab)			
Sindh	−0.03	0.06	*0.664*
Khyber Pakhtunkhwa	−0.18	0.06	*0.001*
Balochistan	0.01	0.08	*0.940*
Female Child Gender	−0.08	0.05	*0.071*
Maternal Education (REF = less than primary)			
Primary or middle	0.11	0.06	*0.074*
Secondary or greater	−0.06	0.05	*0.272*
Any food Insecurity	0.05	0.05	*0.283*
Rural area	−0.01	0.05	*0.768*

Psychosocial Stimulation and ECE Enrollment Show Associations with Child Development and School Readiness

For each age group, 0–35 months and 36–72 months, a simple OLS linear regression model was conducted of child development or school readiness on all risk factors of interest. Controlling for all key risk factors, the amount of psychosocial stimulation a child receives at home had the strongest association with child development for children 0–35 months ($p < 0.001$) (Table 4). That is, holding the child's age, province, level of parental distress, maternal education, food insecurity status, and region constant, a one unit increase in psychosocial stimulation (i.e., one more stimulating activity with a play thing or caregiver in the previous 24 hours) was associated with a 0.15 SD increase in child development *Z*-scores. Parental distress had the second strongest association with child development under age 3 ($p < 0.001$). A one unit increase in parental distress was associated with 0.07 SD decrease in child development *Z*-scores. Figure 4 shows the descriptive relationship between the amount of psychosocial stimulation received at home and average child development scores.

For children 36–72 months old, comparing all risk factors revealed that ECE enrollment had the strongest association with school readiness scores ($p < 0.001$) (Table 5). That is, holding the child's age, province, level of parental distress, maternal education, food insecurity status, and region constant, being enrolled in school was associated with a 4.99-point increase in the school readiness score, or a 20-percentage point increase overall. For reference, this gap is equivalent to the difference between an average 3-year-old and an average 5-year-old's school readiness level. The amount of psychosocial stimulation a child received at home had the second strongest association with school readiness ($p < 0.001$), which was associated with

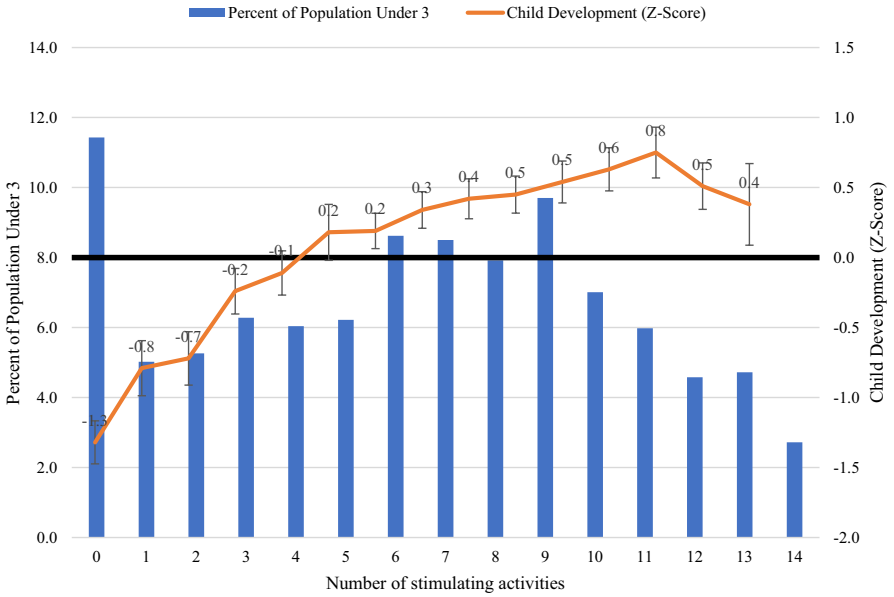

Fig. 4 Child Development Under 3 Years of Age by Varying Levels of Psychosocial Stimulation. Note: All estimates weighted. Sample includes 1389 children who are 0–35 months of age. Psychosocial stimulation as measured by children's access to learning materials and participation in stimulating activities with adult caregivers in the past 24 h on a scale of 0–14

