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INEQUALITIES IN EARLY CHILDHOOD DEVELOPMENT IN THE MIDDLE EAST AND NORTH AFRICA

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Abstract

Early childhood is the most important and sensitive time for human development. However, countries tend to under-invest in this stage of development, particularly in the Middle East and North Africa. Additionally, children may face unequal opportunities to grow and thrive based on their circumstances. This paper analyzes inequality of opportunity in early childhood development in twelve countries in the Middle East and North Africa, assessing development along a variety of dimensions and across the early lifecourse. We quantify inequality from in utero to age five in terms of health, nutrition, social-emotional development, early learning, and early work and decompose inequality into the shares related to different circumstances. The findings demonstrate that there is substantial inequality of opportunity starting early in life, and that inequality of opportunity is particularly high in early learning and in activities that support early cognitive development. A variety of circumstances impact early inequality, with wealth, mother's education, and geographic differences all contributing substantially. Our analysis indicates that ensuring equality of opportunity in school and adult life will require redressing the causes of inequality of opportunity in early childhood.

JEL Classifications: I14, I25, D63, O15, J13

Keywords: Early Childhood, Inequality, Middle East and North Africa

ملخص

تعد مرحلة الطفولة المبكرة هى الأكثر أهمية وحساسية للتنمية البشرية. ومع ذلك، فإن البلدان تميل إلى نقص الاستثمار في هذه المرحلة من التنمية، ولا سيما في الشرق الأوسط وشمال أفريقيا. بالإضافة إلى ذلك، قد يواجه الأطفال عدم تكافؤ الفرص للنمو والازدهار اعتمادا على ظروفهم. تحلل هذه الورقة انعدام تكافؤ الفرص في تنمية الطفولة المبكرة في اثنتي عشرة دولة في منطقة الشرق الأوسط وشمال أفريقيا، وتقيم التطور جنبا إلى جنب مع مجموعة متنوعة من أبعاد و مسارات الحياة المبكرة. نقوم بقياس عدم المساواة بدايه من وجود الطفل داخل الرحم إلى سن الخامسة من حيث الصحة، والتغذية، والتنمية الاجتماعية، العاطفية، التعلم المبكر والعمل المبكر وتحلل عدم المساواة في ظل ظروف مختلفة. وتظهر النتائج أن هناك تفاوت كبير فى الفرص بدءا من الوقت المبكر فى حياة الاطفال، وعدم المساواة في الفرص مرتفع بشكل خاص في التعليم المبكر والأنشطة التي تدعم التنمية المعرفية المبكرة. وجدنا مجموعة متنوعة من الظروف والتى تتفاوت فى تأثيرها في وقت مبكر، مع ثروة، وتعليم الأم، والاختلافات الجغرافية. تحليلنا يشير إلى أن ضمان تكافؤ الفرص في المدارس سوف تتطلب معالجة أسباب انعدام تكافؤ الفرص في مرحلة الطفولة المبكرة.

1. Introduction

The Arab Spring arose over governments' failures to meet social needs and has led to calls for social inclusion and more equal opportunities, especially for young people. While transition governments are focusing on the short term challenges of responding to the needs of youth, they risk missing the opportunity to address the root causes of exclusion and inequality, which start early—before young people can protest, often before they can even walk or talk—in early childhood. Deficits accumulating across different developmental domains throughout early childhood compound each other (Helmers & Patnam, 2011) and position children for a lifetime of risk and diminished human capital. Despite the importance of early childhood, there is limited research on the state of early childhood development (ECD) and inequality in ECD outcomes in the Middle East and North Africa (MENA). ECD in MENA is frequently absent from political agendas, insufficiently researched, and under-resourced. As a result, although the region is middle-income, ECD indicators in MENA more closely resemble those of Sub-Saharan Africa than other middle-income countries (UNESCO, 2010; UNICEF, 2008).

In this paper, we examine the inequality of opportunity children in MENA face in early childhood across a variety of different developmental domains and decompose inequality of opportunity to identify its determinants. This analysis not only contributes to the limited research on ECD and inequality in MENA, but also provides critical information for identifying the vulnerable groups, key issues, and factors that limit children's development early in life. By examining ECD outcomes over the early lifecourse, from in utero to age five, we can identify how early inequalities will be compounded. Comparing countries throughout MENA, we identify countries and outcomes that provide relatively more equal opportunities, so that other countries can replicate policies and programs that improve equality.

That early childhood is the most sensitive and important time for human development is now firmly established in the literature (Heckman, 2006; Shonkoff & Phillips, 2000). Globally, poverty, health, nutrition, and social factors have been shown to hamper the development of hundreds of millions of children, usually irreversibly (Walker et al., 2007, 2011). Deficits in early childhood tend to persist into adult life. For instance, children who do not receive adequate iodine in the early years will have permanently decreased intelligence (Qian et al., 2005). Children who are stunted perform worse in school (Glewwe, Jacoby, & King, 2001) and ultimately earn lower wages (Hoddinott, Maluccio, Behrman, Flores, & Martorell, 2008).

In part because vulnerability and inequality takes root so early, interventions in early childhood to protect and promote human development are also among the highest impact—and most cost-effective—development investments (Heckman, 2006; Lomborg, 2009). ECD programs such as preschool, conditional cash transfers, macro and micronutrient supplementation, parenting support, and immunizations are cost-effective interventions that promote early childhood development and reduce inequalities (Engle et al., 2011; Lomborg, 2009; Walker et al., 2007, 2011). Interventions in early childhood, especially targeting disadvantaged children, are therefore a rare case where there is no equity/efficiency tradeoff; both equity and economic efficiency are promoted by effective ECD programs and policies (Heckman & Masterov, 2007).

To assess the extent of inequality in early childhood, we draw on the concepts and methodology developed in the recent literature on inequality of opportunity (de Barros, Ferreira, Vega, & Chanduvi, 2009; de Barros, Vega, & Saavedra, 2008; Roemer, 1998; Shorrocks, 2013). Using data from fifteen surveys covering twelve countries in MENA, we examine the state of early childhood development in terms of early health, nutrition, social-emotional development, early learning, and early work. We quantify the unequal opportunities children have to develop along

these domains using the dissimilarity index (de Barros et al., 2009) and decompose inequality into the contributions of different circumstances using the Shapley decomposition (Shorrocks, 2013). We also examine the very different development of children who are particularly advantaged or disadvantaged by predicting the different outcomes these children will accumulate over the early lifecourse due to differences in just a few circumstances.

Though we are limited by the data to considering a relatively small set of circumstances, we nonetheless find substantial inequality of opportunity, beginning before children are even born, and extending throughout the early lifecourse. Inequality of opportunity is particularly high in early learning and in activities that support early cognitive development, which has important implications for inequality in children's subsequent entry into school and ultimately the labor force. Our analysis also illustrates the pathways through which circumstances shape children's early opportunities. Overall, wealth, mother's education, and geographic differences tend to contribute substantially to inequality of opportunity. However, there is substantial variation in how different circumstances affect various outcomes across countries and any efforts to redress these inequalities will have to make a careful examination of country and outcome specific determinants.

Before presenting these findings in section 5, we first present a conceptual framework for inequality of opportunity in early childhood development in section 2, describe our empirical strategy in section 3, and discuss the surveys and samples in section 4. We discuss the implications of our findings and conclude in section 6.

2. Inequality of Opportunity in Early Childhood Development: A Conceptual Framework

2.1 Early childhood development production functions

Early childhood development occurs across multiple dimensions and is shaped by a variety of child, family, and community conditions. We draw on the health and education production function literature (Glewwe, 2002; Strauss & Thomas, 1998) to identify the determinants of early childhood development. In an extension of these literatures, we posit the following early childhood development production function:

$$ECD = f(N; I, H, C, \varepsilon) \quad (1)$$

Where, *ECD* is in the set of observed development outcomes. These are the output of an early childhood development production function, *f*, which is based on early childhood inputs, *N*. Both early childhood inputs and the technology that produces *ECD* depend on individual child characteristics, *I*, such as gender, and household socio-economic characteristics, *H*, such as household wealth and parental education, as well as community and regional characteristics, *C*. The ε term captures random genetic variation as well as luck. In estimating the determinants of ECD outcomes, this term will also capture measurement error and unobserved characteristics.

This model is necessarily a simplification. Development is a cumulative process, both in terms of the accumulation of development and the cumulative influence of inputs and the environment, broadly defined (Shonkoff & Phillips, 2000). This means that the full history of inputs, circumstances, and even random variation has an impact on any particular outcome. Additionally, the subset of ECD outcomes, ECD^0,which has preceded any particular outcome ECD'may in fact enter into the early childhood development production function, potentially acting either as an input or shaping the technology of production, as in:

$$ECD' = f(N, ECD^0; I, H, C, ECD^0, \varepsilon) \quad (2)$$

For instance, whether or not a child receives immunizations can affect later nutrition or mortality. This interplay between ECD outcomes has particularly important implications for inequality, which is likely to be compounded over the early lifecourse.

