

Maternal education and early childhood development: evidence from Jordan's Demographic and Health Survey

Mohammad Al-Masaeid and Mohammad Almomani

College of Business Government and Law, Flinders University, Adelaide, Australia

Abstract

Purpose – This study examines the impact of maternal education on early childhood development (ECD) outcomes in Jordan, focussing on developmental milestones across health, learning and psychosocial domains for children aged 24–59 months.

Design/methodology/approach – The analysis draws on nationally representative data from the 2023 Jordan Demographic and Health Survey (JDHS), which includes the UNICEF-designed ECDI2030 module. Linear probability and probit models are used to estimate the effect of maternal education on overall ECD scores and domain-specific indicators. Subgroup analyses are conducted by child age, gender and household wealth. The study also examines potential mechanisms, including women's empowerment, media exposure, age at marriage and fertility patterns.

Findings – The results indicate that maternal education is positively associated with ECD outcomes across all domains. The effects are strongest among girls, wealthier households and children aged 36–47 months. Each additional year of schooling raises the probability of a child being developmentally on track and increases the number of milestones achieved. Mechanism analysis suggests that maternal education contributes to better ECD by delaying marriage, reducing fertility and enhancing women's participation in joint healthcare decisions.

Originality/value – This study is the first to examine the link between maternal education and early childhood development in Jordan, using nationally representative data. By combining a multidimensional and age-disaggregated approach with analysis of underlying mechanisms, this research contributes to the regional literature on education, gender and child development, and offers evidence-based insights to support policy efforts toward achieving Sustainable Development Goal 4.2.1.

Keywords Mother's education, Early childhood development, Socioeconomic status, Demographic and health surveys, Jordan

Paper type Research article

1. Introduction

Early childhood development (ECD) has emerged as a crucial focus of development policy, particularly in low- and middle-income countries, due to its significant impact on shaping future human capital. Recognised as part of the United Nations' 2030 Agenda, ECD is integrated within Sustainable Development Goal (SDG) 4.2.1, which tracks “the proportion of children aged 24–59 months who are developmentally on track in health, learning, and psychosocial well-being, by sex” (United Nations, 2019). A growing body of multidisciplinary research from fields such as neuroscience, psychology, and economics underscores that a nurturing early environment fosters the development of essential cognitive, emotional, and social skills. Children who benefit from high-quality early education and care are more likely to demonstrate school readiness, achieve better academic results, pursue higher education, avoid delinquent behaviour, and earn higher incomes as adults (Barnett, 1995; Campbell *et al.*, 2001; Chetty *et al.*, 2011; Garces *et al.*, 2002; Hustedt *et al.*, 2008; Magnuson *et al.*, 2004; McCoy *et al.*,



2017). Consequently, investing in ECD represents not only a critical social priority but also a strategic avenue toward achieving long-term sustainable development. Health Education

Traditionally, economists have measured human capital by relying on the average years of formal education attained by the working-age population, with a particular emphasis on schooling at the primary, secondary, and tertiary levels (Barro, 1991; Mankiw *et al.*, 1992). However, recent research has begun to shift this perspective, highlighting that the formation of human capital commences well before formal education through early childhood development (Bos *et al.*, 2024; Duncan *et al.*, 2023). This stage represents the most rapid phase of human development, during which investments yield the highest returns across cognitive, emotional, social, and physical dimensions (Rakesh *et al.*, 2024; Karaoglan *et al.*, 2024). According to Heckman (2008), the returns on early childhood interventions significantly exceed those derived from investments in later life stages, including formal education and job training. For example, Heckman *et al.* (2010) reveal that early interventions targeting disadvantaged three-year-olds can generate internal rates of return ranging from 7% to 10% annually. In a similar vein, García *et al.* (2017) demonstrate that two high-quality early childhood programs can produce annual returns of up to 14% and benefit–cost ratios as high as 7.3. These findings emphasise that national economic growth prospects are profoundly affected by the extent to which governments, families, and institutions prioritise and invest in early childhood development through supportive policies and resources.

Maternal education is frequently framed within the contexts of human capital theory and household bargaining models (Jackson *et al.*, 2017). These frameworks assert that education enhances individuals’ knowledge, skills, and decision-making abilities, which consequently leads to improved investments in child health and development (Santos Silva and Klasen, 2021; Prickett and Augustine, 2016; Richards *et al.*, 2013). Mothers who possess higher levels of education are more inclined to adopt healthy behaviours, effectively utilise healthcare services, and engage in developmental practices that foster both cognitive and socio-emotional growth in their children (Rakesh *et al.*, 2024; Frosch *et al.*, 2021; Breiner *et al.*, 2016; Moore *et al.*, 2014). From a gender and development perspective, maternal education also alters intra-household dynamics by enhancing women’s bargaining power, delaying marriages, and reducing fertility rates (Chen, 2022; Nisén *et al.*, 2022; Deschênes *et al.*, 2020). These changes collectively yield greater resources and time available for effective child-rearing. Such theoretical frameworks indicate a positive correlation between maternal education and early developmental outcomes in children.