Table 5 Regression results for risk factors on school readiness for children aged 3–6 years ($N = 1507$)

Variable	Beta coefficient	Linearized standard error	*P*-Value
Constant	6.97	1.20	*<0.001*
Enrolled in school	4.99	0.41	*<0.001*
Child age	0.15	0.01	*<0.001*
Psychosocial stimulation	0.43	0.06	*<0.001*
Maternal education (REF=less than primary)			
Primary or middle	−0.13	0.44	*0.768*
Secondary or greater	0.81	0.38	*0.033*
Province (REF=Punjab)			
Sindh	−0.17	0.43	*0.691*
Khyber Pakhtunkhwa	−0.44	0.37	*0.244*
Balochistan	−0.81	0.68	*0.231*
Female child gender	0.41	0.32	*0.207*
Rural Area	−0.24	0.34	*0.475*
Parental distress sum score	0.05	0.09	*0.562*
Any food insecurity	−0.09	0.35	*0.788*

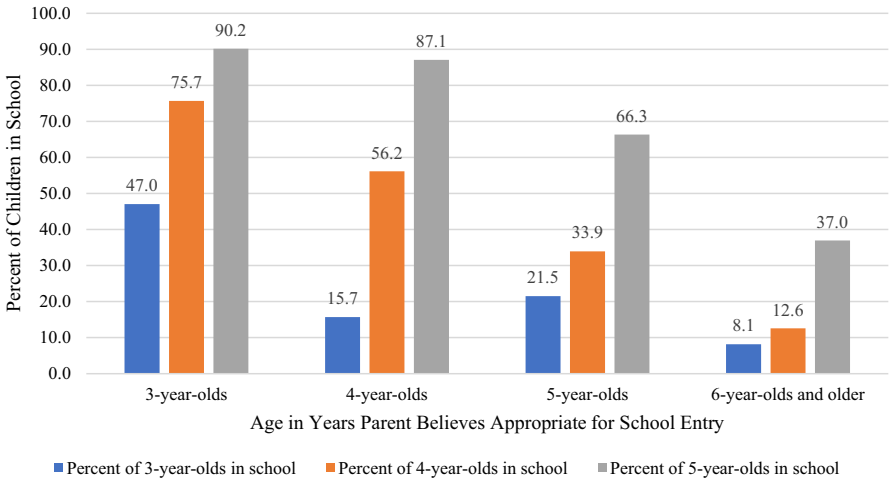

Fig. 5 Actual School Enrollment for 3–5-year-olds by Age Parent Believes Child Should Begin School. Note: All estimates are weighted. The age parents believe their child should begin school is an open-ended question and the answer is in years. Sample includes all caregivers with a child aged 36–72 months ($N = 1507$)

an increase of 0.43 school readiness points for each unit (i.e., one more stimulating activity with a play thing or caregiver in the previous 24 hours) increase of psychosocial stimulation, controlling for all other risk factors. Secondary or greater maternal education (compared to less than primary maternal education) also had a positive association with school readiness ($p = 0.033$). Child gender, living in a rural area, parental distress, and experiencing any level of food insecurity were not associated with school readiness.

Parental Beliefs about Appropriate Age for School Entry

In addition to asking parents about their children's ECE participation, we also asked parents when they think their child should begin school. Most parents believed their child should begin school at 5 years of age (42 percent), followed by 4 years of age (34 percent), 3 years of age (14 percent), 6+ years of age (10 percent), and 2 years of age (1 percent). Parents who reported they believe their child should begin school at a younger age tended to enroll their children at younger ages (Figure 5). For example, among parents who believed their child should begin school at age 3, we saw the highest rates of enrollment for all ages (47 percent for 3-year-olds, 76 percent for 4-year-olds, and 90 percent for 5-year-olds). This is in sharp contrast to parents who believed their child should not begin school until age 6 or older; among this group,