2.2 Inequality of opportunity

To examine inequality in early childhood development, we draw on Roemer's (1998) conceptualization of inequality of opportunity. Roemer makes the distinction between circumstances and effort in determining an individual's outcomes. Effort is under an individual's control, and therefore inequality due to effort is morally acceptable. Circumstances are factors that lie outside an individual's control, and inequality due to circumstances is not morally justifiable, and constitutes inequality of opportunity.

In the case of early childhood development and the age range we are focusing on, from in *utero* to age five, no circumstances are within a child's control. Under Roemer's framework, all inequality in outcomes in early childhood is necessarily inequality of opportunity. The implication, that equality of opportunity in ECD can be achieved only by perfect equality in outcomes, is an unrealistic standard. Therefore, as others have done (Assaad, Krafft, Hassine, & Salehi-Isfahani, 2012), we modify the traditional approach and consider all inequality that is attributable to observable circumstances, such as gender, parents' education, wealth, and place of residence, to be inequality of opportunity. Inequality not explained by observable circumstances we attribute to 'luck' and do not consider it to be inequality of opportunity. Since a limited set of circumstances are observed in the surveys, our estimated inequality of opportunity is therefore a lower bound on true inequality of opportunity.

Equality of opportunity under our approach means that, although children have different outcomes in early childhood, differences in outcomes are distributed independent of children's circumstances. For instance, if a child has the same chance of attending early childhood care and education in rural and urban areas, then there is equality of opportunity in terms of residence. For any vector C defining children's circumstances, and a early childhood development outcome y, if equality of opportunity holds, the distribution of y conditional on C should be equal to the unconditional distribution of y, that is, $F(y|C)=F(y)$(Ferreira & Gignoux, 2008).

If there are J elements in C corresponding to each circumstance and each element C^j takes on a finite number of values, x_j, then we can partition the population into types, k. The maximum number of types is the number of unique combinations of circumstances, which can be given as $\bar{K} = \prod_{j=1}^{J} x_j$(Ferreira & Gignoux, 2011). Then equality of opportunity means that that

$$F^k(y) = F^l(y) \tag{3}$$

for all types l,k.

Defining $\mu^k(y) = \int_0^\infty y dF^k(y)$, it is usually a weaker criterion to state that

$$\mu^k(y) = \mu^l(y) \tag{4}$$

for all types l, k, since two different distributions may, by happenstance, have the same mean (Ferreira & Gignoux, 2011). However, in the case of binary outcome variables, which are bounded between zero and one, the cumulative distribution function is a function of the mean and N, and these two criteria are equivalent (de Barros et al., 2008). Comparison of group means can be used to assess inequality of opportunity for binary variables, which are the type of ECD outcomes we examine.

3. Empirical Strategy

Our empirical strategy proceeds in four steps. First, we summarize the state of early childhood development for a particular country and outcome. This provides important context for questions of inequality. The absence of inequality may denote the universal absence of an outcome, as when less than 1 percent of children in Djibouti live in households with adequately iodized salt, or its universal presence, as when 99% of births in Jordan receive prenatal care. Equality or inequality may have different implications depending on the level of an indicator. Having summarized the state of ECD for a country and outcome, we then measure the extent of inequality of opportunity using a dissimilarity index. Following this, inequality is decomposed with a Shapley decomposition, to identify which circumstances contribute the greatest shares to inequality of opportunity. Lastly, we simulate ECD outcomes for a 'least advantaged' and 'most advantaged' profile for each country. As well as assessing the extent of inequality overall, it is important to quantify the differences in ECD that occur under the extremes of the worst and best of early circumstances. Pervasive but moderate inequality or acute inequality only affecting a small group will have different effects on human capital accumulation and will require different policy responses.

3.1 Measuring inequality

We measure inequality of opportunity using the dissimilarity index (D-index). This measure is common in sociology and demography for applications with binary outcomes (de Barros et al., 2009, 2008), and all the ECD outcomes we examine are binaries. The D-index for a particular ECD outcome is computed as:

$$D = \frac{1}{2\bar{p}} \sum_{i=1}^{k} \alpha_i |p_i - \bar{p}| \qquad (5)$$

where $\bar{p}$ is the population mean for that outcome and p_i is the mean for unique circumstance group i. The α_i are population shares or sampling weights (de Barros et al., 2009). The D-index essentially compares the dissimilarity between groups, as defined by circumstances, and the population mean. As noted earlier (see equations 3 and 4), comparing group means for binary outcomes fully quantifies inequality of opportunity. The D-index can be interpreted as the percentage of available opportunities that need to be reallocated from the children in groups that are better off to the children in groups that are worse off in order to achieve equality of opportunity (de Barros et al., 2009). Expressed as a percentage, the D-index ranges from zero to 100, with zero indicating a situation of perfect equality of opportunity.

Empirically, the D-index is computed based on a logistic regression model.[1] Whether a child, j, has achieved a particular ECD outcome is regressed on his or her circumstances. From the coefficient estimates,[2] we predict $\hat{p}_j$, the predicted probability of the ECD outcome. All children

[1] We implement the D-index in STATA using the module hoi (Azevedo, Franco, Rubiano, & Hoyos, 2010). Indicators that are almost universal or near zero cannot be modeled or decomposed.

[2] Estimation of the D-index is consistent whether or not insignificant parameters are retained. We choose to retain insignificant coefficients, as do others (de Barros et al., 2008), because significance is a function of both coefficient magnitude and sample size, and dropping insignificant coefficients would favor countries with small samples. However, we do not estimate the D-index for outcomes where the entire model is, itself, statistically insignificant.

with the same circumstances will necessarily have the same$\hat{p}_j$[3] so $\hat{p}_j$ can be substituted for p_i in equation 5 to obtain an estimated D-index, $\widehat{D}$, which is a consistent estimator of D (de Barros et al., 2008).[4]

3.2 Decomposing inequality

Using the dissimilarity index, it is possible to decompose inequality into the contribution of different circumstances using a Shapley decomposition (Deutsch & Silber, 2008; Shorrocks, 2013). The Shapley decomposition extends the idea of the Shapley value of cooperative games into applications for decomposing inequality. The decomposition consists of calculating the marginal contributions of each circumstance as they are removed in sequence. For the set of circumstances $x \in X = \{1,2,\dots,m\}$,let $\sigma = (\sigma_1, \sigma_2, \dots, \sigma_m)$ be the order in which circumstances are removed and let $S(\sigma_r, \sigma) = \{\sigma_i | \, i > r\}$ be the set of circumstances that remain after circumstance σ_r has been eliminated. For a particular order of circumstance removal (or addition) the marginal contribution of circumstance *x* to the D-index is (Shorrocks, 2013):

$$C_x^\sigma = D(S(x,\sigma) \cup \{x\}) - D\big(S(x,\sigma)\big) = \Delta_x D\big(S(x,\sigma)\big), \qquad x \in X, \tag{6}$$

where

$$\Delta_x D\big(S(x,\sigma)\big) \equiv D(S \cup \{x\}) - D(S), \qquad S \subseteq X \backslash \{x\}, \tag{7}$$

is the change in the dissimilarity index of adding circumstance *x* to the set *S*. To address the path dependency of contributions to inequality due to the order of circumstance elimination, all possible elimination sequences can be computed and the marginal impacts averaged over the different sequences. For the *m!* potential sequences of elimination, denoted as the set Σ, we compute the average (Shorrocks, 2013):

$$C_x^S = \frac{1}{m!} \sum_{\sigma \in \Sigma} C_x^\sigma \tag{8}$$

The result is an exact, additive decomposition of the D-index into the contributions of each circumstance (Shorrocks, 2013; World Bank, 2012).

3.3 Simulations

While the D-index summarizes inequality of opportunity in the population as a whole, since it combines information on population shares and inequality between groups and the average, it does not distinguish between a society where a large number of groups are at a slightly disadvantage and a society where a small number of groups are at a substantial disadvantage. These two situations have very different implications for both early childhood development and policy responses. We therefore use our regression models, with the same specification as for measuring inequality, to predict early childhood outcomes for two profiles in each country, the 'most advantaged' and the 'least advantaged.' The most advantaged child is from the wealthiest 20% of households, has secondary (or higher) educated parents, while the least advantaged child is from the poorest 20% of households and has illiterate parents. Rural/urban and regional

[3]This is a parametric approach to estimating inequality of opportunity. Nonparametric approaches, such as estimating inequality for each of *k* groups are also possible. However, an extremely limited set of circumstances would have to be used to obtain adequate cell sizes in all the *k* groups. Parametric methods are therefore preferable.

