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Exploring the Relationship Between Maternal Occupation and Under-Five Mortality: Empirical Evidence from 26 Developing Countries

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Abstract

While greater female participation in the job market is seen as an effective way of achieving higher economic growth, some studies reveal that maternal employment could be a risk factor for child mortality. We analyze the association between under-five mortality and maternal employment in 26 developing countries from Sub-Saharan Africa, South Asia, and the Middle East using Demographic and Health Surveys. Logistic regression results suggest that maternal employment is associated with a 24.5% higher risk of child mortality than stay-at-home mothers. Compared to stay-at-home mothers, maternal engagement in agriculture is associated with 24% higher odds of under-5 mortality, while engagement in blue-collar jobs is associated with 29% higher odds of under-5 mortality. We also find that white-collar jobs do not give any advantage over the stay-at-home mothers with respect to this risk. Interaction of maternal employment types with breastfeeding confirms the increased risk of child mortality for agriculture and blue-collar jobs.

Keywords Under-five mortality · Maternal employment · Agriculture jobs · Blue-collar jobs · White-collar jobs · Breastfeeding

Résumé

Alors qu'une participation accrue des femmes sur le marché du travail est considérée comme un moyen efficace d'obtenir une croissance économique plus élevée, certaines études révèlent que le travail des mères pourrait être un facteur de risque de la mortalité infantile. Nous analysons le lien entre la mortalité des enfants de moins de cinq ans et le travail des mères dans 26 pays en développement d'Afrique subsaharienne, d'Asie du Sud et du Moyen-Orient à l'aide d'enquêtes démographiques et de santé. Les résultats de la régression logistique suggèrent que le fait que les mères travaillent est associé à un risque de mortalité infantile 24,5 % plus élevé que lorsque

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les mères sont au foyer. Par rapport aux mères au foyer, le fait que la mère ait un emploi dans l'agriculture est associé à un risque de mortalité des moins de 5 ans 24 % plus élevé, tandis qu'un emploi manuel, en tant qu'ouvrière, est associé à un risque de mortalité des moins de 5 ans 29 % plus élevé. En ce qui concerne ce risque, nous constatons également que les emplois de bureau n'apportent aucun avantage par rapport aux mères au foyer. L'interférence avec l'allaitement, en fonction des types d'emploi, confirme le risque accru de mortalité infantile lorsque les mères travaillent dans l'agriculture et comme ouvrières.

Introduction

Even though under-five mortality across the world has been reduced significantly in the last three decades, reducing it further is one of the most important development goals. The SDG 3 aims at reducing neonatal mortality and under-five mortality rates to 12 and 25 per 1000 live births, respectively, by 2030. However, according to UNICEF global estimates,[1] neonatal mortality was 18 per 1,000 live births, and under-five mortality was 39 per 1000 live births in 2017. In absolute terms, 5.4 million children under the age of five passed away globally in 2017. Wide regional disparities exist with regards to under-five mortality. In Sub-Saharan Africa, 1 out of every 13 children dies before his/her fifth birthday. Inequities in the under-five mortality also exist within countries both spatially and with respect to socioeconomic status.

Existing literature has identified various factors associated with under-five mortality. The maternal attributes associated with under-five mortality include the education of mothers (Shifa et al. 2018), mother's age (Kravdal 2018; Marphatia et al. 2017), number of children ever born (Nasejje and Mwambi 2017), birth order of the child (Khan and Awan 2017; Kravdal 2018; Maniruzzaman et al. 2018), birth space (Khan and Awan 2017), breastfeeding (Ogbo et al. 2017), marital status of the mother at the time of last birth (Shifa et al. 2018) and mother's empowerment (Kenea and Jisha 2017; Stiyaningsih and Wicaksono 2017). The gender of the child (Ezeh 2017) is also a significant correlate of child mortality. The household characteristics significantly associated with child mortality include the type of cooking fuel used in the household (Milanzi and Namacha 2017), location of the kitchen (Shifa et al. 2018), urban–rural residential status (Gebresilassie et al. 2021), and household wealth status (Anyamele et al. 2017). Health seeking behavior of women, such as access to and utilization of basic health services (Chadoka-Mutanda and Odimegwu 2017; Hong et al. 2017), the context of kinship relations (Dong et al. 2017), and religion (Akseer et al. 2018) are also significantly related to the odds of child survival. Some other macro-level risk factors of child mortality are reduced health expenditure because of corruption by the government authorities (Sommer 2020) and inadequate water and sanitation infrastructure (Günther and Fink 2013).

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[1] https://data.unicef.org.

The job status of the parents as a predictor of under-five mortality has of late been extensively analyzed. Father's occupation type is significantly associated with the odds of child mortality (AlMazrou et al. 1997; Rahman and Ali 2007; Upadhyay et al. 2012; Van Malderen et al. 2013). Fathers' engagement in manual occupations (Zakar et al. 2015), low-status occupations (Saha et al. 2014), and unskilled manual jobs (Oliveira et al. 2007) are found to be the risk factors for child mortality. Both parents' working status is also a risk factor (Deb et al. 2017; Debowska and Boduszek 2017). Some other factors related to the under-five mortality previously analyzed in the context of women's job status are paid maternity leave (Fallon et al. 2017; Nandi et al. 2018; Patton et al. 2017) and the minimum wages (Lenhart 2017).