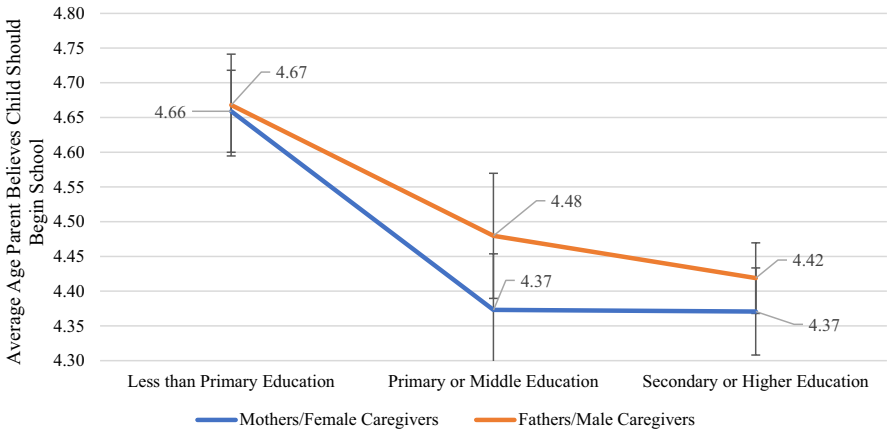

Fig. 6 Age Parents Believe Their Child Should Begin School by Parent Gender and Parental Educational Attainment Note: All estimates are weighted, 95% confidence intervals included; Sample includes all caregivers with a child aged 36–72 months ($N = 1507$). The age parents believe their child should begin school is an open-ended question and the answer is in years

only 8 percent of 3-year-olds, 13 percent of 4-year-olds, and 37 percent of 5-year-olds were enrolled in school.[3]

Parental beliefs on appropriate age of preschool entry also varied with maternal education (Fig. 6). On average, mothers with less than a primary school education believed their child should begin school 4 months later than a mother with a primary school education or greater (4 years and 8 months vs. 4 years and 4 months respectively). This difference was statistically significant. Though mothers, on average, reported believing a younger age was more appropriate for school entry compared to that reported by similarly educated fathers, this difference was not statistically significant.

Psychosocial Stimulation by Child and Caregiver Gender

Psychosocial stimulation was more strongly correlated with child development for children aged 0–35 months than any other independent variable examined, and it was also highly correlated with school readiness for children aged 36–72 months. No differences were found in the amount of psychosocial stimulation by child gender ($p = 0.9380$). However, when assessing differences by parent gender, mothers reported providing significantly higher rates of psychosocial stimulation than fathers ($p < 0.001$). On a scale of 0–14, a low level of stimulation was defined as four or fewer opportunities for learning and a high level of stimulation was defined as 11–14 opportunities. Twenty-seven percent of male caregivers reported providing

[3] Enrollment in school refers to an index child between the ages of 36-72 months. Belief about the age when children should begin school refers to the caregivers' belief about all of their children, not just the index child.

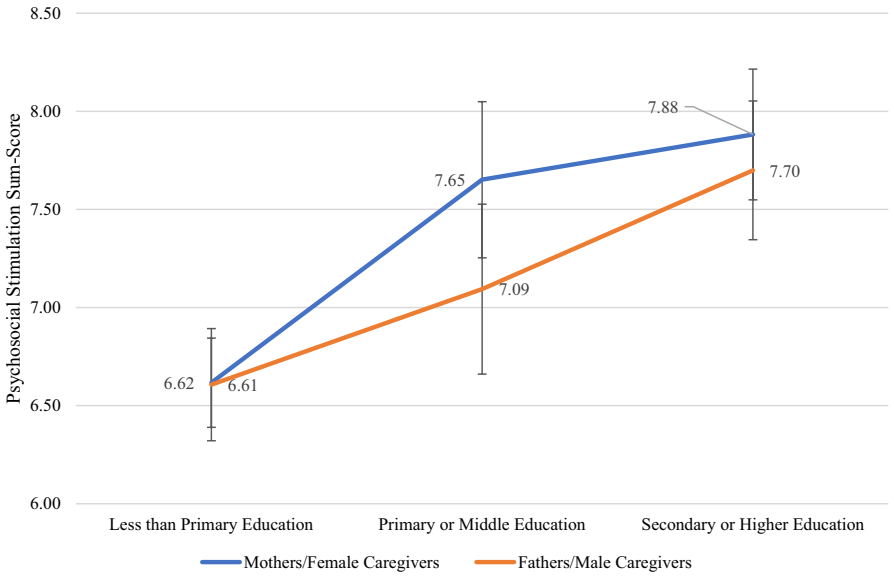

Fig. 7 Average Psychosocial Stimulation Scores Among Children Aged 0–72 Months in Pakistan by Parent Gender and Educational Attainment Note: All estimates are weighted. Psychosocial stimulation as measured by children's access to learning materials and participation in stimulating activities with adult caregivers in the past 24 hours on a scale of 0–14. Sample includes all children ($N = 2896$)