[4] For a sketch of the consistency and the asymptotic variance of $\widehat{D}$ see de Barros et al. (2008). Note that the estimated standard errors for $\widehat{D}$ will necessarily be a function of sample size, so some caution must be used in considering the statistical significance of$\widehat{D}$, as sample size varies for indicators within a survey as well as across surveys.

differences are country specific, although the least advantaged child tends to live in a rural area while the most advantaged child tends to live in an urban area. The differences in ECD outcomes for these two profiles illustrate how much ECD varies based on just a few circumstances within a country.

4. Data and Sample

4.1 The surveys

In order to assess the state of early childhood development across a variety of dimensions and throughout the Middle East and North Africa, we use fifteen different surveys covering twelve countries. The countries we examine are Algeria, Djibouti, Egypt, Iraq, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, West Bank and Gaza, and Yemen. The surveys used for each country are listed in Table 1. We use three types of surveys: the Demographic and Health Surveys (DHS), the Multiple Indicator Cluster Surveys (MICS), and the Pan-Arab Project for Family Health Surveys (PAPFAM).[5,6] All the surveys are designed to be nationally representative after the application of sample weights, which are used throughout the analysis.

We use the surveys with the most recent data available on an indicator. For three countries (Djibouti,[7] Syria,[8] and Yemen[9]) due to different issues and indicators covered in different surveys, we use multiple surveys to examine different indicators, analyzing ECD indicators from the most recent survey with data available on that indicator. Of the fifteen surveys, the oldest is the 2002 PAPFAM for Algeria, and the most recent is the 2012 PAPFAM for Djibouti. Because of the paucity of surveys covering ECD topics in the region, we are necessarily comparing countries at different points in time.

All the surveys have relatively similar structures; each initially collects data on the household itself and all individuals in the household. This data allows us to examine the relationship between parental and household characteristics and ECD outcomes, as well as the contributions of different characteristics to inequality. The surveys have detailed questionnaires for women, usually ever married women ages 15-49, which include questions on ECD indicators. There are also detailed questions about children, which are sometimes incorporated into the women's questionnaire or are answered separately by a child's caregiver. In most surveys, anthropometric data is collected on children under the age of five. Not all indicators or circumstances are available in all surveys.

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[5] The DHS surveys are funded by USAID and monitor issues of population, health and nutrition. The MICS surveys are run by UNICEF and are designed to monitor the situation of children and women. The PAPFAM surveys are run by the League of Arab States and coversimilar topics to the DHS surveys.

[6] The survey used for the West Bank and Gaza is a 2006 National Health Survey that is, in fact, a combined MICS/PAPFAM survey.

[7] In the case of Djibouti, we use both the 2006MICS and the 2012PAPFAM. The 2006 MICS was the most recent data source for questions on ECCE, child labor, and salt iodization. All other indicators for Djibouti are from the 2012 PAPFAM.

[8] In the case of Syria, we use both the 2009 PAPFAM and the 2006 MICS. The 2009 PAPFAM for Syria did not include information on development activities, violent child discipline, or child labor, so these were drawn from the 2006 MICS for Syria. All other indicators for Syria are from the 2009 PAPFAM.

[9] The 2006 MICS for Yemen did not include anthropometrics. The 2003 PAPFAM for Yemen was the most recent data source with anthropometrics, and was therefore used for the stunting indicator. All other indicators for Yemen are from the 2006 MICS.

4.2 Indicators

We examine early childhood development across a variety of dimensions: health, nutrition, social and emotional development, and early learning and early work. Our indicators cover the entire early lifecourse, from in *utero* through age five, just prior to the age of school entry, which is six in most MENA countries. To identify important outcomes and indicators in early childhood development, we examined the global early childhood development literature (Black et al., 2008; Engle et al., 2011; Shonkoff & Phillips, 2000; Walker et al., 2007, 2011). Based on important indicators and outcomes identified in this literature, and as constrained by the data available, we constructed the following eleven indicators to examine ECD along a variety of dimensions: (1) prenatal care, (2) having a skilled attendant at birth, (3) being fully immunized at age 1, (4) neonatal mortality, (5) infant mortality, (6) stunting, (7) adequately iodized salt, (8) whether a child was engaged in development activities, (9) whether a child was violently disciplined, (10) early childhood care and education (ECCE) attendance, and (11) child labor at age five. Due to data availability, the indicators are a mix of early childhood inputs, such as iodized salt and early childhood care and education, which are important contributors to development, and true early childhood outcomes, such as height and mortality. In what follows, we describe each of these ECD indicators in detail.

The indicator for prenatal care was based on whether a woman reported receiving prenatal care during her pregnancy from a medical professional. Prenatal care is particularly important for identifying and redressing early health and nutrition issues (UNICEF, 2008). The indicator for a skilled delivery attendant was based on whether a birth was attended by a nurse, trained midwife, or doctor. As well as aiding in a safe delivery, skilled attendants play an important role in identifying health issues and providing post-natal care (World Health Organization, 2004). A child was considered fully immunized if he or she, at age 1 (12-23 months), had received six key vaccines.[10] Immunizations prevent potentially fatal illnesses that can hamper healthy physical growth, and are one of the most cost-effective development interventions (Lomborg, 2009). Neonatal mortality and infant mortality were based on women's birth history data.[11]

Children were identified as stunted if their height fell two standard deviations below the median height of a child of the same age and sex from a healthy reference population.[12]Stunting indicates accumulated malnutrition, damages psycho-social development (Dercon & Sanchez, 2011) and causes poorer school performance and lower wages later in life (Glewwe & Miguel, 2008; Grantham-McGregor et al., 2007). Children were identified as living in a household with adequately iodized salt if the salt tested within the household had 15 or more ppm of iodine.[13]Iodine deficiency is the world's leading cause of mental retardation, reducing IQ by approximately ten points (Molina, 2012), and micronutrient supplementation is extremely cost-

[10]The BCG (tuberculosis) vaccine, the measles vaccine, 3 DPT (diphtheria, pertussis (whooping cough), and tetanus) doses, and 3 polio doses.

[11] Mortality was usually examined for births over the period 1-5 years prior to the survey to avoid censoring on infant mortality while maintain a reasonable sample size; sometimes this period had to be approximated based on a child's year of birth compared to the survey, depending on data limitations and rates of parental recall for month of birth.

[12]Usually, the more recent WHO standards were used, but in the case of some of the older surveys, previously calculated height-for-age z-scores were included, and sufficient anthropometric data (usually whether measurements were recumbent) were not available, so the existing z-scores based on older CDC standards had to be used.

[13]Households without salt or where the salt was not tested were considered to be missing on this indicator.

effective, with benefit-cost ratios upwards of 15:1 for iodine (Behrman, Alderman, & Hoddinott, 2004).

The two indicators for social and emotional development, whether a child was engaged in development activities or whether a child was violently disciplined, were only available in the MICS surveys and follow their definitions. A child was defined as engaged in development activities if an adult, usually a parent, engaged in at least four of six developmentally supportive activities[14] in the past three days. Improvements in children's social, emotional, and cognitive development occur with increases in these type of development activities (Engle et al., 2011).A child was identified as violently disciplined when, in the past month, anyone in the household had engaged in psychological aggression or physical punishment.[15]Violent child discipline hampers children's development, learning, and school performance in the short term, ultimately reducing human capital and damaging children's social-emotional development (UNICEF, 2010).

We identified children as having attended early childhood care and education (ECCE) if their parents reported they currently attended an early childhood program.[16]ECCE programs, particularly high-quality programs, improve cognitive and educational outcomes, and yield increased wages later in life (Engle et al., 2011).Child labor data was only available for children age five. A child was defined as engaged in child labor if he or she was doing work in a business or family enterprise, or engaging in household chores such as collecting firewood, cleaning, fetching water, or caring for other children. Child labor may be dangerous to children, particularly at age five, or compete with their school work (Assaad, Levison, & Zibani, 2010; Bourdillon, Levison, Myers, & White, 2010; Orkin, 2012)and may also diminish their health and human capital (Edmonds, 2008).

4.3 The explanatory variables

For the age range we are examining, in utero through age five, any variations in early childhood development that are linked to the circumstances into which a child is born are considered inequality of opportunity. Children have no control over their circumstances at this age, such that circumstances can be treated as exogenous. For the sake of comparability across surveys and given the limitations of the datasets, we focus primarily on a relatively small set of circumstances that have previously been linked to ECD and inequality, namely child gender, household wealth, parents' education, rural/urban residence, and region of residence.