Against the background of the uncertainty in the association between maternal occupation and child mortality, this study explores the relationship between maternal occupation and child mortality using data from 26 developing countries from Middle East, Sub-Saharan Africa and South Asia.

Under-Five Mortality and Women's Occupation: Summary Statistics

Under-five mortality has been steadily coming down over recent decades, and currently, the global under-five mortality is 38 per 1000 live births (World Bank 2020e). However, there are wide regional disparities in the under-five mortality. The under-five mortality rate was 22 per 1000 live births in the Middle East and North Africa (MENA), 40 per 1000 live births in South Asia, and 76 per 1000 live births in Sub-Saharan Africa (World Bank 2020e). Women also differ widely with respect to their labor force participation and their work-type in developing countries. Globally, 57% of women aged 15 and above are employed (World Bank 2020d). Working women's share in the total labor force was 43%, 48%, and 63% in MENA, South Asia, and Sub-Saharan Africa, the three regions where our sample countries are located. Among all the employed women, 26% of women are engaged in the agriculture sector (World Bank 2020a). While 20% of working women were engaged in the agriculture section in the Middle East and North Africa (MENA), this share was 56% in South Asia and 52% in Sub-Saharan Africa. Women's share of female employment in the industry was 16% globally, 13% in the MENA region, 18% in South Asia, and 8% in Sub-Saharan Africa (World Bank 2020b). Women's share of female employment in the services sector was 59% globally, 67% in the MENA region, 40% in Sub-Saharan Africa, and 26% in South Asia (World Bank 2020c). Women's share of wage and salaried workers out of total female employment was 53% globally, 73% in the MENA region, 25% in South Asia, and 18% in Sub-Saharan Africa (World Bank 2020f).

In our sample countries, the under-five mortality rate was 56 per 1,000 live births (Boyle et al. 2019). Women's share in agricultural jobs in the 26 selected countries was 29%. Around 21% of the women were engaged in blue-collar jobs, and 8% of the women were engaged in white-collar jobs. Nearly 42% of the women were stay-at-home mothers.

Theoretical Background

In recent years, conflicting evidence has emerged regarding the association of mothers' occupation with under-five mortality (Akinyemi et al. 2018; Goli et al. 2017; Khan and Awan 2017; Saabneh 2017; Van Rossem et al. 2017). It is argued that when the children pass the infancy stage, they require complementary food choices that may not be afforded by the women who do not do any paid work resulting in child malnutrition and mortality (Black et al. 2013).

Though many studies contend that a mother's economic activity may generate positive outcomes for both mother and children, empirical results from less developed countries indicate higher mortality rates among working mothers' children (Andoh et al. 2007). A study in India found that women's job in the low-status occupations was significantly associated with a higher risk of under-five mortality and low nutritional status (Saabneh 2017). Saabneh (2017) speculates that the working women's inadequate childcare may contribute to the increased risk of child mortality. Maternal employment status is also found to be significantly associated with childhood obesity (Anderson 2012; Cawley and Liu 2012; Meyer 2016), which in turn might be associated with child mortality. A study in Pakistan finds a significant association between mothers' employment and adverse health outcomes for the children in working environments, where women are not paid in cash for their work (Jafree et al. 2015).

The Mechanism Linking Maternal Employment with Under-Five Mortality

Various mechanisms linking maternal employment with under-five mortality have been suggested in the existing literature. The studies, which consider maternal employment as a protective factor against child mortality, highlight the role of additional household income in improving children's nutritional status (Saabneh 2017). A greater autonomy wielded by the employed mothers (Chakrabarti and Biswas 2012), larger positive impact of resources controlled by mothers (Luke and Xu 2011), exposure to new social networks and greater freedom of movement, and better health-seeking behavior (Bloom et al. 2001; Mehari and Wencheko 2013) are believed to work as protective factors for child survival.

The studies that see maternal employment as a risk factor often analyze the type of work's moderating role between maternal employment and under-five mortality (Cleland et al. 1992; Anderson and Eswaran 2009). The women engaged in low-paid jobs have no advantage with respect to child survival over their stay-at-home counterparts (Saabneh 2017). The distribution of female employment partially explains the maternal employment-child mortality relationship. Around 95% of the women are engaged in informal work in South Asia, and 89% of the women are engaged in informal work in Sub-Saharan Africa.[2] The informal work includes street vending, trading petty goods and services, subsistence farming, seasonal work, domestic

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[2] http://www.unwomen.org/en/news/in-focus/csw61/women-in-informal-economy.

work, and industrial outwork.[3] Besides, social norms also determine how women translate their income to power. Increasing mechanization of agricultural activity in developing countries such as mechanized land preparation, digging of well, and seedling propagation in areas known for their subsistence farming practices (Minten et al. 2020) also poses new challenges to women engaged in agricultural sector.