low stimulation, whereas only 19 percent of female caregivers reported providing low stimulation. The median number of activities that mothers engaged in with their children is 8 (IQR = 6, 11), while the median number of activities that fathers engaged in with their children is 7 (IQR = 4, 10). Greater maternal and paternal education were positively associated with statistically significantly higher levels of psychosocial stimulation (Fig. 7). Notably, uneducated mothers and fathers provided almost the same (low) amount of psychosocial stimulation on average, but mothers who had completed at least primary school reported slightly higher provision of psychosocial stimulation than did similarly educated fathers, although this difference was not statistically significant.

Discussion

ECD has been an understudied area in Pakistan, particularly for very young children, and this study contributes to our understanding of how young Pakistani children are faring. Other national-level surveys tend to measure nutritional and physical growth metrics among children under age 3, academic performance among older children, or collect province-level but not national-level data on ECD. This study, which provides national estimates of ECD, fills key gaps in the literature on children's development under age 3 and school readiness for children aged 3–6 years. We quantified the compounding and pernicious impact of multiple risk factors on

children's development for both children under 3 and aged 3–6, with clear declines in development and school readiness as risk factors increased.

The study also explored which household- and caregiver-oriented variables have the strongest associations with child outcomes. For children under age 3, we found that higher levels of psychosocial stimulation at home and lower levels of caregiver distress were most significantly associated with higher levels of child development. For children ages 3–6, higher levels of psychosocial stimulation at home were shown to be the second strongest correlates with school readiness levels, and enrollment in school was the strongest correlate of school readiness. The school readiness measure spanned content knowledge of literacy and math but also included age-appropriate social–emotional skills. To our knowledge, very little has been studied relative to young children's social–emotional skills in Pakistan until now. An exception is the recent ITA (2021) study in Punjab, which found that caregivers reported high levels of social–emotional skills among their young children, for example, getting along with other children (94 percent) and adjusting easily to transitions (79 percent). This domain, which includes the ability to share, follow directions, and cooperate, is known to be a key determinant of children's concurrent and long-term wellbeing and achievement (Taylor et al., 2017).

To better understand caregiver beliefs about enrollment, parents were asked at what age they believe their child should begin school. We found that 42 percent of parents believe their child should begin school at age 5, followed by 34 percent believing their child should begin school at age 4. This range aligns with current education policy in Pakistan, which states that compulsory education begins at age 5, and children should have at least one year of preprimary education. Given that well over half (58 percent) of children aged 5 are, in fact, not enrolled in school (Tomlinson et al., 2023), the current finding underscores the need to better understand supply- and demand-side barriers and to expand access to preschool opportunities across Pakistan. The ITA (2021) study findings from Punjab underscore this need, given that only one-fifth (21 percent) of heads of school reported high levels of regular attendance in school between January and March 2021, once schools reopened after COVID closures.

Results also showed a strong association between the age parents believe their child should begin school and actual enrollment, with younger-age beliefs correlating with actual enrollment. For example, parents who believe their child should begin school at age 3 have the highest rates of enrollment (regardless of child age); whereas parents who believe a child should enroll at age 6 are less likely than other parents to have a child enrolled in school (regardless of child age). Beliefs about school entry also differ by parental educational status. Mothers and fathers who did not complete primary school believe their child should start school at an older age than educated caregivers. The same pattern is seen with psychosocial stimulation; uneducated caregivers provide far less psychosocial stimulation than educated caregivers, who are more likely to talk with their young child, tell them stories, read to them, or take them on outings. This is true for mothers and fathers, but higher education levels—completion of secondary school or higher—correlates with higher stimulation for mothers than for fathers. This suggests both that supporting girls and women to go further in their education is especially important for improving