Wealth is operationalized as a categorical variable for which quintile of households a child falls into, based on an asset index (see Filmer & Pritchett, 2001; Rutstein & Johnson,

[14]The activities were (1) read books or looked at picture books with the child (2) told stories to the child (3) sang songs with the child (4) took the child outside the home, compound, yard, or enclosure (5) played with the child (6) spent time with the child naming, counting, and/or drawing things.

[15]Consistent with the MICS definition (UNICEF, 2010), we define violent child discipline to include: psychological aggression (shouted, yelled, or screamed at the child; called the child dumb, lazy, or another name like that) physical punishment (shook the child; spanked, hit or slapped the child on the bottom with a bare hand; hit the child on the bottom or elsewhere on the body with something like a belt, hairbrush, stick, or other hard object; hit or slapped the child on the hand, arm, or leg) and severe physical punishment (hit or slapped the child on the face, head, or ears; beat the child with an implement (hit over and over as hard as one could)).

[16] ECCE data is for ages 3-4 in Tunisia, Jordan, West Bank and Gaza, Iraq, Djibouti, and Yemen. Data is for ages 3-5 in Egypt, Syria, and Libya. Egypt data is ever attendance, rather than current attendance.

2004).[17]Mother's and father's education were categorical variables for education levels.[18]Rural/urban residence was a dichotomous variable.[19]Regions were country specific categories.[20]For health outcomes using DHS surveys we also examine access to health services, namely whether a woman identifies the distance to health services to be a problem. Even using this relatively limited set of circumstances, not all circumstances could be accounted for in all countries. However, we determined this set of circumstances was the optimal tradeoff between including important circumstances and allowing comparability across indicators and countries.

4.4 The samples

There are necessarily different samples with varying characteristics for each country and each indicator, and fully characterizing all of the different samples and sub-samples for the different indicators and countries is not feasible. However, Table 1, which lists the surveys used in each country, also includes references to reports for each survey, where interested readers can find detailed information on the sample and its characteristics. Additionally, Table 2 (described below) includes the number of observations for each indicator and country in parentheses below the indicator.

5. Results

5.1 The state of early childhood development

There is substantial variation in ECD indicators within the MENA region. Table 2 presents the average level of each indicator for each country with the number of observations in parentheses below each indicator. Early health care, in terms of prenatal and delivery care, tends to be fairly high, although in Morocco only 67.9% of births received prenatal care and 62.9% had a skilled delivery attendant and Yemen had a 47.0% rate of prenatal care and a 35.7% rate for skilled delivery. The pattern of full immunizations is bimodal; half of countries have rates around 90% or so, and half have rates around 50%. Neonatal mortality ranges from a low of 10 deaths per thousand births (Lebanon) to 40 deaths per thousand births (Yemen). The next highest neonatal mortality rate is in Morocco, at 25 deaths per thousand births. Infant mortality ranges from a low of 15 deaths per thousand births (Lebanon) to 71 deaths per thousand births (Yemen). Yemen is again an outlier, although Morocco had 38 deaths per thousand births.

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[17]Usually the asset index or wealth quintiles were provided with a dataset, but in several cases they had to be constructed by the authors. For the 2004 PAPFAM for Lebanon, the wealth index that accompanied the dataset was re-estimated, as the provided index was inverted, with the poorest households having more assets than the richest.

[18]Throughout, we refer to mother's education and father's education, but in the data this may have been a woman's education in data about prenatal care and information on her current partner's education. In some cases, only mother's education was available (for instance in some birth histories) or only the household head's education was available. Additionally, some parents were absent from the household or data was missing; if this was just a few observations, they were simply discarded. However, if a substantial number of observations had missing data, a category was created for missing data; children with absent parents or parents with unknown education levels might face inequality of opportunity in early childhood development based on this circumstance. Although in general we tried to have similar education categorizations across countries, because of different education structures across countries as well as the level of detail on education available, there was some variation in categorizations.

[19] There were two exceptions to rural/urban residence as a binary. In West Bank and Gaza residence could be urban, rural, or in a refugee camp. In Egypt, the regions are actually defined partially on an urban/rural basis so there is no separate urban/rural variable.

[20] Generally the highest level of administrative or geographic region identified in the surveys for each county was used. As a result, there is substantial variation in the number of regions and the share of the population in each across countries. Inequality related to regions must therefore be interpreted with some caution, as it is, in part, a function of the number of regions identified.

In terms of nutrition, stunting is common. Only Jordan has stunting rates below 10% (7.6%). Yemen has the highest rate of stunting, with 53.1% of children 0-4 years stunted. There is a very wide range of salt iodization from 0.4% of children in Djibouti having iodized salt to 87.7% of children in the West Bank and Gaza. Most countries have low rates of development activities. Jordan has the highest rate, with 81.6% of children experiencing development activities. Yemen (25.5%) and Djibouti (26.5%) have the lowest rates. Violent child discipline is pervasive in MENA; 95.5% of children in the West Bank and Gaza are violently disciplined, and everywhere else with data, except for Djibouti (36.2%) has rates above 75%.

Few children attend early childhood care and education. In countries with data, Tunisia has the highest rate, with 44.5% of children 3-4currently attending ECCE. Yemen (2.7%) and Iraq (3.8%) have some of the lowest rates of ECCE attendance. Child labor at age five ranges from 7.0% in Libya to 24.0% in Tunisia. While most countries have fairly high coverage in terms of early health, overall MENA shows large deficits in early childhood development.

5.2 The extent of inequality

Ideally, a society would provide its youngest members with equal opportunities to develop and thrive, but in MENA, opportunities for children are not equal. Table 3 presents the dissimilarity index for the different ECD indicators and countries. There is a substantial amount of inequality starting early, in prenatal and delivery care. Yemen has the greatest inequality on these measures, with a D-index of 16.8 for prenatal care and a D-index of 26.1 for skilled delivery. This means that 16.8% of the opportunities for prenatal care and 26.1% of the opportunities for skilled delivery would have to be reassigned for equality of opportunity to prevail. Morocco has relatively high inequality in early health, with a D-index of 14.3 for prenatal care and 19.6 for skilled delivery. Egypt also has high early health D-indices, 9.0 for both prenatal care and skilled delivery. This is consistent with a common pattern, that countries with the lowest rates of care having greater inequality(de Barros et al., 2009), as when countries approach universal care, inequality necessarily decreases.

In terms of children age 1 being fully immunized, overall there continues to be a mixed picture in terms of equality of opportunity. A number of countries have low D-indices. Particularly notable is Egypt, which did not have equitable access to prenatal or delivery care but has the lowest D-index for immunizations. Morocco also does substantially better on immunizations than other early health care. D-indices are less likely to be statistically significant for this indicator, which may be a result of the sample restriction to age 1. However, two countries stand out. Both Iraq (8.6) and Yemen (20.6) have high and statistically significant D-indices for early immunizations, meaning children have unequal opportunities to avoid the morbidity and potential mortality of common illnesses.

Given the relative infrequency of early mortality, inequality on this measure must be interpreted with some caution. While D-indices for neonatal mortality range from 9.7 (Iraq) to 40.0 (Tunisia), none are statistically significant. Nor are D-indices for infant mortality statistically significant. This may be due to the overall rarity of early deaths, making it difficult to precisely model their relationship with characteristics.

Children face unequal opportunities to achieve healthy physical growth; most countries have significant inequality of opportunity in terms of stunting. The D-indices range from 24.1 in Jordan to 4.9 in Yemen. For stunting, the country with the lowest rate—Jordan—in fact has the highest inequality, while the country with the highest rate—Yemen—in fact has the lowest

inequality. In most countries, stunting is a pervasive problem that is exacerbated by the examined circumstances, but not entirely driven by them.

Circumstances play a substantial role in children's micronutrient intake opportunities; in the five countries with data, only West Bank and Gaza demonstrates equality of opportunity for iodized salt access. In Egypt, Iraq, Libya, and Syria there is statistically significant inequality of opportunity. Moreover, it is relatively extensive. Egypt has a D-index of 7.2, Libya's is 16.9, Iraq's 20.3, and Syria's 32.3.This means in Syria one third of the opportunities to consume iodized salt, and achieve healthy brain development, would have to be redistributed in order for children to face equality of opportunity.

As well as facing unequal opportunities to cognitively develop based on micronutrients, children have unequal opportunities for social, emotional, and cognitive development based on unequal chances of engaging in development activities. In every country with data except Jordan, the D-index is statistically significant for development activities. The D-index is relatively low in West Bank and Gaza, at 5.7, and high in Yemen at 19.3. In sharp contrast to the unequal opportunities for development activities, the D-index is consistently low and insignificant for violent discipline. Violent discipline rates are extremely high, and this is clearly a challenge to children's early development regardless of circumstances.