The difference in the time devoted by the employed and stay-at-home mothers to their children has also been analyzed as the potential determinant of under-five mortality (Sivakami 2010). However, it is found that even if the employed women devote less time to their children, the children are ignored only in the activities which are less critical for their survival (Sivakami 2010). The women who do not do any paid work also spend a lot of time on household chores, neglecting children, leading to a phenomenon called "time poverty" (Kabir 2016). The effect of bad working conditions on working mothers' health with adverse consequences on child survival is well documented (Talavera-Velasco et al. 2018; Talibov et al. 2018; Spitzmueller et al. 2018; Sejbaek et al. 2018; Oenning et al. 2018; Younes et al. 2018). Women's employment in the agriculture sector requiring rigorous physical work affects the breastfeeding patterns and childcare in general (Ladusingh and Singh 2006).

The discussion above shows that evidence about the link between maternal employment and under-five mortality is conflicting. Risks involved in some female employment types for child survival have been adequately highlighted. However, few studies have analyzed how different job types are associated with child mortality (especially, the protective effect of better job types) in a cross-country setting. Treating different employment types as a homogeneous group is a recurring methodological limitation of many existing studies.

This paper attempts to analyze (i) if mother's employment is a risk factor of under-five mortality in 26 countries from South Asia, Africa and the Middle East; (ii) if different employment types (agriculture jobs, blue-collar jobs and white-collar jobs) affect the odds of under-five mortality equally or not, and (iii) whether the interaction between employment types and a significant protective factor viz. breastfeeding, impacts the association of different maternal employment types and under-five mortality.

Methodology

This study uses the information of ever-married women aged 15–49 with the history of live births for the past five years preceding the survey from 26 selected countries of Africa, South Asia, and the Middle East (Bangladesh, Cameroon, Congo, DR, Benin, Ethiopia, Ghana, Guinea, India, Cote d'Ivoire, Kenya, Madagascar, Malawi, Mali, Morocco, Mozambique, Niger, Nigeria, Pakistan, Rwanda, Zimbabwe, Uganda, Egypt, Tanzania, Burkina Faso, Yemen, Zambia). All the available waves for these countries were used to account for the historical trends in the child mortality patterns. Only single births were considered for this study since multiple

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[3] http://interactive.unwomen.org/multimedia/infographic/changingworldofwork/en/index.html.

births being a greater risk factor for child mortality (Bellizzi et al. 2018) can potentially bias the child morality upwards.

The outcome variable for this study is under-five mortality. The DHS has collected information on under-five mortality (0–59 months). Under-five mortality is a binary variable split into "survived" as the reference group and "died" as the second option. The main explanatory variable of interest in this study is the mother's occupation, which is categorized as "Stay-at-home mothers" (reference category) and "Working mothers."

Women's employment types differ widely with respect to the economic returns, rigor, workplace hazards, and timing away from home. Therefore, a mother's occupation needs to be stratified for a more nuanced exploration of the job-related differences influencing the odds of under-five mortality. Following Cleland et al. (1992), we stratified mother's occupation into a multi-categorical unordered variable with "stay-at-home mothers" as the reference group and three alternative occupational categories of working women: "Agriculture jobs," "Blue-collar jobs," and "White-collar jobs" as the other groups.

The agriculture job category includes self-employed farmers or agricultural employees. White-collar jobs include professional, managerial, or clerical workers with at least five years of schooling, sales or service workers with secondary or higher schooling. Blue-collar jobs include all skilled and unskilled manual workers, including domestic workers, professional, managerial, or clerical workers with less than five years of schooling, and sales and services workers with less than secondary schooling and never-married mothers. See Cleland et al. (1992) for further details. Some additional child-related, maternal, and community-level confounding factors such as birth interval, birth size and gender of the child, duration of breastfeeding, mother's education, age and marital status at the time of birth, place of residence (urban/rural), and household wealth are included in the analysis.

Data Sources

We have used data from the Integrated Public Use Microdata Series project of Demographic and Health Surveys (IPUMS-DHS).[4] Demographic and Health Surveys (DHS) are nationally representative and internationally comparable datasets. DHS uses a stratified two-stage cluster sampling procedure (Aliaga and Ren 2006). In the first stage, the primary sampling units (PSUs), or clusters, are selected from a sampling frame through the probability proportional sampling technique. The PSU is generally a geographical area called the enumeration area (EA) containing a number of households created from the most recent population census. When the information in an EA is considered outdated, possibly because of the outdated population census, the DHS updates the EA information. In the second stage, a fixed number of households are selected from each of the selected EAs through a systematic sampling of equal probability and fixed

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[4] https://www.idhsdata.org/idhs/.

size. All household members in a certain age group (all women 15–49 and men 15–59) selected in the second stage are interviewed. The stratified two-stage cluster sampling technique is considered more precise than simple random sampling at both stages.

The advantage of using data from IPUMS-DHS is that all the variables are consistently coded across all the countries and for all the periods. The IPUMS-DHS database includes data on the individual respondents and the household information linked from the household recodes.