ECD levels. In parallel, intentionally teaching male caregivers about the importance of early stimulation could boost ECD outcomes (Cuartas et al., 2020). In a meta-analysis across 38 low- and middle-income countries, children of highly engaged fathers showed significantly higher ECD levels than children of moderately engaged or unengaged fathers (Jeong et al., 2016). Given the evidence on positive associations between fathers' and male caregivers' involvement and children's development (Rollè et al., 2019), countries and development partners are increasingly promoting gender-transformative parenting to support male parents/caregivers in providing gender-responsive nurturing care to young girls and boys (UNICEF, 2023b; Plan International, 2021). Programs implemented in Rwanda and Kenya provide examples of effective interventions focusing on fathers (Breeding & Holla, 2021; Plan International USA, 2023). For instance, the Rise and Shine project (2019–2023) on ECD in Kenya has promoted sustained male involvement in responsive caregiving by utilizing male agents to reach male caregivers, and undertaking additional measures to retain male caregivers' participation in interventions (Upward Bound, 2022).

Parents Need Support to Manage Distress and Mental Health Concerns

Regardless of education, income or other assets, all parents need support to manage distress and mental health concerns, which spiked during the COVID-19 period of isolation, service deprivation, and scarcity. Parental mental health is equally as important as physical health and nutrition status in terms of impacts on child development and school readiness (Donald et al., 2019; McDonald et al., 2016). Investments in the holistic wellbeing of mothers and all household caregivers are investments in young children and human capital formation for Pakistan.

Our findings indicate a strong association between parental distress and child development; that is, children of non-distressed parents show higher ECD scores than children of distressed parents ($p < 0.001$), and in more than half (57 percent) of households with children under age 3, parents were distressed. Parents of young children with pre-existing mental health conditions are at an especially high risk for distress because of the social isolation, employment instability, and school and childcare center closures imposed by the pandemic (UNICEF, 2021). Moreover, research on distress should distinguish between fathers' and mothers' experiences, given evidence of gender differences in roles and experiences by parent gender (Lo et al., 2023). Stress-related risks can be mitigated through effective interventions that promote parental wellbeing, such as those found in Turkey (Aksoy Derya et al., 2021) and China (Liu et al., 2021). In Pakistan, there are opportunities to meet parents' mental health needs at least partially through home visits, counseling, and dissemination of health and wellbeing messages. For example, the Lady Health Worker (LHW) Program has a network of over 110,000 LHWs across Pakistan who are trained and deployed to increase access to essential primary care services and support health systems at the household and community levels. They are often recruited from local communities and can therefore provide services while also catering to cultural sensitivities (Bechange et al., 2021).

Very Low Rates of Psychosocial Stimulation, Especially For Children Under 3 Years

Our study also found overall low rates of psychosocial stimulation in households, which was especially pertinent for children under 3 years of age, many of whom experience insufficient engaging interactions. We also found that higher levels of psychosocial stimulation at home is strongly and positively associated with both ECD and school readiness levels. However, approximately 1 in every 9 children (12 percent) under age 3 in our study had experienced no psychosocial stimulation in the previous 24 hours.

Parenting education from the prenatal stage and throughout the early years is needed at scale across Pakistan, especially relative to early stimulation. Research in Pakistan and other South Asian countries such as India and Nepal, have demonstrated the effectiveness of parental education programs on early stimulation and responsive care in improving ECD (ARNEC, 2019; Devercelli et al., 2022; Khan et al., 2019; Sesame Street, 2019; Yousafzai et al., 2014), but there is need to build on these programs to scale up. Employing flexible, participatory, and multimodal approaches that are designed to meet the needs of extended-family caregivers is recommended (ARNEC, 2019), and programs should emphasize quality, frequency, and variety in interactions (Nieto, 2019). Programs can serve as distribution mechanisms to get books and learning and play materials into households and, when modeling and hands-on practice are involved, can strengthen caregiver–child bonds. For instance, evidence on the distribution of children's learning materials, such as picture books and early stimulation messages through community health workers as part of a national nutrition program in Bangladesh, demonstrate modest improvements in children's language, cognitive, and social–emotional skills (Breeding & Holla, 2021).