The following framework (Figure 1) illustrates our hypothesised model of how maternal education influences critical domains of early childhood development (ECD). We posit that

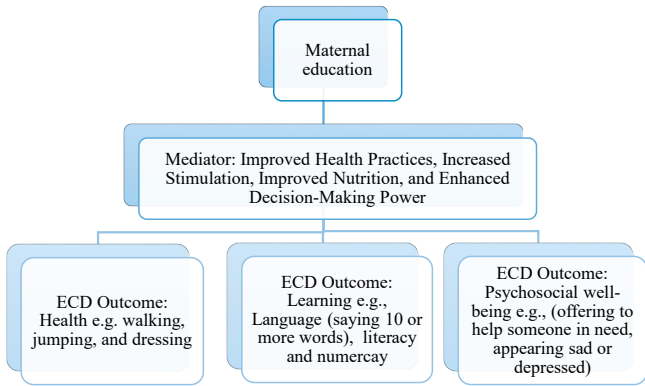


Figure 1. Hypothesised pathways from maternal education to ECD outcomes. Source: Figure created by the authors

maternal education does not directly impact ECD outcomes but operates primarily through four key mediating mechanisms: improved health practices, increased cognitive stimulation, enhanced nutrition, and decision-making power. These mediators, in turn, positively influence the child's health, learning, and psychosocial well-being, with the salience of specific pathways potentially varying across developmental stages (24–59 months).

Jordan's youthful demographic profile holds significant potential for long-term economic growth. According to data from [Our World in Data Database \(2025\)](#), the population of children under five steadily increased from 1950 to 2016, after which it levelled off and is expected to remain stable through 2,100. As of 2023, children under five account for approximately 10% of the total population, which is slightly higher than the average of 9.8% for lower-middle-income countries. This positions Jordan ahead of peers like Haiti, where the under-five share is 9.4%. This relatively large proportion of young children indicates that Jordan still has a demographic advantage. To fully leverage this opportunity, however, carefully crafted medium- and long-term policy interventions will be essential, particularly in early childhood development and education. One pressing concern is the low enrolment in pre-primary education. The World Bank's [World Development Indicators \(2025\)](#) report that Jordan's gross enrolment rate for pre-primary education was just 27% in 2020, significantly lower than the lower-middle-income average of 58%. This gap highlights a missed opportunity to invest in early human capital development, which is essential for realising the long-term benefits of the country's demographic structure.

In light of the aforementioned context, this study examines the socioeconomic factors influencing early childhood development (ECD) outcomes in Jordan, utilising nationally representative microdata from the 2023 Jordan Demographic and Health Survey (JDHS). Notably, this iteration of the JDHS marks the inaugural collection of comprehensive data on developmental milestones for children aged 24–59 months. Our analytical framework is informed by existing literature, which consistently indicates that children from higher socioeconomic backgrounds typically experience greater early-life investments. This study places particular emphasis on maternal education, as previous research underscores its pivotal role in shaping child health and educational outcomes (e.g. [Karaoglan et al., 2024](#); [Cuartas, 2022](#); [Prickett and Augustine, 2016](#); [Buis, 2013](#); [Augustine et al., 2009](#); [Chen and Li, 2009](#); [Cunha and Heckman, 2007](#); [Blau, 1999](#)).

This study offers several significant contributions to the field of early childhood development (ECD), addressing important gaps in both the regional and global literature. Firstly, to our knowledge, it is the first to investigate the link between maternal education and ECD outcomes in Jordan using nationally representative data from the 2023 Jordan Demographic and Health Survey (JDHS). While prior research has examined ECD in other contexts, evidence from the Middle East and North Africa remains scarce, leaving an important regional gap. Secondly, although [Karaoglan et al. \(2024\)](#) conducted a related study in Türkiye, our work extends the global evidence base in crucial ways. Their study relied on a shortened ECD index with just 10 items and focused narrowly on children aged 36–59 months, whereas we use the complete UNICEF-developed ECDI2030 module with 20 validated items across health, learning, and psychosocial well-being on children aged 24–59 months. This enables a more comprehensive assessment of developmental outcomes and contributes to the international push for standardised measurement. Finally, we advance the literature by disaggregating outcomes by age subgroups (24–35, 36–47, and 48–59 months) and by specific developmental domains. This multidimensional, age-specific exploration not only fills a gap in lower-middle-income country research but also provides globally relevant insights into how maternal education influences children's development across different stages of early childhood.

In the empirical analysis, we examine the Early Childhood Development (ECD) index, as well as its three individual domains. Our findings indicate that approximately 76% of children in Jordan are on a solid developmental path, with 73% of boys and 79% of girls meeting the necessary milestones. For children aged 36–47 months, impressively, over 88% are hitting the

developmental benchmarks, and on average, children between 2 and 5 years achieved 13.8 out of 20 milestones. Additionally, results from our linear probability model suggest that for every additional year of education that a mother completes, there is a notable increase in the likelihood of her child being developmentally on track. Additionally, we find that household wealth is positively correlated with the child's developmental status.

The paper is structured as follows: [Section 2](#) provides an overview of early childhood development in the context of Jordan. [Section 3](#) describes the data sources used in the analysis, and [Section 4](#) outlines the empirical methodology. [Section 5](#) presents descriptive statistics and discusses the main findings from the econometric models. Finally, [Section 6](#) concludes the study with potential policy recommendations.

2. Early childhood development in Jordan

The 2023 Jordan Population and Family Health Survey (JPFHS) provides the most comprehensive national overview of early childhood development (ECD) to date, utilising the UNICEF-developed ECDI2030 tool. This tool evaluates the developmental progress of children aged 24–59 months across three interconnected areas: health, learning, and psychosocial well-being, in keeping with Sustainable Development Goal (SDG) indicator 4.2.1. The findings indicate that 84% of Jordanian children in this age bracket are on track developmentally. However, this national average conceals considerable disparities based on factors such as gender, region, maternal education, wealth, and nationality ([DoS and ICF, 2024](#)).