The IPUMS-DHS project includes data for 41 countries from Sub-Saharan Africa, the Middle East and North Africa, and South Asia from 1987 to 2018. We chose a sample of 26 countries out of 41 countries. Our sample choice was driven by three related factors: economic underdevelopment, high prevalence of under-five mortality, and systematic discrimination against women. It can be shown that these factors crucially affect each other. Child mortality in developing countries is significantly higher than in developed countries. According to the World Bank data, the under-five mortality rate per 1,000 live births in 2019 was 5.7 in high-income countries, 18 in upper-middle-income countries, 40 in lower-middle-income countries, and 68 in low-income countries (World Bank 2020e).

Additionally, there is a strong correlation between economic underdevelopment and adverse life circumstances for women (Clark and Clark 2004), which affects child mortality rates even in developed countries (Mohamoud et al. 2019). Many developing countries' social institutions reflected in their laws, cultural norms, traditions and codes of conduct constrain women's participation in economic activities outside the home (Morrisson and Jütting 2005). However, greater female participation has not uniformly improved life quality through the mechanism, as predicted in the literature, of increased empowerment for women and lower barriers in traditional societies (Clark and Clark 2004). Industrialization of traditional societies has been routinely associated with the confinement of women in unstable, low-paying, and unskilled manufacturing jobs and erosion of the support from kinship networks that are generally available in traditional societies (Clark and Clark 2004). Our sample consisted of 26 developing countries. IPUMS-DHS had harmonized data on child mortality and maternal employment status in only 26 countries, and we included all these countries in our sample.

The heterogeneous nature of the employment-mortality link varies with contextual factors in different countries and can be a potential source of bias. Therefore, we included time and country fixed effects in the regression models. The DHS has a stratified two-stage cluster design. Therefore, sampling weights were used to ensure the representativeness of the data. Our final sample from 26 countries for multiple surveys waves from 1987 to 2016 consisted of information on 947,096 live births.

The procedures and questionnaires for DHS surveys are reviewed and approved by the ICF Institutional Review Board (IRB) and typically by the IRB of the DHS program's host countries. Informed consent is taken from the respondent or parent/guardian of the respondent, where the respondent is a minor.

Statistical Methods

This study's outcome variable is under-five mortality, a binary variable split into "survived" as the reference group and "died" as the second category. Alternative measures such as the linear probability model (LPM), the probit model, and the logit model are routinely used in empirical studies to estimate the binary outcome variable (Hill et al. 2018). LPM is believed to give unreliable estimates partly because of the estimates' linearity, and partly because the predicted probabilities may go beyond the [0, 1] range. On the contrary, probit and logit models are nonlinear models and are specially designed to force the predicted values between [0, 1] range (Hill et al. 2018).

The probit and logit models, though mostly similar, differ in several ways. A probit model is considered numerically more complicated because it is based on the normal distribution (Hill et al. 2018), while the logit model is based on logistic distribution. However, the advent of greater computing power has made numerical complexity irrelevant (Stock and Watson 2020). The logit and probit models also differ with respect to the S-shaped cumulative density function to constrain the predicted probabilities within the [0, 1] interval. Though logit estimates are larger (approximately 1.6 times higher than the probit estimates), such a large difference is considered misleading because their partial effects are nearly similar (Greene 2018).

Regarding whether probit should be preferred to logit or vice versa, there is a general understanding that it is a matter of preference of the researcher (Stock and Watson 2020). The logit model is more frequently used in epidemiological studies, while probit is more frequently used in economic analysis. Ultimately, a lot of subjectivity is involved in the choice between logit and probit models. Consequently, we used the logistic regression model to estimate the association between maternal employment and under-five mortality. Our preference for the logit model over probit model was driven primarily because of the ease of interpretation of the logit model's estimates which can be readily transformed to the odds ratios.

The analysis was conducted first by pooling the data and then disaggregating the data at the country-level to better understand the contextual factors affecting maternal employment and under-five mortality across the selected countries and the country-level. Second, we used the mother's occupation stratified with respect to the quality of work for a more refined exploration of the job-related differences influencing the odds of under-five mortality. In this part of the analysis, we used maternal employment as a multi-categorical unordered variable with "stay-at-home mothers" as the reference group and "Agriculture jobs," "Blue-collar jobs," and "White-collar jobs" as the other categories.