Prioritizing Early Childhood Education

ECE enrollment was the strongest predictor of school readiness in this study, and it is an essential area for enforcing and strengthening policy in Pakistan. While preprimary education falls within the purview of primary schooling in the public sector, which constitutes 87 percent (119,202 schools) of the country's total primary schools, many schools do not have preprimary sections available, especially in the rural areas (Pakistan Education Statistics, 2018). Provincial policies such as the "Early Childhood Education Policy Sindh 2014" and "Punjab Early Childhood Education Policy 2017" are beginning to carve out a separate space for ECE, however just 19 percent of children aged 3–5 are enrolled nationally, and the rates are even lower among vulnerable populations (Tomlinson et al., 2023). There is global evidence showing that including ECE in compulsory education effectively increases enrollment rates (e.g., Tanzania; UNICEF, 2019). In Pakistan, children aged 5 years are considered primary students in some data sets and preprimary in the National Education Policy 2009—regardless, 58 percent of 5-year-olds are not enrolled in school at any level (Tomlinson et al., 2023).

Our findings that show that most parents believe children should be enrolled in school between ages 4 and 5, which contrasts with high levels of non-enrollment at those ages, and further suggests that barriers to enrollment need to be better understood and removed. The ITA (2021) study in Punjab reported that costs, transportation, lack of information about program quality, and clarity on parents' rights and responsibilities were barriers to participation (World Bank, 2019b).

Need to Promote Holistic ECD Programs

Despite the challenges, Pakistan already has some programs and platforms in place that aim to effectively promote holistic ECD (Devercelli et al., 2022). Pilot interventions have shown that low-cost mental health interventions such as the Thinking Healthy Programme, delivered by community health workers, show modest benefits including reduced maternal depression and disability (Rahman et al., 2013), improved knowledge about play and development, and improved breastfeeding practices (Sikander et al., 2019). Community-based health interventions have been shown to promote newborn survival, improve children's health, and reduce stunting (Lassi et al., 2016; Khan et al., 2019; Yousafzai et al., 2018). In addition, teaching stimulation and nurturing care in parenting programs delivered through community health services and family physicians has been shown to significantly benefit children's development and care in Pakistan (Khan et al., 2019; Yousafzai et al., 2014).

Resources and attention directed toward families with children under age 3 who provide inadequate psychosocial stimulation would boost outcomes for this vulnerable population and would engender greater opportunities for healthy development and learning longitudinally. This population is likely to be larger than it appears in this study because the sample excludes the most disenfranchised families, those who lack the resources to have a cell phone and are therefore likely among the poorest households. Providing caregivers—including the more than one-tenth of the population lacking early stimulation knowledge and skills—with the support needed, for example, through parenting programs or health-based services, to responsively engage with their young children, will facilitate disadvantaged children's likelihood of reaching their developmental and productivity potential. For instance, evidence from a home visiting program in a disadvantaged setting in Jamaica where trained community workers encouraged and guided mothers on how to interact and play with their children found that psychosocial stimulation early in childhood can have substantial effects on labor market outcomes (Gertler et al, 2013).

Implications for Data Collection

Better and more data are needed through national and provincial surveys to explore the nexus between ECD services and children's cognitive and social–emotional development. At present, household surveys such as PSLM, MICS and the National Nutrition Survey, along with administrative data on service uptake, allow for analyses of some ECD outcomes, such as nutritional status and ECE enrollment.

However, these surveys do not lend themselves to a nation-wide, comprehensive analysis of holistic ECD that focuses on cognitive and social–emotional development for children across the birth to age 6 span. The current survey constitutes a first attempt to gather and analyze this information—albeit in an operating environment restricted by the pandemic. Comprehensive and regular survey data tracking children's development and school readiness, based on ECE experience, socioeconomic status, location, gender, and other factors, can provide insights into which interventions work and for whom. Monitoring of inequities is crucial to assess if the most vulnerable populations are reached, especially given the higher poverty risk for families with young children (World Bank, 2012).