Early childhood care and education is an important component of early childhood development, especially for disadvantaged children (Heckman & Masterov, 2007; Heckman, 2006). It is also the most unequal aspect of early childhood development. D-indices range from a high of 43.5, in Iraq, to 12.1 in the West Bank and Gaza. Inequality is high regardless of overall ECCE attendance rates, with a D-index of 25.5 in Tunisia, which has a 44.5% attendance rate among 3-4 year olds, as well as in Iraq (D-index of 43.5), which has 3.8%attendance. The measures for inequality of child labor are also fairly high, but insignificant except in Iraq, possibly due to small sample sizes in most countries.

Overall, even examining just a few circumstances, we find children face unequal opportunities to develop across a variety of domains, and substantial redistribution of opportunities would be required to achieve equality of opportunity. There is no inherent standard for what is a high level of inequality as measured by the D-index. However, to help contextualize the level of inequality in ECD in MENA as relatively high or low, we provide a few examples of other D-indices. In Egypt in 2008, the D-indices for a number of important services(household access to improved drinking water, electricity, and a non-shared toilet) ranged from 1.0-3.0(World Bank, 2012). In contrast, Egypt had statistically significant D-indices of 7.2-9.0 for prenatal care, delivery care, stunting, and salt iodization, as well as a D-index of 21.8 for ECCE.As of 2005, the D-index for completing sixth grade on time in 19 Latin American and Caribbean countries averaged 11 and ranged from 3 to 27(de Barros et al., 2009). In Egypt, the D-index for school enrollment ages 6-14 was 2.4 and the D-index for completing primary on time was 6.3.Compared to these D-indices, the inequality of 12.1-43.5 in ECCE in MENA is very high. Additionally, inequality of opportunity is substantial for early health indicators, and worsens for nutrition and opportunities for social, emotional, and cognitive development, especially early childhood care and education. This increasing inequality across the lifecourse and across a variety of domains is likely to compound as children continue to develop.

5.3 Inequality decompositions

The D-indices demonstrated that there is substantial inequality of opportunity in early childhood related to a relatively small set of circumstances. This section examines the relative contributions

of different circumstances to inequality of opportunity. Identifying the risk factors for unequal development is particularly important for understanding the drivers of inequality, and targeting programs or policies to redress inequality. Table 4 presents the Shapley decompositions, which show the contribution of different circumstances to inequality of opportunity across the different indicators and countries. There is substantial heterogeneity in the relationship between different ECD indicators and circumstances between and within countries. We therefore focus on patterns for countries with greater inequality of opportunity on a particular measure.

Looking at early health care, particularly in countries with substantial inequality, wealth is an important determinant of inequality of opportunity. In Morocco and Yemen, which have the highest inequality in prenatal care, the contribution of wealth to inequality is slightly more than 25%. Mother's education also plays a large role in early health care access, with father's education playing a smaller but important role. Regional and rural/urban differences vary substantially, but regional differences are particularly large in Morocco for both prenatal and delivery care. The contributions of region tend to be larger for delivery care than prenatal care, which may be related to issues of physical access. However, for the countries that have the data available, distance to health care facilities does not play a substantial role in inequality of opportunity for any health outcome.

For the countries with large inequality in immunizations, namely Iraq and Yemen, wealth has a larger share in inequality of opportunity in Yemen (32.4%) than in Iraq (23.8%). Mother's education is associated with around a fifth or quarter share of inequality, and rural/urban differences around 20%. Regional differences are much larger in Iraq (22.5%) than in Yemen (12.7%).

Examining the circumstances that contribute the most to inequality of opportunity in stunting, two patterns emerge. Some countries (Egypt, Iraq, Syria, West Bank and Gaza, Yemen) have relatively low contributions to inequality from wealth, but high contributions from regional or urban/rural differences. The others tend to have a large share attributable to wealth and parents' education. For the countries where inequality is driven by geographic differences, pervasive public health issues may play larger role than in the countries where inequality is driven by specific family circumstances. In Iraq, Libya, and Syria, most of the inequality of opportunity in access to iodized salt is related to geographic differences, likely linked to iodine supply and iodization enforcement, while in Egypt, family wealth plays a large role (43.6%).

Wealth usually plays a large role in inequality of opportunity for development activities. While the wealth share in Djibouti is 13.4% and in Syria is 17.5%, the wealth shares in Iraq, Jordan, Tunisia, West Bank and Gaza and Yemen range from 22.9% to 48.2%. Mother's education plays a more important role than father's education, accounting for 8.9%-37.5% of inequality in development activities. Geographic differences are generally smaller than for health outcomes, but urban/rural differences are large in Tunisia and especially Syria, while regional differences are large in Djibouti. Notably, gender contributes essentially nothing to inequality of opportunity in development activities. Parents are investing equally in engagement with their sons and daughters. Violent discipline is pervasive, and relatively equitable, with widely varying contributors across different countries.

Early childhood care and education, one of the most inequitable outcomes, is driven by multiple factors in all countries. Wealth plays a particularly large role in Jordan (38.2%) and Egypt (36.8%), but is above a 20% share everywhere. Mother's education ranges from an 8.7% share in Tunisia to 41.8% in West Bank and Gaza. There are no appreciable urban/rural differences in

Jordan, West Bank and Gaza or Djibouti, but large shares of inequality are related to rural/urban residence in Iraq, Tunisia, and Syria. Regional differences are small in Iraq, Jordan, Syria, and West Bank and Gaza, but largest in Libya (37.2%), Egypt, and Djibouti. Inequality related to gender is near zero for ECCE. While there may be differences in educational outcomes by gender later in life, they do not start in early childhood. Differences in child labor are driven by different circumstances by country, but include an appreciable regional component in Iraq and Libya.

Comparing the circumstances contributing to inequality across indicators and within countries, wealth and parents' education are particularly important in Algeria, while in Djibouti wealth and geographic differences play a larger role. In Egypt regional differences tend to dominate, followed by wealth and mother's education. Geographic differences also are common in Iraq, as well as inequality by wealth and mother's education. Wealth and parental education play a large role in Jordan, but geographic location less so. In Libya, geographic differences tend to be quite large. Geographic differences are substantial in Morocco, as are differences by wealth. In Syria, urban/rural gaps dominate, followed by mother's education and wealth. Tunisia has substantial inequality related to geographic location, as well as wealth. Wealth, mother's education, and region are substantial drivers in West Bank and Gaza. In Yemen, while wealth differences are also large, the contributions of geographic location, especially regions, tend to be largest.

Overall, it is clear that, in addition to extensive inequality of opportunity in early childhood, there are a number of different contributors to inequality. Gender does not contribute substantially to early inequality of opportunity. While the share of inequality attributable to different circumstances varies by indicator and by country, wealth, parents' education, especially mother's education, and place of residence/region all contribute substantially to inequality of opportunity. Addressing inequality for a particular indicator and in a particular country will require identifying the drivers of inequality of opportunity for that outcome and context. Given that multiple circumstances contribute substantially to inequality of opportunity, it is also particularly important to consider and target children with multiple disadvantages in redressing inequality of opportunity.

5.4 Simulations

The compounded effects of multiple disadvantages (or advantages) are examined in this section, where we compare the 'least advantaged' child to the 'most advantaged' child. Table 5 presents these simulations. Overall, these simulations show the very different opportunities a child with multiple disadvantages will face, compared to a child with multiple advantages. In terms of prenatal care, in every country the most advantaged child faces more than a 95% chance of receiving prenatal care. However, the least advantaged child has lower and varying chances of receiving prenatal care, with the highest probability of prenatal care in Jordan (97.6%), and the lowest probability in Yemen (25.5%). Patterns are fairly similar for delivery care. Based on differences in just a few circumstances, children face different chances of early health care.

Consistent with the patterns of inequalities observed earlier, while usually the most advantaged child has an approximately90% chance of being fully immunized, in many countries the least advantaged child has less than a 40% chance of being fully immunized. However, in Algeria, Egypt, and Morocco, a least advantaged child has more than an 80% chance of being fully immunized, indicating that, despite multiple risk factors, immunizations are relatively equitably distributed throughout these countries. Inequality in early mortality must be interpreted with some caution, since early deaths are relatively infrequent. However, it is notable that the least

advantaged child continues to be systematically disadvantaged compared to the most advantaged child on this measure as well.