Part of the employment-survival association might arise from the differences among the stay-at-home mothers and non-working mothers in factors correlated with child mortality. Bicego and Boerma (1993) found that higher child mortality was associated with women from low-castes and women with no education in India. However, these two groups are also more likely to take up paid jobs. Therefore, part of the child mortality explained by women's working status is confounded by their educational status and caste. In the same vein, it is found that poor households are associated with higher child mortality risk and higher female employment rates
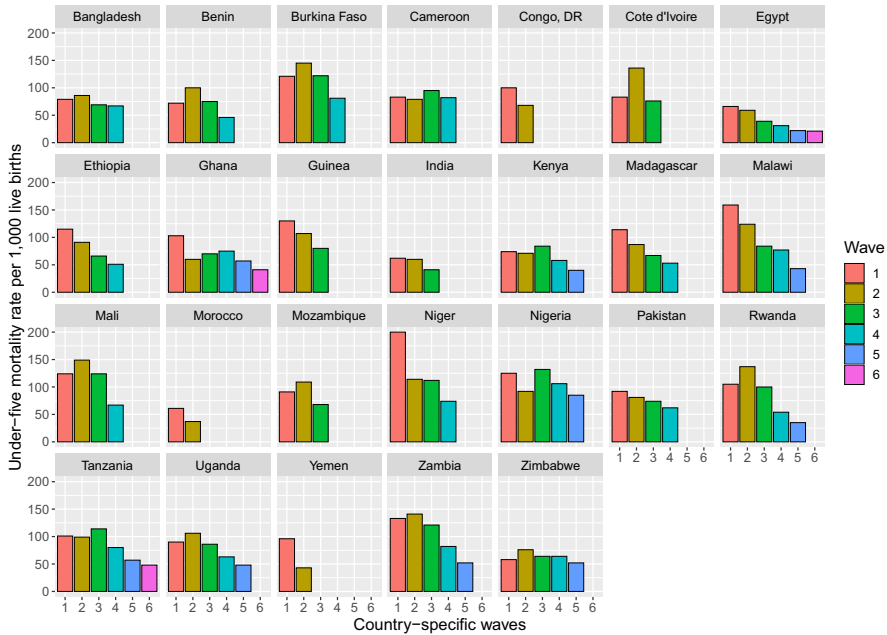
Fig. 1 Mortality

(Rajaram et al. 2003). In the poorest households, female employment may primarily be driven by poverty (Kabir 2016). Methodologically, such complex relationships call for interacting the maternal employment with other individual or community-level factors. There is reason to believe that working women compromise on optimal breastfeeding practices because of the requirements of their professional life (Ladusingh and Singh 2006; Ogbo et al. 2017). Therefore, we carried out a supplementary analysis by interacting maternal job types with breastfeeding to better understand the link between maternal employment and under-five mortality.

Results

Figure 1 presents estimates of under-five mortality rates per 1000 live births and the occupational status of mothers. There are vast differences in the under-five mortality rates, with 21 per 1000 live births in Egypt in 2014 and 85 per 1000 live births in Nigeria in 2013. Trends in under-five mortality also show wide disparities. While Yemen shows a reduction of over 50 percentage points in under-five mortality from 1991 to 2013, this change is less than one percentage point in Cameroon from 1991 to 2011.

Figure 2 shows the distribution of maternal occupation and trends across time. The ratio of women engaged in agriculture-related jobs was 2.1% in Egypt in 2014 and 75.4% in Rwanda in 2014. Women engaged in blue-collar jobs are lowest in Mali (0.6% in 2012) and highest in Benin (43% in 2011). Women engaged in
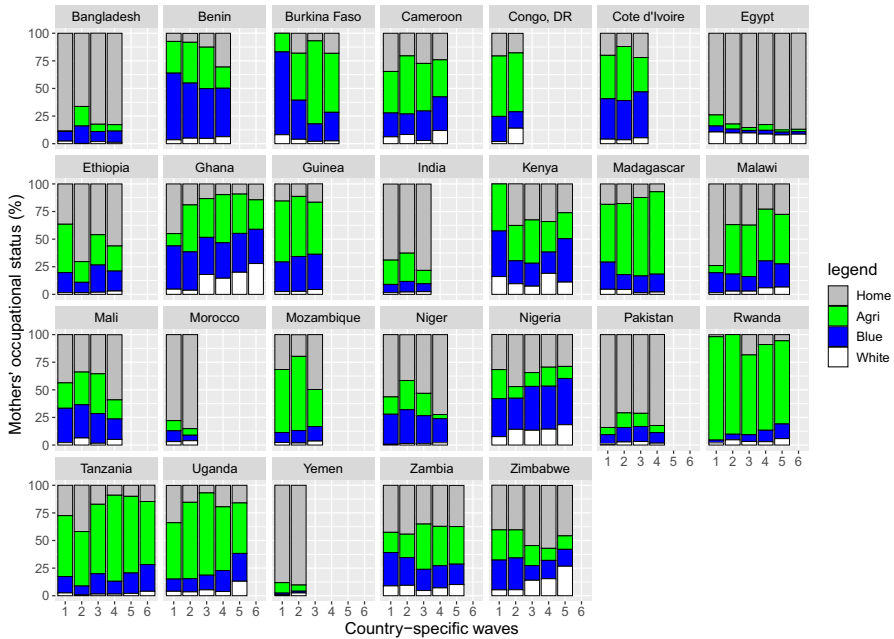
Fig. 2 Occupation

white-collar jobs are lowest in Bangladesh (1.2% in 2004) and the highest in Ghana (26.1% in 2014). Only 6.4% of the women were stay-at-home mothers in Rwanda in 2014, but 90.3% were stay-at-home mothers in Yemen in 2013.

Varying degrees of changes are observed in the occupational distribution of women across time (Fig. 2). Around 12 percentage point reduction in stay-at-home mothers was observed in Malawi from 1992 to 2016. In Mozambique, there was an increase of 9 percentage points in stay-at-home mothers' share from 1997 to 2011 but a decrease of around 12 percentage point in agriculture jobs from 1997 to 2011. In Malawi, there was an 11 percentage point increase in women's agriculture jobs from 1992 to 2016. The share of women in blue-collar jobs went down by ten percentage points in Mali from 1995 to 2012 but increased by 3.5 percentage points in Cameroon from 1991 to 2011. The share of women in the white-collar jobs went down by five percentage points in Burkina Faso from 1993 to 2010 but went up by ten percentage points in the Democratic Republic of Congo from 2007 to 2013.