Second, there is a need to better understand constraints and effective mechanisms to increase access to and quality of ECE programs. Research on age of entry, program type and duration, and intensity of attendance is needed to understand which ECE programs are working and for whom. Program quality data are almost entirely lacking. Reliable administrative data on elements of quality, including teacher–child interactions, student–teacher ratios, mixed-aged classrooms, physical environments, availability of materials, curriculum, teacher training, incentive structures, and parent engagement, among other inputs, would be invaluable. Notably, it would be worth exploring the frequency and effectiveness of psychosocial stimulation in the classroom. Data on both supply- and demand-side barriers are needed, with analysis of the impacts of socio-cultural norms and income inequalities, to allow for more targeted access to ECE and entry points for coordinated service provision.

Third, further research is needed to explore the role of gender-related norms, knowledge, and skills relevant to ECD. While this study provides an initial analysis of parental stimulation and ECD, further research is needed on differential patterns of early stimulation between women and men caregivers, how those might impact child development, and what approaches to parenting education programs are effective for women and men respectively.

Limitations

Several constraints in data collection limit the conclusions we could draw. First, the respondents were predominantly male, which meant that most respondents were not the child's primary caregiver. Second, an issue with cell-phone towers in Sindh resulted in under-sampling the province, however we were able to account for any selection bias with survey weights. Third, approximately 6 percent of Pakistani households that do not own a phone were excluded from our study. As such, our study results are only representative of the phone-owning households in Pakistan and our findings may not be able to capture the full extent of negative outcomes that may actually exist. Nonetheless, the only way to collect data during the period of social distancing imposed by the pandemic was via a phone survey, and we feel that the findings are still quite representative. Fourth, given the nature of the phone survey, all responses were caregiver-reported. Fifth, since the survey was cross-sectional, we could not draw any causal inferences from our regression analyses, and rather could only comment on associations between our exposures and outcomes of

interest. Sixth, the tool used to quantify psychosocial stimulation was developed for in-person data collection, and was in this case used over the phone. However, all of the questions on the tool can be answered in yes/no format over the phone, and the tool was previously validated in Pakistan, which is why we utilized it in our data collection. Seventh, the tools we used to quantify parental distress and food insecurity had not been previously validated in Pakistan.

Conclusion

This work sheds light on a major gap in the ECD literature as, prior to this study, no nationally representative data existed that quantified ECD among 0–3-year-olds in Pakistan. Moreover, it highlights the need to expand the reach of supportive parenting programs that explicitly support parents, including fathers, in understanding both why and how to provide responsive and engaging interactions with their children from infancy onward. These programs should prioritize caregivers of children of all ages, but specifically the one-ninth of caregivers who provide no stimulation to children under age 3—an age when responsive engagement is uniquely important to development. It is estimated that the recent floods in 2022 will cause the national poverty rate to increase by 3.7–4.0 percentage points, pushing between 8.4 and 9.1 million people into poverty. The poorest households in the poorest areas, where human development outcomes were already the lowest, have suffered the most. The adverse impact will be seen in health and education losses, with the affected areas showing some of the highest stunting rates in the country and an estimated 20 percent of households being moderately to severely food insecure. The proportion of households unable to access healthcare is also expected to increase from 31.4 percent to 34.9 percent (an additional 1.2 million households). Thus, an additional 5.5 million children under five will not be fully immunized. Approximately 1.5 million households are estimated to be deprived of clean water and sanitation adding to the pressure on the already overburdened healthcare system. The floods have also caused USD 559 million worth of damages to the public education sector, with an estimated 2.4 million students affected in school education (preprimary to higher secondary). Within the education sector, the damage to primary schools constitutes 80 percent of all damaged institutions, catering to 1.1 million students (Government of Pakistan, 2022). Early childhood education was gaining ground in the education sector prior to COVID-19, and gains must not be lost due to pandemic and flood-related economic setbacks. This paper serves as a call to action to invest in ECD, which has been overlooked as a key contributor to academic achievement, and human capital development in Pakistan.

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Declaration

Conflict of interest All authors hereby declare no conflicts of interest or competing interests.

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