Girls are more likely to be developmentally on track, with 86% reaching key milestones, compared to 82% of boys. When examining regional differences, children in the southern part of Jordan are struggling more, with only 78% on track. At the same time, those in the central and northern regions fare better, at 85% and 84%, respectively. Nationality also plays a crucial role: 85% of Jordanian children meet developmental milestones, but only 76% of Syrian children and 79% of those from other nationalities do. The situation is particularly alarming for Syrian children in refugee camps, where merely 71% are meeting developmental expectations ([DoS and ICF, 2024](#)).

Maternal education and household wealth significantly influence the prediction of child development outcomes. Research shows that only 65% of children whose mothers lack formal education are developmentally on track, compared to 88% of those whose mothers possess higher education levels. Likewise, children from the lowest wealth quintile are significantly less likely to meet developmental milestones, at 73%, compared to their peers in wealthier quintiles, where the percentage ranges from 85% to 91%. These disparities highlight the urgent need for targeted investments in early childhood services, especially in disadvantaged regions, refugee communities, and low-income or low-education households. Such efforts are crucial for making equitable progress toward achieving SDG 4.2.1 ([DoS and ICF, 2024](#)).

3. Data

The data for this study come from the 2023 round of the Jordan Population and Family Health Survey (JPFHS), which is conducted regularly every five years by the Department of Statistics. These surveys are part of the broader Demographic and Health Surveys (DHS) series. Financed mainly by the United States Agency for International Development and implemented by Macro International in collaboration with national statistical agencies (see <https://dhsprogram.com/> for further information). The JPFHS is nationally representative, employing a two-stage stratified cluster sampling design. In the first stage, enumeration areas were selected from the national census frame with probability proportional to size. In the second stage, households within each cluster were systematically selected. Data were collected through face-to-face interviews with eligible women aged 15–49. Using standardised DHS questionnaires that were translated into Arabic and pretested prior to

fieldwork. For the first time in 2023, the JPFHS included a set of questions to assess the early childhood development of 24 to 59-month-old children. We use these questions to understand the factors determining ECD, focussing on the effects of maternal schooling and other family socioeconomic indicators. Our operational sample consists of 3,346 children who can be linked to their mothers and for whom complete data exist on ECD variables.

Early childhood development is a multidimensional process that involves the progression of motor, cognitive, language, socioemotional, and regulatory skills during the early years of life (UNICEF, 2016). These domains, while distinct, are closely interconnected, and nurturing them in an integrated manner is essential for enabling children to reach their full developmental potential. Early gains in physical growth, literacy, numeracy, socioemotional capacity, and learning readiness significantly shape long-term outcomes related to health, education, and overall well-being (Shonkoff and Phillips, 2000).

To support global monitoring of child development and ensure comparability across countries, UNICEF developed the Early Childhood Development Index 2030 (ECDI2030) as part of the Multiple Indicator Cluster Survey (MICS) program. The ECDI2030 comprises 20 items that assess developmental progress in three overarching domains: health, learning, and psychosocial well-being. Each domain encompasses multiple subdomains. Health includes gross and fine motor development as well as self-care. Learning covers expressive language, literacy, numeracy, pre-writing, and executive functioning. Psychosocial well-being includes emotional and social skills, as well as internalising and externalising behaviour. Unlike previous versions, ECDI2030 is not designed to measure these domains separately but instead to produce a unified summary score that aligns with Sustainable Development Goal (SDG) indicator 4.2.1 (DoS and ICF, 2024).

The JPFHS 2023 administered the ECDI2030 module as part of its women's questionnaire. Mothers were asked 20 questions about one of their randomly selected biological children aged between 24 and 59 months. These questions assessed children's behaviour in daily contexts and their ability to perform age-appropriate tasks, reflecting a developmental progression of skills. The index captures whether children are developmentally on track based on the number of milestones achieved relative to their age group. Specifically, children are considered on track if they meet the following minimum thresholds: at least 7 milestones for ages 24–29 months, 9 for 30–35 months, 11 for 36–41 months, 13 for 42–47 months, and 15 for 48–59 months (DoS and ICF, 2024).

A child's developmental status is assessed based on mothers' responses to a set of 20 questions covering three domains: health (5 items), learning development (10 items), and psychosocial well-being (5 items). While the ECD index, derived from the MICS program, is a valuable tool for researchers and policymakers, it has certain limitations. Notably, the data are based on caregiver reports rather than direct assessments, making the results somewhat subjective. As a result, caregiver responses may be affected by recall errors or reporting bias (UNICEF, 2023).

In the health domain, a child is considered developmentally on track if they can perform essential motor and self-care tasks, including walking on uneven surfaces, jumping with both feet, dressing themselves, and fastening buttons without assistance. The learning domain covers several subskills, such as expressive language (e.g. saying 10 or more words; speaking in sentences of three or more words; using sentences of five or more words), literacy (e.g. correctly using pronouns like "I", "you", "she", or "he"; naming familiar objects when shown; recognising at least five letters of the alphabet; writing their name), and numeracy (e.g. recognising numbers from 1 to 5). It also includes pre-writing and executive functioning skills, such as correctly giving three objects when asked, counting 10 objects without mistakes, and colouring or playing with blocks without giving up or needing help. The psychosocial well-being domain evaluates emotional and social behaviours, such as asking about familiar people other than parents, offering to help someone in need, and getting along with other children. It also includes assessments of internalising behaviours (e.g. appearing sad or depressed) and externalising behaviours (e.g. hitting, biting, or kicking others) [1].