Table 1 looks at the association of a selected individual, household, and community-level factors and under-five mortality.[5] Higher under-five mortality is associated with working mothers (8.6% vs. 6.8% in stay-at-home mothers, $P < 0.001$). Stratifying the mother's working status into more fine-grained categories suggests that women's agriculture and blue-collar jobs were similarly associated with higher under-five mortality (8.9% vs. 6.8% in stay-at-home mothers, $P < 0.001$).

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[5] Complete list of the factors associated with under-5 mortality is given in Supplementary Table S-1.

Table 1 Bivariate association between under-5 mortality and selected indicators

	Under-5 mortality		
	No (%)	Yes (%)	χ^2
Woman's occupation			
Stay-at-home mothers ($n=421,916$)	93.2	6.8	$P<0.001$
Working ($n=521,211$)	91.4	8.6	
Woman's occupation categories			
Stay-at-home mothers ($n=421,916$)	93.2	6.8	$P<0.001$
Agriculture ($n=294,439$)	91.1	8.9	
Blue collar ($n=171,803$)	91.1	8.9	
White collar ($n=53,496$)	94.8	5.2	
Breastfeeding			
Never breastfed ($n=41,109$)	57.6	42.4	$P<0.001$
<6 months ($n=43,801$)	59.2	40.8	
6–12 months ($n=91,964$)	87.9	12.1	
>12 months ($n=309,729$)	97	3	

The P values are estimated from the Pearson χ^2 test

Table 2 Logistic regression analysis of under-5 mortality and maternal employment (stay-at-home mothers vs working mothers)

Under-5 mortality	OR[a]	AOR[b]
Maternal employment		
Stay-at-home mothers (Reference)	1	1
Working mothers	1.282***	1.245***
	[1.259,1.306]	[1.161,1.334]
Country-fixed effects	No	Yes
Time-fixed effects	No	Yes
Log-likelihood	− 262,901.7	− 22,835.1
χ^2	693.7	13,127.0
P	7.01e−153	0

Exponentiated coefficients; 95% confidence intervals in brackets

[a]The odds ratios are unadjusted. [b]The AOR are adjusted odds ratios and the model is adjusted for duration of breastfeeding, birth interval (preceding and subsequent), residence, ANC visits, mother's and father's education, size of child at the time of birth, sex of child, mother's current age and marital status, number of children ever born, household wealth index and women's empowerment

*$P<0.05$, **$P<0.01$, ***$P<0.001$

In comparison, the white-collar jobs are associated with less under-five mortality (5.2% vs. 6.8% in stay-at-home mothers, $P<0.001$). Breast-feeding, preceding and following a birth interval of more than 24 months, residence in urban areas, antenatal care (ANC) visits (at least once), higher education of a woman and her husband empowerment are significantly associated with smaller under-five mortality.

Similarly, average birth-size, female sex of the child, mother's age between 18 and 34, the mother being in wedlock, number of children ever born less than three, childbirth order number between second and fourth, higher household wealth index, and woman's empowerment are also significantly associated with smaller under-five mortality.

Table 2 presents the results of multivariate logistic regression analysis using the pooled data from 26 countries. The estimates show that maternal working status is a significant risk factor of under-five mortality (OR 1.282; 95% CI 1.259–1.306).[6] Adjusting the model with potential confounders reveals a slight decrease in the risk (Adj OR 1.245; 95% CI 1.161–1.334), but maternal work still remains a significant risk factor.

In addition to the regression analysis of pooled data for 26 countries, we repeated the multivariate analysis at the country level (Table 3). The logistic regression analysis at the country level shows that in 12 out of 26 countries, maternal work is significantly associated with under-five mortality. Except in Ghana and Malawi, where maternal work is a protective factor against under-five mortality, maternal work is a risk factor for under-five mortality in other countries. The adjusted model shows that six out of 26 countries show maternal work as a risk factor for under-five mortality. There is not a single country where maternal work is a protective factor against under-five mortality. Compared to stay-at-home mothers, maternal work is associated 66% and 89% higher odds of under-five mortality in Mali (Adj OR 1.66, 95% CI 1.32–2.08, $P < 0.001$) and Ethiopia (Adj OR 1.89, 95% CI 1.12–3.18, $P < 0.05$) respectively.

The results in Table 3 (above) run counter to the intuitive understanding that paid jobs enable women to take better care of their children, which should be expected to translate into less child mortality risk. Therefore, we stratified the paid work into three subcategories (agriculture jobs, blue-collar jobs, and white-collar jobs) for a more in-depth exploration of the link between maternal work and under-five mortality.