In terms of stunting, there are large gaps between the most advantaged and least advantaged. Jordan is a particularly interesting illustration, where the least advantaged child has a 29.4% chance of being stunted, compared to a 1.7% chance for the most advantaged. In other countries, such as Libya or Yemen, there is not such a large gap, but the difference still continues to favor the most advantaged child in terms of accumulating early growth. The gaps in iodized salt by advantage are substantial; in Iraq the least advantaged child has an 8.5% chance of living in a household with sufficiently iodized salt, while a most advantaged child has a 66.1% chance. These are particularly large gaps in the chances for healthy brain development based on circumstances, and differences that are likely to be compounded by other gaps, such as the gaps in development activities, which are also substantial. For instance, in Tunisia, the least advantaged child has only a 4.9% chance of experiencing at least four development activities, while the most advantaged child has a 97.4% chance.

Both violent discipline and child labor are pervasive, and show limited inequality as well as relatively small gaps between the most and least advantaged. However, looking at ECCE, the gaps in the chance of a child attending ECCE based on just a few characteristics are particularly large, consistent with the findings of the D-index. While a least advantaged child in Egypt has a 9.6% chance of attending ECCE, a most advantaged child is more than six times as likely, with a 62.5% chance. The least (versus most) advantaged child has a 0.1% (versus 22.1%) chance of attending ECCE in Iraq, a 1.0% (versus 17.8%) chance in Libya, a 2.1% (versus 69.0%) chance in Syria, a 3.7% (versus 92.2%) chance in Tunisia, and a 4.5% (versus 28.4%) chance in Djibouti. Only in West Bank and Gaza is the gap relatively smaller, 12.8% (least advantaged) to 57.6% (most advantaged).

Looking across the predicted outcomes for least advantaged and most advantaged children, it is clear that the least advantaged children face substantially reduced opportunities for successful development across every indicator. These deficits in ECD are likely to compound, as implied by the production function in equation 2, where early ECD outcomes can act as inputs for later development. Since we have cross-sectional data, and, for instance, look at immunizations with children age 1, ECCE with children age 3-4, and child labor for children age 5, we cannot directly examine potential compounding effects, but the simulations indicate the potential for compounding inequality over the early lifecourse. Other research indicates that these inequalities are likely to interact and compound each other (Helmers & Patnam, 2011), so that by the time the least advantaged children reach school age (age 6 in MENA countries), they are at a very substantial physical, cognitive, social, and emotional disadvantage. This disadvantage is likely to further compound during the school years and into adult life; for instance, children who are stunted perform worse in school (Glewwe et al., 2001).

6. Conclusions

The early years of life are vital to the course of human development (Shonkoff & Phillips, 2000). Deficits and inequality early in life tend to accumulate and compound (Helmers & Patnam, 2011), and lead to persistent shortfalls in human capital. This paper has shown that, in addition to low levels of early childhood development in the Middle East and North Africa, there is substantial inequality of opportunity across a variety of dimensions. Based on a relatively few circumstances, which are entirely outside of their control, children face unequal opportunities to develop in terms of health, nutrition, cognitive, social, and emotional development.

Using fifteen datasets from twelve MENA countries and examining eleven different indicators, covering a variety of dimensions of development and the early lifecourse from in *utero* through age five, we measured inequality of opportunity in early childhood development. We found inequality early in life to be quite high. Even the high level of inequality we estimated is a lower bound on the true inequality of opportunity, since we examined just a few circumstances. Inequality of opportunity was particularly high in early learning and in activities that support early cognitive development, placing children at a substantial disadvantage upon entry into school and ultimately in the labor force. Our analysis also illustrated the contributions of circumstances to children's early opportunities. Wealth, mother's education, and geographic differences tend to contribute substantially to inequality of opportunity. Gender does not play a large role in inequalities in early childhood. There was substantial variation in how different circumstances affect outcomes and inequality across countries. A careful examination of country and outcome specific determinants will have to be made before designing any policy or program to address inequality.

Further research is needed into the mechanisms through which these circumstances contribute to inequality in ECD in order to design effective policy responses. For instance, Glewwe (1999) investigates why mother's education contributes to child health. He finds that it is mother's health knowledge, which is primarily learned outside the classroom but supported by mothers' literacy and numeracy, which improves child health. If mother's knowledge is the key mechanism through which mother's education impacts other ECD outcomes, this suggests an effective route for improving ECD and decreasing inequality will be directly educating families about ECD and activities that promote ECD.

Likewise, the substantial contributions of urban/rural or regional differences could have a number of different mechanisms. Other research has suggested variation in disease environments (Curtale, Hassanein, El Wakeel, Barduagni, & Savioli, 2003) could contribute to inequality in health outcomes related to place of residence. Unequal provision of government services across different areas could also contribute to geographic differences, as in Egypt where the regional component of ECCE inequality may be related to an unequal provision of public kindergartens across regions(Janssens, Van Der Gaag, & Tananka, 2001). There may also be economic differences across regions that are not captured by the wealth indicators, as well as cultural and attitudinal differences that vary within countries.

Inequality in early childhood is likely to be compounded by the continued impact of children's circumstances. However, it may also be the case that inequality of opportunity is worse during early childhood than during the school years, but that early deficits still shape later outcomes. For instance, in Egypt, we found a D-index of 21.8 for ECCE, meaning that 21.8% of the opportunities to attend ECCE would have to be redistributed in order for equality of opportunity to prevail. In contrast, a study using the same dataset and relatively similar circumstances found a D-index of 2.4 for school enrollment for ages 6-11 and a D-index of 10.4 for school enrollment at ages 15-17(World Bank, 2012). Subsequent access to higher education is extremely unequal (Assaad, 2013).Inequality of opportunity in schooling access is most acute with ECCE, diminishes with primary enrollment, and then increases through secondary school and higher education. While children may have equal opportunities to enroll in primary school, they have unequal opportunities to succeed and progress given the pattern of inequality in early childhood.

Although MENA currently has substantial deficits and inequality in ECD, investments in early childhood can generate high returns while enhancing equity(Heckman & Masterov, 2007).For instance, the Indonesia Early Childhood Education and Development Project provided a package

of early childhood services that reduced achievement gaps between rich and poor children(Jung & Hasan, 2014). However, it is clear that in MENA, disadvantaged children have less access to ECD services. Ensuring that disadvantaged children have equal access to ECD services could reduce inequality not just during the early years, but create a virtuous cycle into the school years, throughout children's development, and translate into more equal adult outcomes.

The centrality of the early years has important implications for the role of public inputs in generating (in)equality of opportunity. For instance, while public primary through higher education are free of charge in Egypt, pre-primary is not. Additionally, public classrooms for pre-primary are distributed much more inequitably, in geographic terms (Janssens et al., 2001) than primary classrooms. Public resources should be re-allocated to ensure that children are on equal footing early, not simply to give them equal opportunities to enroll in primary school when they are already likely to be at a disadvantage.

The successes of several countries, such as Egypt and Morocco, in achieving equality of opportunity for full immunizations but not equality on other indicators is a good illustration of the challenges countries face in of moving towards equality of opportunity in early childhood. Immunizations can be delivered in one 'shot,' such as a national immunization day or immunization campaign. Facilities with ongoing physical access are not required, in contrast to delivery care or ECCE. The resource and time commitment for immunizations is low, in contrast with development activities or addressing stunting with improved nutrition. Addressing issues relating to parenting practices such as violent child discipline, development activities, or feeding and nutrition is possible but will also require new forms of outreach to families, such as parenting education (Engle et al., 2011). Improving the level of ECD and decreasing inequality in these indicators requires sustained, targeted, and relatively complex programs. There are examples of such programs in MENA. However, bringing them up to scale and targeting them to the disadvantaged remain challenging (UNICEF, 2009).

Despite the challenges of addressing inequality of opportunity in early childhood, given the vital importance of this stage of development (Heckman, 2006; Shonkoff & Phillips, 2000), MENA countries must work towards providing equality of opportunity. If countries transitioning after the Arab Spring are serious about addressing exclusion and inequality, they will have to start early in life, long before children become youth protesting in the streets, by addressing inequality of opportunity in early childhood development.