We establish a binary variable to represent the overall ECD index, where a value of 1 indicates that the child is developmentally on track for their age group, and a value of 0 indicates otherwise. Informed by the existing literature, our analysis predominantly emphasises maternal education and other socioeconomic determinants influencing child development. Maternal caregiving plays a particularly critical role in the Jordanian context, as traditional gender roles often assign childcare responsibilities primarily to mothers. A significant explanatory variable within our study is household wealth, which is derived from data concerning household assets and living conditions as detailed in the 2023 JPFHS. Additional control variables incorporated in the analysis include the child's age in months, sex, maternal age, household size, birth order of the child, the number of children under the age of five, the governorate level, and residential status (urban versus rural).

4. Empirical methodology

The relationship between early childhood development and maternal education is estimated using the following specification:

$$ECD_i = \beta_0 + \beta_1 EDU_i + \beta_2 X_i + \mu_i \quad (1)$$

where ECD is the early childhood development status of child i , EDU is his/her mother's years of schooling, X is a vector of control variables that include the variables listed above, and μ is the random error term, which is clustered at the mother level to account for the fact that there might be siblings in the data. The coefficients of interest are β_1 , which shows the improvement in the ECD index when the mother's years of schooling increase by one year, and β_2 , which shows how control variables impact the ECD. We include province fixed effects by adding dummy variables for each province (with one omitted category to avoid perfect multicollinearity), these province dummies are included in X_i . We use sampling weights throughout the analysis.

5. Results

5.1 Descriptive statistics

Table 1 presents the descriptive statistics of the key variables for children aged 24–59 months in our sample. Girls represent approximately 49% of the sample, and the average age of all children is 42.6 months. Overall, 76% of children are found to be on track in terms of the overall ECD index. Gender-disaggregated data reveal that 79% of girls are developmentally on track compared to 73% of boys, suggesting a slight advantage for girls. By age group, 77% of children aged 24–35 months are on track, followed by 88% among those aged 36–47 months, and 73% for children aged 48–59 months. Children in Jordan achieved an average of 13.8 out of 20 milestones. Disaggregated by domain, the mean number of milestones achieved is 3.64 out of 5 for the health domain, 6.52 out of 10 for learning, and 3.63 out of 5 for psychosocial well-being. Across all domains, girls consistently outperform boys. For instance, girls achieved 14.11 milestones on average, compared to 13.51 for boys, with similar patterns observed across the health, learning, and psychosocial sub-domains.

Mothers of the children in the sample have an average age of 31.9 years and possess an average of 11.2 years of formal education. In terms of educational attainment, 3% of mothers lack formal education, 9% have completed primary school, 56% have attained secondary education, and 32% hold higher education degrees. The distribution of household wealth reveals that a significant proportion of families with young children fall within the lower wealth quintiles: 38% are in the bottom 20%, and 24% are in the second quintile. Only 6% of households belong to the top 20%, highlighting the economic vulnerability faced by families with young children in Jordan. The average household size consists of six members, and the average birth order of the child is 1.5, indicating that many of the children in the sample are

Table 1. Descriptive statistics of variables

	Whole	Male	Female
ECD index (1/0)	0.76	0.73	0.79
ECD index 24–35 (1/0)*	0.77	0.75	0.79
ECD index 36–47 (1/0)**	0.88	0.76	0.81
ECD index 48–59 (1/0)***	0.73	0.69	0.77
Number of ECD milestones achieved (0/20)	13.80	13.51	14.11
Number of health ECD milestones achieved (0/5)	3.64	3.56	3.73
Number of learning ECD milestones achieved (0/10)	6.52	6.34	6.69
Number of psychosocial ECD milestones achieved (0/5)	3.63	3.59	3.68
Female	0.49	–	–
Age in months	42.66	42.74	42.58
Mother’s years of education	11.18	11.17	11.19
Educational attainment of mother			
No education	0.03	0.03	0.03
Primary school	0.09	0.10	0.10
Secondary school	0.56	0.56	0.55
Higher	0.32	0.31	0.32
Mother’s age	31.89	32.00	31.78
Household Wealth Quantile			
Bottom 20%	0.38	0.38	0.38
2nd 20%	0.24	0.24	0.23
3rd 20%	0.18	0.17	0.19
4th 20%	0.14	0.15	0.14
Top 20%	0.06	0.06	0.06
Birth order	1.51	1.49	1.54
Number of children under five	1.85	1.82	1.87
Household size	6.00	6.01	5.99
Rural Residence	0.18	0.17	0.19
Mother’s work	0.10	0.10	0.10
# of Observations	3,346	1,682	1,664

Note(s): Author’s calculations using data from the 2023 JPFHS. *The total number of observations for the ECD index among children aged 24–35 months is 935; **1,157 for children aged 36–47 months; and ***1,254 for children aged 48–59 months

Source(s): Table created by authors

either first or second born. On average, there are 1.85 children under the age of five per household. Furthermore, 18% of the sample population resides in rural areas and 10% of mothers have jobs.

5.2 Linear probability model results

The results for the overall ECD index in Table 2 show that maternal education has a modest positive impact: in panel 1 each additional year of schooling increases the likelihood that a child is developmentally on track by 1% point. Given that 76% of children are on track, after controlling for household wealth and other household and individual level characteristics. This finding is consistent with Karaoglan et al. (2024) for Turkey, who report a similar effect even after accounting for confounding factors. Likewise, Jeong et al. (2017), using data from 44 low- and middle-income countries, including Lebanon and Iraq from the MENA region, found robust associations between both parents’ education levels and children’s development scores. These comparisons highlight the importance of situating the findings within the broader MENA context to strengthen their regional relevance.

The results in Panel 2 illustrate the effects of varying levels of maternal education on ECD. Mothers with secondary or higher education have a significantly greater impact on their children’s development compared to those with no education or only primary schooling.