Table 4 provides the disaggregated regression results where the agriculture-related (OR 1.334, 95% CI 1.307–1.362, $P < 0.001$) and blue-collar jobs (OR 1.334, 95% CI 1.302–1.367, $P < 0.001$) are risk factors of under-five mortality, while the white-collar jobs are a protective factor (OR 0.742, 95% CI 0.707–0.779, $P < 0.001$).[7] The model adjusted for a set of potential confounders shows that compared with stay-at-home mothers, maternal engagement in agriculture-related jobs was associated with 24% higher odds of under-five mortality (Adj OR 1.241, 95% CI 1.145–1.346, $P < 0.001$), while mothers blue-collar job status was associated with 29% higher odds of under-five mortality (Adj OR 1.292, 95% CI 1.182–1.412, $P < 0.001$). However, the adjusted model failed to find any significant difference between stay-at-home mothers and mothers engaged in white collar jobs with respect to the risk of under-five mortality (Adj OR 1.102, 95% CI 0.938–1.295, $P > 0.05$).

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[6] Please see the Supplementary Table S-2 for a complete logistic regression analysis.

[7] Please see the Supplementary Table S-3 for a complete logistic regression analysis disaggregated by maternal work type.

Table 3 Country level logistic regression analysis of under-5 mortality and maternal employment (stay-at-home mothers vs working mothers)

Country	OR[a]	[95% CI]	AOR[b]	[95% CI]
Bangladesh	1.03	[0.90,1.17]	1.02	[0.57,1.82]
Cameroon	1.17*	[1.05,1.31]	1.36	[0.95,1.96]
Congo Democratic Republic	1.07	[0.92,1.26]	1.44	[0.80,2.59]
Benin	1.36***	[1.20,1.53]	0.88	[0.58,1.33]
Ethiopia	1.08	[0.98,1.19]	1.89*	[1.12,3.18]
Ghana	0.81***	[0.71,0.92]	1.91	[0.73,4.99]
Guinea	1.27***	[1.10,1.48]	1.47	[0.76,2.84]
India	1.39***	[1.30,1.48]	1.3***	[1.11,1.51]
Cote d'Ivoire	1.27*	[1.05,1.54]		
Kenya	1.28***	[1.12,1.46]	1.48	[1.01,2.17]
Madagascar	0.89	[0.77,1.04]	1.2	[0.47,3.03]
Malawi	0.86***	[0.80,0.92]	0.97	[0.78,1.20]
Mali	1.25***	[1.15,1.35]	1.66***	[1.32,2.08]
Morocco	1.15	[0.92,1.44]	1.21	[0.59,2.47]
Mozambique	1.1	[0.96,1.25]	0.75	[0.39,1.45]
Niger	1.23***	[1.14,1.33]	1.39	[0.93,2.07]
Nigeria	0.96	[0.90,1.01]	0.88	[0.71,1.08]
Pakistan	1.6***	[1.41,1.81]		
Rwanda	1.05	[0.91,1.21]	2.07	[0.57,7.57]
Zimbabwe	1.07	[0.95,1.21]	1.04	[0.66,1.65]
Uganda	1.07	[0.94,1.21]	1.25	[0.76,2.08]
Egypt	0.99	[0.87,1.12]	1.08	[0.79,1.48]
Tanzania	1.02	[0.92,1.13]	1.72	[0.99,2.99]
Burkina Faso	1.1	[0.98,1.23]	1.55	[0.80,2.99]
Yemen	0.99	[0.81,1.20]		
Zambia	1.05	[0.98,1.14]	1.43*	[1.02,2.01]

Exponentiated coefficients; 95% confidence intervals in brackets

[a]The odds ratios are unadjusted. [b]The AOR are adjusted odds ratios and the model is adjusted for duration of breastfeeding, birth interval (preceding and subsequent), residence, ANC visits, mother's and father's education, size of child at the time of birth, sex of child, mother's current age and marital status, number of children ever born, household wealth index and women's empowerment and survey wave

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Country Level Logistic Regression Analysis

Table 5 presents the country level logistic regression estimates in which maternal job types are stratified into multiple categories. When we compared maternal engagement in agriculture jobs with the stay-at-home mothers' category, the unadjusted estimates show a significant association between maternal engagement in agriculture sector-related jobs and child mortality in 15 out of 26 countries.

Except for two countries (Bangladesh and Malawi), maternal jobs in the agriculture sector is a risk factor of under-five mortality. The adjusted ORs suggest that maternal work is a risk factor in Cameroon, India, and Mali, while it is a protective factor only in Niger. A comparison of mothers doing blue-collar jobs with stay-at-home mothers shows a significant association between maternal engagement in blue-collar jobs and child mortality in 12 out of 26 countries (unadjusted ORs). Except in Ghana, the maternal blue-collar job is a risk factor of under-five mortality. The adjusted ORs suggest that maternal work is a risk factor in India, Kenya, and Mali. When we compared the maternal engagement in white-collar jobs with the stay-at-home mothers' category, unadjusted estimates show that maternal white-collar job was a protective factor against child mortality in 20 out of 26 countries. However, the adjusted ORs fail to find any significant association between the mother's white-collar job and under-five mortality.