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Table 1: Data Sources

Country	Surveys (References)
Algeria	PAPFAM 2002(National Office of Statistics, Ministry of Health Population and Hospital Reform, & League of Arab States, 2003)
Djibouti	PAPFAM 2012(Ministry of Health (Djibouti), Institute of Statistics and Demographic Studies, & League of Arab States, 2012) andMICS 2006(Ministry of Health & League of Arab States, 2007)
Egypt	DHS 2008(El-Zanaty & Way, 2009)
Iraq	MICS 2011(The Central Statistics Organization and the Kurdistan Regional Statistics Office, 2012)
Jordan	DHS 2012 (Department of Statistics (Jordan) & ICF International, 2013)
Lebanon	PAPFAM 2004(The Arab League & The Republic of Lebanon Central Administration of Statistics, 2006)
Libya	PAPFAM 2007(League of Arab States, 2009)
Morocco	DHS 2003/4(Ministry of Health, ORC Morocco, & League of Arab States, 2005)
Syria	MICS 2006(Central Bureau of Statistics et al. 2008) and PAPFAM 2009 (League of Arab States & Syrian Arab Republic, 2011)
Tunisia	MICS 2011/2012(Ministry of Development and International Cooperation, National Institute of Statistics, & UNICEF, 2013)
West Bank and Gaza	PAPFAM/MICS (NHS) 2006(Palestinian Central Bureau of Statistics, 2007)
Yemen	PAPFAM 2003 (Ministry of Health and Population Republic of Yemen & Pan-Arab Project for Family Health, n.d.) and MICS 2006 (Ministry of Health and Population & UNICEF, 2008)

Notes: DHS is the Demographic and Health Survey, MICS is the Multiple Indicator Cluster Survey, and PAPFAM is the Pan-Arab Project for Family Health Survey. The 2006 NHS for West Bank and Gaza was a combined PAPFAM/MICS survey.

Table 2: Percentage of Children (or Births) with ECD Indicator

	Algeria	Djibouti	Egypt	Iraq	Jordan	Lebanon	Libya	Morocco	Syria	Tunisia	West Bank and Gaza	Yemen
Prenatal Care	79.2	87.9	73.6	77.7	99.1	95.4	93.8	67.9	87.7	98.1	98.5	47.0
	(4,297)	(1,944)	(10,868)	(13,994)	(6,811)	(1,224)	(7,771)	(4,754)	(10,891)	(1,135)	(6,342)	(1,585)
Skilled Delivery	94.4	87.4	79.0	90.8	99.6	98.2	98.7	62.9	96.3	98.6	97.7	35.7
	(3,431)	(1,943)	(10,844)	(13,994)	(10,360)	(1,174)	(7,769)	(6,150)	(10,891)	(1,135)	(6,323)	(1,585)
Fully Immunized	92.6	30.7	91.7	64.3	93.0	51.5	86.9	89.6	77.9	89.6		40.7
	(780)	(398)	(2,188)	(7,254)	(2,030)	(229)	(1,888)	(1,143)	(2,451)	(581)		(677)
Neonatal Mortality	2.0	3.6	1.6	2.0	1.5	1.0	1.1	2.5	1.2	1.2	2.1	4.0
	(11,950)	(3,394)	(8,367)	(37,584)	(8,462)	(3,594)	(9,735)	(4,977)	(13,281)	(2,977)	(8,526)	(3,985)
Infant Mortality	3.3	6.0	2.4	3.1	1.8	1.5	1.7	3.8	1.7	1.7	3.0	7.1
	(11,950)	(3,394)	(8,367)	(37,584)	(1,462)	(3,594)	(9,735)	(4,977)	(13,281)	(2,977)	(8,526)	(3,985)
Stunted	19.3	33.5	28.9	21.7	7.6	10.7	21.0	23.1	25.8	10.1	11.8	53.1
	(4,348)	(3,361)	(9,478)	(35,036)	(6,267)	(940)	(10,281)	(5,573)	(14,920)	(2,640)	(9,236)	(10,116)
Iodized Salt		0.4	76.7	24.4			52.5		30.4		87.7	
		(2,128)	(10,119)	(36,468)			(13,308)		(12,808)		(12,135)	
Develop. Activities		36.6		53.5	81.6				55.0	71.1	46.8	25.5
		(1,808)		(13,962)	(3,904)				(11,017)	(1,164)	(10,105)	(3,783)
Violent Discipline		36.2		77.2	91.3				85.0	94.9	95.5	93.2
		(1,051)		(10,378)	(1,654)				(3,862)	(1,260)	(2,796)	(952)
ECCE		14.1	40.2	3.8	21.7		9.3		17.2	44.5	34.1	2.7
		(903)	(6,203)	(13,951)	(3,826)		(6,897)		(9,413)	(2,977)	(3,952)	(1,472)
Child Labor (Age 5)		18.6		10.1			7.0		12.3	24.0		15.8
		(606)		(7,244)			(2,136)		(3,079)	(639)		(710)

Note: Number of observations in parentheses.

Table 3: Dissimilarity Indices for ECD Outcomes

	Algeria		Djibouti		Egypt		Iraq		Jordan		Lebanon	Libya		Morocco		Syria		Tunisia		West Bank and Gaza		Yemen	
Prenatal Care	7.7	***	6.4	**	9.0	***	20.9		0.5		2.6	2.0	*	14.3	***	5.1	***	high		0.5		16.8	**
	(1.7)		(2.5)		(1.1)		(28.8)		(0.7)		(1.9)	(0.8)		(1.8)		(0.8)				(0.3)		(5.1)	
Skilled Delivery	2.4	*	9.6	***	9.0	***	2.9	***	0.2		high	0.7	*	19.6	***	2.1	***	high		0.8	*	26.1	***
	(1.1)		(2.9)		(1.0)		(0.6)		(0.4)			(0.3)		(1.8)		(0.6)				(0.4)		(6.4)	
Fully Immunized	2.2		22.2		1.7		8.6	***	2.3		18.4	2.7		3.6		6.2	*	4.4				20.6	*
	(2.6)		(14.7)		(1.2)		(2.1)		(2.4)		(11.3)	(1.9)		(1.9)		(2.5)		(4.0)				(8.3)	
Neonatal Mortality	13.9		insig.		24.9		9.7		19.7		low	30.7		19.5		insig.		40.0		insig.		insig.	
	(11.4)				(15.7)		(9.9)		(15.5)			(18.5)		(13.8)				(27.8)					
Infant Mortality	14.7		insig.		20.3		6.1		20.3		low	25.8		19.8		insig.		33.4		insig.		15.5	
	(9.0)				(12.1)		(7.2)		(14.6)			(13.8)		(12.4)				(20.1)				(10.7)	
Stunted	9.9		9.6		9.0	**	7.1	**	24.1	*	insig.	6.3		16.1	***	13.0	***	19.8		13.4	**	4.9	*
	(6.1)		(5.3)		(3.0)		(2.5)		(10.4)			(3.8)		(4.5)		(2.7)		(11.2)		(5.0)		(2.0)	
Iodized Salt			low		7.2	***	20.3	***				16.9	***			32.3	***			insig.			
					(1.0)		(2.4)					(1.9)				(2.1)							
Development Acts.			13.9	*			12.6	***	3.4							10.6	***	11.8	**	5.7	**	19.3	***
			(6.2)				(1.8)		(2.1)							(1.5)		(3.9)		(1.8)		(5.4)	
Violent Discipline			11.6				2.6		4.5							1.7		insig.		0.8		high	
			(10.3)				(1.6)		(5.1)							(1.3)				(0.7)			
ECCE			34.6		21.8	***	43.5	***	24.4	***		23.7	***			36.3	***	25.5	***	12.1	**	low	
			(28.4)		(2.7)		(10.6)		(7.3)			(7.0)				(4.1)		(6.0)		(3.9)			
Child Labor			23.2				17.0	***				25.7				12.1		21.7				25.1	
			(15.6)				(8.3)					(18.7)				(8.1)		(13.1)				(15.1)	

Notes: Standard Errors in Parentheses. *p<.05 ** p<.01 *** p<.001. "insig." denotes a statistically insignificant model at the 5% level. Where the model underlying the dissimilarity index was insignificant, the outcome was not modeled. “low” denotes an outcome that was too infrequent to model while “high” denotes an outcome that was too close to universal to model. Blank cells are for outcomes that were unavailable in the data

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Table 4: Contributions of Circumstances to Inequality (D-Index) Using Shapley Decomposition