Table 2. LPM results

Variables Panel	ECD index 1 whole	2 whole	3 male	4 male	5 female	6 female
Education	0.010*** (0.003)		0.009** (0.003)		0.011*** (0.003)	
Educational levels (no education and primary edu. omit.)						
Secondary edu.		0.075* (0.039)		0.048 (0.044)		0.094* (0.047)
Higher		0.108*** (0.039)		0.087* (0.045)		0.124*** (0.046)
Mother's age	−0.001 (0.001)	−0.000 (0.001)	−0.002 (0.002)	−0.002 (0.002)	0.001 (0.001)	0.001 (0.002)
Household Wealth (Bottom 20% omit.)						
2nd 20%	0.076*** (0.019)	0.065*** (0.019)	0.073** (0.034)	0.081** (0.034)	0.049* (0.025)	0.054** (0.025)
3rd 20%	0.113*** (0.021)	0.108*** (0.020)	0.109** (0.041)	0.116** (0.043)	0.094*** (0.027)	0.108*** (0.027)
4th 20%	0.118*** (0.020)	0.111*** (0.020)	0.092** (0.037)	0.103** (0.036)	0.116*** (0.018)	0.132*** (0.017)
Top 20%	0.095*** (0.029)	0.087*** (0.027)	0.097** (0.045)	0.112** (0.047)	0.047 (0.049)	0.071 (0.044)
Birth order	0.006 (0.016)	0.019 (0.018)	0.031 (0.026)	0.032 (0.025)	−0.003 (0.021)	−0.003 (0.021)
Number of children under five	−0.010 (0.011)	−0.016 (0.011)	−0.013 (0.011)	−0.014 (0.011)	−0.015 (0.018)	−0.014 (0.018)
Household size	0.005 (0.003)	0.000 (0.004)	0.001 (0.005)	0.000 (0.005)	0.001 (0.004)	−0.000 (0.004)
Rural residence	−0.002 (0.019)	0.023 (0.022)	0.014 (0.026)	0.015 (0.027)	0.033 (0.031)	0.033 (0.031)
Work	0.004 (0.015)	0.010 (0.017)	−0.019 (0.032)	−0.015 (0.033)	0.027 (0.027)	0.036 (0.027)
Mean of dependent variable	0.76		0.73		0.79	
# of obs.	3,346		1,682		1,664	
R-squared	0.08	0.07	0.09	0.09	0.10	0.10

Note(s): Robust standard errors in parentheses clustered at the household number (30 clusters). All the regressions include governorates and age in months dummies, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source(s): Table created by authors

Children whose mothers have completed higher education are 10.8% points more likely to be developmentally on track than those whose mothers have no education or only completed primary school. The positive impact of secondary education is smaller than that of higher education.

To evaluate the differing impacts of maternal education on the early development of boys and girls, we analysed the model separately for each gender. As illustrated in Panels 3 and 5, every additional year of maternal schooling boosts the chances of being developmentally on track by 0.9% points for boys and 1.1% points for girls. Although the effect is somewhat stronger for girls, the difference is not substantial, indicating positive outcomes for both genders. However, upon closer examination of education levels, we find that higher maternal education corresponds to a 12.4% point increase for girls, in contrast to an 8.7% point increase for boys. This suggests that greater levels of maternal education may have a more significant impact on girls' early development.

Additionally, our analysis reveals that household wealth consistently serves as a strong predictor of ECD outcomes. When we compare children in the bottom 20% of the wealth distribution to those in the second, third, and fourth quintiles, we find that the latter are 6.5–13.2% points more likely to be on track developmentally. Interestingly, the wealth gradient is most pronounced in the fourth quintile, where children enjoy up to a 13.2% point advantage, especially among girls (see Panel 6). This suggests that the benefits of increased wealth are most significant before reaching the highest levels of wealth. While children from the top 20% also show improved outcomes, the additional benefits for girls are not statistically significant, pointing to a possible inverted U-shape pattern. This shape may imply diminishing returns on wealth at the higher levels or indicate possible ceiling effects in specific developmental areas. These findings align with cross-country research conducted by Cuartas *et al.* (2023) and Dadras *et al.* (2024), which reinforces the notion that income plays a crucial role in influencing child development, particularly for families moving out of poverty.

5.3 Overall results

Table 3 explores how maternal education impacts ECD across various age groups of children. In the case of children aged 24–35 months (Panel 1), the findings indicate that there is no statistically significant relationship. Furthermore, children in this age bracket whose mothers have completed at least high school do not show statistically significant effects either.

The impact of maternal schooling becomes increasingly pronounced and statistically significant as children get older. For instance, in the case of children aged 36–47 months (Panel 3), each additional year of maternal education has a positive influence on development, resulting in a 12.7% point increase in the likelihood of these children being on track developmentally. Secondary education also shows a noteworthy positive effect in this age group. Likewise, for children aged 48–59 months (Panel 5), a higher level of maternal education corresponds to an 11.9% point increase in developmental readiness. These findings indicate that the role of maternal education in shaping child development becomes more apparent as children mature.

The findings indicate that the impact of a mother’s education on early childhood development becomes increasingly evident and statistically significant as children age. Additionally, the marked effects observed in the middle-age group (36–47 months) suggest

Table 3. LPM results for ECD on track for different age group

Variables	ECD index 24–35		ECD index 36–47		ECD index 48–59	
Panel	1	2	3	4	5	6
Education	0.003 (0.004)		0.015** (0.004)		0.010** (0.004)	
Educational levels (no education and primary edu. omit.)						
Secondary edu.		0.052 (0.059)		0.107** (0.042)		0.056 (0.057)
Higher		0.065 (0.055)		0.127*** (0.044)		0.119* (0.060)
Mean of dependent variable	0.77		0.88		0.73	
# of obs.	935		1,157		1,254	
R-squared	0.08	0.08	0.06	0.06	0.10	0.10

Note(s): Robust standard errors in parentheses clustered at the household number (30 clusters). All the regressions include governorates and age in months dummies, mother’s age, birth order, number of children under five, household size, rural residence and employment status, **p* < 0.1, ***p* < 0.05, ****p* < 0.01

Source(s): Table created by authors

that this may be a crucial period during which maternal education significantly influences a child's growth and development. Health Education

Table 4 illustrates how maternal education affects various components of the ECD index, which comprises 20 items reported by caregivers across three key developmental areas: health (5 items), learning (10 items), and psychosocial well-being (5 items). A child is deemed developmentally on track if they can accomplish specific tasks and exhibit age-appropriate behaviours, including walking, dressing independently, using expressive language, recognising letters and numbers, and interacting positively with peers.

The findings presented in Panels 1 and 2 indicate a strong connection between maternal education and the total number of ECD milestones achieved. Each additional year of schooling is linked to a 0.107 increase in the overall milestone count. Moreover, children whose mothers have completed secondary or higher education reach 0.745 and 1.156 more milestones, respectively, compared to those whose mothers have either no education or only primary schooling. In the health domain (Panels 3 and 4), the impact of maternal education is smaller but still significant; one additional year of schooling corresponds to a 0.016 increase in health-related milestones, which include motor and self-care skills. The learning domain (Panels 5 and 6) demonstrates the most robust association. Specifically, for each extra year of maternal education, learning milestones rise by 0.068, while children of mothers with higher education register an impressive 0.743 additional learning milestones. This domain encompasses essential skills such as expressive language, literacy, numeracy, and executive functioning.

In the psychosocial domain (Panels 7 and 8), maternal education exhibits a consistent positive relationship with child development. For every additional year of schooling, children achieve an increase of 0.021 in psychosocial milestones, while those with higher education see an even greater boost of 0.246 milestones. These milestones reflect key aspects of children's emotional and social development, including empathy, cooperation, and self-regulation of behaviour. Overall, the findings highlight the substantial impact of maternal education, particularly at higher levels, on various aspects of early childhood development, including learning and psychosocial well-being.

Table 4. OLS results for milestones achieved of ECD with different domains

Variables	ECD milestone total		Health milestones		Learning milestones		Psychosocial milestones	
Panel	1	2	3	4	5	6	7	8
Education	0.107*** (0.023)		0.016** (0.006)		0.068*** (0.015)		0.021*** (0.005)	
Educational levels (no education and primary edu. omit.)								
Secondary		0.745** (0.360)		0.121 (0.101)		0.465** (0.222)		0.159** (0.064)
Higher		1.156*** (0.343)		0.166 (0.116)		0.743*** (0.199)		0.246*** (0.073)
Mean of dependent variable	13.80		3.64		6.52		3.63	
# of obs.	3,346		3,346		3,346		3,346	
R-squared	0.29	0.29	0.23	0.23	0.28	0.28	0.08	0.08

Note(s): Robust standard errors in parentheses clustered at the household number (30 clusters). All the regressions include governorates and age in months dummies, mother's age, birth order, number of children under five, household size, rural residence and employment status, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source(s): Table created by authors

5.4 Heterogeneity analysis

The following sections outline a series of robustness checks designed to assess the stability and validity of our primary findings. Initially, we investigate the variations in the effect of maternal education across important subgroups. Following that, we examine potential mechanisms by analysing the pathways through which maternal education influences child outcomes. Finally, we re-estimate the models using an alternative econometric approach, specifically Probit regression, to verify the consistency of our results.

First, we examine the variation in the impact of maternal education on ECD across different socioeconomic and demographic subgroups, drawing on the estimates presented in Table 5. When examining the relationship according to place of residence, a significant and positive effect is observed in urban areas, with a 1.1% point increase for each additional year of education. However, this impact diminishes in rural areas. This discrepancy may stem from better access to educational and healthcare facilities in urban settings, which could amplify the benefits of maternal education. Focussing on children from the poorest 40% of households, we find that each additional year of maternal schooling increases the likelihood of being developmentally on track by 1.4% points, a statistically significant figure. In contrast, among children from the wealthiest 60%, the effect is not statistically significant. This indicates that maternal education has a greater impact on child development outcomes in lower-wealth contexts, likely because these children begin with fewer resources and support.

A similar trend emerges when we look at children based on their mothers' employment status. For children whose mothers are not involved in paid work, maternal education significantly impacts development: each extra year of schooling boosts the likelihood of being developmentally on track by 1.1% points. Conversely, among children whose mothers are working, the difference is not statistically significant. This could suggest a trade-off between the time mothers spend at home and their participation in the workforce, particularly in areas where the quality of external childcare is lacking.