	Wealth	Mother's Education	Father's Education	Head's Education	Rural	Region	Child Sex	Distance to Health Care
Prenatal Care								
Algeria	21.3	37.0	26.4		15.4			
Djibouti	28.8	6.3	10.2		32.4	22.2		
Egypt	35.2	28.5	15.2			17.6		3.6
Iraq	30.6	23.6	16.7		23.7	5.4		
Jordan	45.6	23.6	22.0		0.6	2.2		5.9
Lebanon	24.0	46.3	29.7					
Libya	21.8	48.5	27.5			2.2		
Morocco	26.3	18.8	10.3		2.7	35.2		6.8
Syria	16.5	23.8	6.5		44.4	8.8		
West Bank and Gaza	21.5	23.9	17.5		21.6	15.6		
Yemen	28.6	23.5	13.4		15.8	18.6		
Skilled Delivery								
Algeria	17.9	36.8	22.3		23.0			
Djibouti	30.2	4.4	9.2		37.5	18.7		
Egypt	36.1	23.6	10.2			28.8		1.3
Iraq	37.4	18.1	15.2		25.6	3.6		
Jordan	46.7	21.8	27.1		1.9	0.6		2.0
Libya	2.3	17.7	12.6			67.3		
Morocco	28.1	16.4	12.4		3.5	32.6		7.1
Syria	21.4	25.1	7.2		32.1	14.2		
West Bank and Gaza	6.1	5.2	7.9		5.7	75.0		
Yemen	42.2	12.1	3.3		20.5	21.9		
Fully Immunized								
Algeria	44.5	36.2	16.3		3.0			
Djibouti	40.6	2.9	28.1		3.9	22.0	2.6	
Egypt	22.5	11.5	8.5			53.0	3.3	1.2
Iraq	23.8	17.2	12.9		23.2	22.5	0.5	
Jordan	28.5	29.7	9.7		17.1	2.4	1.1	11.6
Lebanon	50.4	14.8	34.8					
Libya	29.9	26.4	20.7			21.7	1.3	
Morocco	28.8	11.0	11.7		25.0	13.0	3.9	6.7
Tunisia	13.6	20.1	8.2		10.4	47.7	0.1	
Syria	10.3	29.1	11.1		46.5	2.2	0.8	
Yemen	32.4	28.6	6.8		19.4	12.7	0.2	
Neonatal Mortality								
Algeria	28.9			19.0	2.2		2.2	
Egypt	15.8	28.8	3.2			25.0	27.2	
Iraq	3.7	11.7			6.9	3.3	74.4	
Jordan	41.5	15.5	20.0		0.4	0.7	21.1	0.8
Libya	15.6	11.7	17.6			31.9	23.2	
Morocco	20.9	14.6	11.2		28.9	18.7	5.7	
Tunisia	8.5	6.6	40.0		10.3	30.3	4.4	

Table 4: Continued

	Wealth	Mother's Education	Father's Education	Head's Education	Rural	Region	Child Sex	Distance to Health Care
Infant Mortality								
Algeria	42.8			41.9	5.0		5.0	
Egypt	29.7	18.9	7.2			37.0	7.2	
Iraq	15.6	28.7			2.5	7.0	46.1	
Jordan	31.2	20.3	32.2		1.6	0.7	12.3	1.7
Libya	15.2	14.9	21.2			33.4	15.2	
Morocco	29.7	18.8	5.2		7.5	29.7	9.0	
Tunisia	19.5	7.0	43.7		10.2	19.3	0.2	
West Bank and Gaza	58.0			11.9	5.7	24.4	0.1	
Yemen	29.7	3.5			3.3	60.0	3.4	
Stunted								
Algeria	56.4			32.0	4.2		4.2	
Djibouti	52.9	2.7	12.0		21.4	10.7	0.2	
Egypt	4.8	4.5	7.2			72.5	8.6	2.6
Iraq	10.6	10.8	15.5		7.8	49.9	5.4	
Jordan	28.9	24.3	13.1		17.7	2.0	13.2	0.8
Libya	20.9	35.0	16.9			12.6	14.6	
Morocco	38.1	8.3	9.5		16.1	17.3	2.2	8.5
Syria	12.9	18.1	5.4		60.0	2.6	0.9	
Tunisia	25.8	10.3	23.0		11.3	25.0	4.6	
West Bank and Gaza	17.7	11.2	5.0		10.8	51.9	3.4	
Yemen	8.1	36.3	0.1	8.1	36.3		0.1	
Iodized Salt								
Egypt	43.6	17.4	9.2			19.3	0.1	10.3
Iraq	22.5	9.7	4.0		16.0	47.8	0.1	
Libya	6.7	5.1	4.7			83.4	0.1	
Syria	15.1	12.9	2.7		57.7	11.6	0.0	
West Bank and Gaza								
Development Activities								
Djibouti	13.4	8.9	3.5		8.7	64.2	1.2	
Iraq	37.2	24.2	20.9		15.3	1.7	0.8	
Jordan	22.9	37.5	22.2		13.0	3.6	0.8	
Syria	17.5	23.0	12.5		40.6	6.4	0.0	
Tunisia	27.8	19.3	9.8		25.6	16.6	0.9	
West Bank and Gaza	48.2	23.7	12.1		2.8	11.9	1.2	
Yemen	29.1	28.5	11.2		15.1	15.6	0.4	
Violent Discipline								
Djibouti	36.7	11.7	13.8		10.6	27.0	0.3	
Iraq	22.9	8.9	20.3		4.2	28.9	14.9	
Jordan	25.0	13.2	26.8		11.9	18.6	4.5	
Syria	19.7	8.3	4.8		58.7	0.9	7.5	
West Bank and Gaza	23.7	17.8	6.7		8.3	40.9	2.7	

Table 4: Continued

	Wealth	Mother's Education	Father's Education	Head's Education	Rural	Region	Child Sex	Distance to Health Care
ECCE								
Djibouti	21.3	21.3	32.4		3.5	20.9	0.5	
Egypt	36.8	26.0	13.2			23.3	0.8	
Iraq	33.5	21.1	17.0		25.5	2.7	0.3	
Jordan	38.2	39.6	14.5		7.3	0.4	0.0	
Libya	23.1	20.2	15.6			37.2	4.0	
Syria	23.4	31.3	14.4		26.1	4.7	0.1	
Tunisia	29.0	8.7	7.3		42.5	12.2	0.2	
West Bank and Gaza	32.0	41.8	20.9		1.5	3.7	0.1	
Child Labor								
Djibouti	35.3	6.1	22.4	0.7	31.7	3.8	3.8	
Iraq	8.4	15.5	2.0		3.5	54.0	16.6	
Libya	7.8	12.7	11.5			67.9	0.1	
Syria	11.2	17.1	9.3		44.8	2.0	15.6	
Tunisia	16.3	12.7	6.2		8.7	49.5	6.6	
Yemen	11.3	22.6	20.0		1.1	39.3	5.7	

Note: Cells are the percentage shares (contributions) of circumstances to inequality, with inequality measured by the D-index and circumstance contributions calculated by the Shapley decomposition.

Table 5: Most and Least Advantaged Simulations—Predicted Probability (Percentage)

	Advantage	Algeria	Djibouti	Egypt	Iraq	Jordan	Lebanon	Libya	Morocco	Syria	Tunisia	West Bank and Gaza	Yemen
Prenatal Care	*Least*	51.8	61.4	59.7	43.9	97.6	60.5	77.4	37.0	53.4		83.9	25.5
	Most	99.5	99.3	96.1	96.4	100.0	100.0	98.6	99.3	99.8		98.8	96.3
Skilled Delivery	*Least*	77.2	45.6	54.2	70.4	94.7		98.5	26.9	73.8		93.2	17.2
	Most	100.0	100.0	97.1	98.2	100.0		99.9	99.8	99.4		97.7	96.4
Fully Immunized	*Least*	85.1	27.6	90.4	34.3	33.5	11.7	70.1	82.7	61.5	55.9		14.9
	Most	95.5	33.0	88.1	90.7	89.2	78.7	87.9	97.1	94.5	91.3		87.8
Neonatal Mortality	*Least*	2.5		1.9	2.3	0.7		1.2	2.9		1.6		
	Most	1.5		0.8	2.6	0.5		0.2	1.4		1.1		
Infant Mortality	*Least*	4.1		2.8	3.9	0.8		3.2	5.2		5.0		10.2
	Most	1.5		1.1	3.0	0.5		0.4	1.1		2.2		0.0
Stunted	*Least*	28.6	42.1	35.9	30.5	29.4		29.6	37.9	39.9	21.5	16.7	55.6
	Most	16.2	21.1	20.8	12.1	1.7		22.5	11.1	10.1	6.8	5.8	36.4
Iodized Salt	*Least*			55.8	8.5			39.8		12.5			
	Most			88.0	66.1			73.0		83.4			
Development Activities	*Least*		24.1		19.1	42.3				26.0	4.9	34.4	10.4
	Most		60.8		84.9	86.9				78.6	97.4	59.9	55.1
Violent Discipline	*Least*		22.0		80.6	99.8				88.0		95.2	
	Most		49.2		62.6	53.7				84.7		94.5	
ECCE	*Least*		4.5	9.6	0.1	4.7		1.0		2.1	3.7	12.8	
	Most		28.4	62.5	22.1	44.3		17.8		69.0	92.2	57.6	
Child Labor	*Least*		24.4		6.6			1.2		11.7	8.3		11.5
	Most		10.6		2.9			0.2		10.2	18.7		40.5