Table 5. LPM estimation, heterogeneity analysis

Variables	ECD index		Wealth		Mother's work status	
	Residence					
Panel	Urban	Rural	Poorest 40%	Richest 60%	Work	No work
Education	0.011*** (0.003)	0.005 (0.007)	0.014*** (0.003)	0.003 (0.003)	-0.001 (0.011)	0.011*** (0.003)
# of obs.	2,738	608	2,053	1,293	342	3,004
R-squared	0.08	0.14	0.08	0.07	0.14	0.08

Panel	Region			Maternal age group		
	Central	North	South	<25	25-34	35+
Education	0.011** (0.004)	0.004 (0.003)	0.015** (0.006)	0.012 (0.011)	0.010** (0.003)	0.008 (0.005)
# of obs.	1,442	1,160	744	402	1,831	1,113
R-squared	0.10	0.10	0.11	0.17	0.10	0.10

Note(s): Control variables that correspond to the main variable of interest in each regression are excluded to avoid multicollinearity. For example, when examining heterogeneity by place of residence or region, the rural residence variable is omitted from the set of controls. Robust standard errors in parentheses clustered at the household number. All the regressions include governorates and age in months dummies, mother's age, birth order, number of children under five, household size, rural residence and employment status, **p* < 0.1, ***p* < 0.05, ****p* < 0.01. The mean of dependent variable is 0.76

Source(s): Table created by authors

It is essential to clarify whether these insignificant results stem from a limited sample size or reflect underlying contextual factors. For example, the rural subgroup has only 608 observations, and the mother's work subgroup has only 342 observations, which reduces statistical power and may mask meaningful effects. On the other hand, the muted effects among wealthier households or in specific regions could reflect structural differences: higher-income families may already provide enriched home environments that reduce the marginal impact of maternal education, while in rural areas, barriers such as limited access to quality schools, health facilities, and childcare services may dilute the benefits of education. These distinctions are critical for designing targeted policies. Where small sample sizes are the main limitation, further data collection and larger surveys are needed to confirm subgroup patterns.

Regional differences also come into play. In the Southern region, the positive effect of maternal education is most pronounced, registering at 1.5% points. In comparison, it stands at 1.1% points in the Central region but lacks statistical significance in the North. Furthermore, when we break it down by maternal age, the most substantial effect of education on child development is seen among mothers aged 25–34, with a coefficient of 1.0% points. This likely indicates that mothers in their prime childbearing years have greater decision-making power, maturity, and experience, which can enhance the developmental benefits of their education for their children.

5.5 Potential mechanisms

We delved deeper into the ways maternal education can impact ECD by exploring key intermediate outcomes related to women's empowerment and reproductive behaviours. As illustrated in Table 6, there is a significant correlation between maternal education and various characteristics, including increased media exposure, enhanced decision-making power within the household, delayed marriage, and lower fertility rates, all of which are generally associated with better outcomes for children's well-being.

Research indicates that each additional year of a mother's education boosts the likelihood of her regularly watching television by 1.0% point, which may improve her access to important health and child-related information. Furthermore, with each year of schooling, the probability that a woman is involved in joint decision-making about her own healthcare increases by 0.9% points. These results suggest that more educated women are not only better informed but also more empowered when it comes to household issues, particularly those related to health.

Furthermore, maternal education is closely linked to delayed marriage and reduced fertility rates. Each additional year of schooling increases a mother's age at her first marriage by approximately 0.28 years and results in a decrease of 0.064 children born. These patterns are consistent with a significant body of research indicating that later marriages and smaller family sizes contribute to better investments in child development (McLanahan and Percheski, 2008; Cáceres-Delpiano, 2006). Such findings support the idea that education not only enhances

Table 6. The effects of mother's education on intermediate outcomes

Variables	Mother watches TV	Joint decision on women's health care	Mother's age at first marriage	Number of children
Education	0.010*** (0.002)	0.009** (0.003)	0.277*** (0.019)	−0.064*** (0.005)
Obs.	3,346	3,333	3,346	3,346
R ²	0.05	0.05	0.47	0.64

Note(s): Controls: governorates and age in months dummies, mother's age, birth order, number of children under five, household size, rural residence and employment status. Standard errors (in parentheses) clustered at the household level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Source(s): Table created by authors

women’s autonomy and knowledge but also has a positive influence on key life outcomes that affect the environments in which children are raised.

The findings in Table 6 highlight significant long-term economic benefits that arise from improving maternal education. By increasing access to information and giving women greater decision-making power, we not only enhance maternal and child health but also boost women’s ability to participate in the labour market, thus expanding the nation’s productive potential. Additionally, trends such as delayed marriage and lower fertility rates lead to higher investments in each child, resulting in improved educational outcomes and better job opportunities for the next generation, as key components in building human capital. Together, these elements demonstrate how maternal education creates a positive cycle: empowering women, fostering child development, and ultimately driving productivity growth and sustained economic progress.

5.6 Probit model results

Finally, to reinforce the strength of our primary findings and to address the binary nature of the ECD outcome, we used a Probit model for our analysis. In Table 7, we present both the coefficient estimates and the marginal effects. The results align well with those derived from the LPM, further confirming the positive and statistically significant link between maternal education and early childhood development.

As illustrated in Panel 2, each additional year of maternal education boosts the likelihood that a child is developmentally on track by 0.9% points. When we delve deeper into educational attainment (as shown in Panel 4), we find that completing secondary education is associated with a 7.1% point increase in the probability of being on track. In contrast, obtaining higher education results in a 10.5% point increase.

The Probit estimates underscore the crucial role that maternal education plays in promoting early childhood development. The consistent results observed in both linear and non-linear models indicate that this effect holds across different analytical approaches, suggesting a genuine underlying relationship. Such robustness reinforces the argument that enhancing maternal education should be a primary focus of policy aimed at improving child development outcomes in low- and middle-income settings.

Table 7. Probit results

Variables	ECD index			
	Probit 1	Marginal effect 2	Probit 3	Marginal effect 4
Panel				
Education	0.033*** (0.010)	0.009*** (0.002)		
Educational levels (no education and primary edu. omit.)				
Secondary edu.			0.228* (0.116)	0.071* (0.038)
Higher			0.353*** (0.119)	0.105*** (0.038)
Mean of dependent variable	0.76			
# of obs.	3,346			
R-squared	0.07		0.07	
Note(s): Robust standard errors in parentheses clustered at the household number. governorates and age in months dummies, mother’s age, birth order, number of children under five, household size, rural residence and employment status. * <i>p</i> < 0.1, ** <i>p</i> < 0.05, *** <i>p</i> < 0.01				
Source(s): Table created by authors				

6. Conclusion

This paper examines the impact of maternal educational attainment on early childhood development (ECD) outcomes in Jordan, utilising individual-level data from the 2023 Jordan Demographic and Health Survey (JDHS). We propose that higher levels of maternal education enhance key aspects of women's empowerment and household decision-making, which in turn influence developmental outcomes for children aged 24–59 months. To investigate this relationship, we apply various econometric techniques, including linear probability models and Probit regressions. A significant methodological contribution of our study is its use of recent, nationally representative microdata, which is enriched with detailed information on household, maternal, and regional characteristics. Building on prior research (e.g. [Bechraki et al., 2022](#); [Patra et al., 2016](#); [Nisselle et al., 2011](#); [Maher et al., 2010](#); [Robinson and Page, 2009](#)), our empirical strategy enables a more nuanced exploration by controlling for a wide range of covariates. This approach not only enhances the internal validity of our results but also offers robust evidence on the role of maternal education in shaping early childhood development within the context of a lower-middle-income country.

This study enriches the existing literature on maternal education and its impact on child development as well as contributes to the broader conversation about women's empowerment and reproductive behaviour in the Middle East and North Africa (MENA) region. By highlighting essential pathways such as increased media exposure, greater participation in joint health decision-making, later marriage ages, and lower fertility rates, our analysis illustrates how maternal education boosts women's agency within their households. These factors are closely linked to improved early childhood development outcomes, showcasing how education can transform gender norms and family dynamics. In this light, investing in female education stands out as a vital strategy for enhancing both maternal autonomy and child well-being in Jordan.

Our research clearly demonstrates that maternal education has a significant positive impact on early childhood development (ECD) outcomes across various indicators and demographic groups. Notably, every additional year of schooling is associated with a 1% point increase in the likelihood that children will be developmentally on track. This effect holds steady across genders, though it tends to be slightly more pronounced for girls. Further analysis reveals that the positive influence of maternal education intensifies as children age, particularly for those between 36 and 59 months old. Additionally, maternal education plays a crucial role in enhancing each of the fundamental developmental domains, health, learning, and psychosocial well-being, highlighting its extensive and multifaceted impact. These insights suggest that investing in female education not only supports women but also yields significant intergenerational benefits by fostering better child development. To improve early childhood outcomes in Jordan and similar regions, policymakers would prioritise enhancing access to quality education for girls and weave maternal education into their early childhood policy strategies.

6.1 Limitations and future research

While the ECD index provides a valuable and standardised tool for assessing child development, it is important to acknowledge that the data rely on caregiver-reported (mother) outcomes rather than direct child assessments. This reliance introduces potential subjectivity, as caregiver responses may be influenced by recall errors or social desirability bias. Future research could strengthen the evidence base by incorporating longitudinal data and objective assessments of children's developmental outcomes to validate and extend these findings.

Building on the insights from this study, future research could explore how household structure and family composition influence the connection between maternal education and parental investments in children's development. The transition from prioritising the quantity of children to focusing on their quality, which is evident in improved early developmental outcomes, may be affected by factors such as the opportunity cost of women's time, caregiving

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responsibilities, and the support of extended family. These elements are particularly significant in Jordan, where traditional gender roles and multigenerational living arrangements continue to shape decisions related to fertility and caregiving.

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6.2 Policy implications

Ultimately, this study highlights the crucial need to align education policy with broader reforms that consider family dynamics and gender sensitivity, thereby effectively supporting early childhood development in Jordan. Expanding access to quality education for girls not only boosts women's autonomy and improves maternal health outcomes but also influences key decisions regarding fertility, the timing of marriage, and caregiving roles, all of which impact child well-being. In a conservative and stratified society like Jordan, an increase in maternal education transforms traditional expectations surrounding marriage and motherhood, opening up new opportunities to enhance early childhood outcomes.

To translate these findings into actionable policy, Jordan could consider targeted interventions such as conditional cash transfer programs linked to school attendance, which have contexts to raise girls' enrolment and reduce early marriage. Additionally, community-based early learning and parenting programs, particularly those implemented through local women's associations or health centres, can complement formal education by equipping mothers with practical skills to stimulate children's learning and improve caregiving practices. Scaling up school-readiness and child nutrition initiatives, including parental awareness campaigns about early childhood development, could further amplify the benefits of maternal education.

These changes are particularly relevant for achieving Sustainable Development Goals 3 and 4, which focus on promoting good health and well-being (SDG 3) and ensuring quality education (SDG 4). Therefore, investing in female education is not just a matter of equity; it is a strategic approach to fostering intergenerational development and advancing social progress in Jordan.

Note

1. To simplify analysis and interpretation, categorical variables, including responses related to emotional well-being and behavioural indicators, were recoded into binary variables. This coding system differentiates positive developmental outcomes, represented as 1, from negative outcomes or behaviours, represented as 0. For instance, a child who does not appear sad, depressed, or exhibit aggressive behaviour is classified as 1 (indicating they are developmentally on track). Conversely, any signs of sadness, depression, or aggression are scored as 0 (suggesting they are not on track).

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Corresponding author

Mohammad Al-Masaeid can be contacted at: mohammad.almasaeid@flinders.edu.au