Interaction Between Job Types and Breastfeeding

Since breastfeeding is a significant factor that protects against the risk of under-five mortality (Ahmed et al. 2016), we interact employment types with breastfeeding in our multivariate model. The interaction of breastfeeding and job types shows that even breastfeeding for more than 12 months fails to reduce under-five mortality risk for the women engaged in agriculture and blue-collar jobs (Table 6).[8] Compared with the women who stay at home and do not breastfeed at all, the under-five mortality risk is 98% higher (OR 1.989, 95% CI 1.588–2.490, $P < 0.001$) for the women who are engaged in agriculture job and have breastfed for more than 12 months. Similarly, the under-five mortality risk is two times higher for the women who are engaged in blue-collar jobs and who have breastfed for more than 12 months compared with the stay-at-home mothers who have never been breastfed (OR 2.036; 95% CI 1.571–2.639, $P < 0.001$). The interaction between white collar jobs of the mother and breastfeeding turns out to be a protective factor against under-five mortality, but this is statistically not significant.

Discussion

This study has found that the occupational status of the mother is significantly associated with under-five mortality. Compared to the stay-at-home mothers, maternal working status was associated with a 25% higher risk of under-five mortality in 26 countries from South Asia, Africa, and the Middle East. The strength of the association, however, differed across countries. Stratifying the working status into three job categories shows that maternal engagement in agriculture and blue-collar jobs was associated with 24% and 29% higher risk of under-five mortality than stay-at-home mothers. The country-level analysis also showed

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[8] Please see the Supplementary Table S-4 for a complete interaction analysis of maternal employment and breastfeeding.

Table 4 Logistic regression analysis with maternal employment stratified into three categories

Under-5 mortality	OR[a]	AOR[b]
Maternal employment types		
Stay-at-home mothers (Reference)	1	1
Agriculture	1.334***	1.241***
	[1.307,1.362]	[1.145,1.346]
Blue collar	1.334***	1.292***
	[1.302,1.367]	[1.182,1.412]
White collar	0.742***	1.102
	[0.707,0.779]	[0.938,1.295]
Country-fixed effects	No	Yes
Time-fixed effects	No	Yes
Log-likelihood	− 261,569.8	− 22,691.9
χ^2	1293.3	13,065.6
P	4.22e−280	0

Exponentiated coefficients; 95% confidence intervals in brackets

[a]The odds ratios are unadjusted. [b]The AOR are adjusted odds ratios and the model is adjusted for duration of breastfeeding, birth interval (preceding and subsequent), residence, ANC visits, mother's and father's education, size of child at the time of birth, sex of child, mother's current age and marital status, number of children ever born, household wealth index and women's empowerment

*$P<0.05$, **$P<0.01$, ***$P<0.001$

Table 5 Country level logistic regression analysis of maternal employment and under-5 mortality disaggregated by maternal employment type

Country	Agriculture workers vs stay-at-home mothers			
	OR*	[95% CI]	AOR†	[95% CI]
Bangladesh	0.81	[0.66,1.00]	0.98	[0.36,2.70]
Cameroon	1.32***	[1.17,1.49]	1.55	[1.01,2.40]
Congo, DR	1.15	[0.98,1.35]	1.88	[0.90,3.93]
Benin	1.6***	[1.40,1.82]	0.87	[0.51,1.48]
Ethiopia	1.11	[0.99,1.24]	1.98*	[1.04,3.77]
Ghana	0.9	[0.77,1.04]	2.03	[0.55,7.48]
Guinea	1.46***	[1.25,1.70]	1.27	[0.54,2.97]
India	1.46***	[1.36,1.57]	1.38***	[1.15,1.66]
Cote d'Ivoire	1.41***	[1.15,1.73]		
Kenya	1.34***	[1.15,1.57]	0.94	[0.59,1.49]
Madagascar	0.91	[0.78,1.06]	1.5	[0.43,5.21]
Malawi	0.85***	[0.79,0.91]	1	[0.79,1.27]
Mali	1.42***	[1.29,1.56]	1.9***	[1.43,2.52]
Morocco	1.87***	[1.43,2.44]	1.3	[0.52,3.22]
Mozambique	1.12	[0.98,1.29]	0.78	[0.32,1.92]
Niger	1.4***	[1.26,1.57]	1.29	[0.78,2.13]
Nigeria	1.03	[0.94,1.12]	0.64*	[0.46,0.91]
Pakistan	1.87***	[1.57,2.23]		
Rwanda	1.1	[0.95,1.27]	2.33	[0.56,9.78]
Zimbabwe	1.19*	[1.01,1.40]	0.92	[0.50,1.68]
Uganda	1.09	[0.96,1.23]	1.26	[0.72,2.20]
Egypt	1.43***	[1.18,1.73]	0.89	[0.49,1.62]
Tanzania	1.01	[0.90,1.12]	1.54	[0.86,2.75]
Burkina Faso	1.15*	[1.02,1.30]	1.47	[0.62,3.51]

Table 5 (continued)

Country	Agriculture workers vs stay-at-home mothers			
	OR*	[95% CI]	AOR†	[95% CI]
Yemen	1.15	[0.92,1.43]	1.42	[0.98,2.06]
Zambia	1.01	[0.93,1.10]		
Blue-collar workers vs stay-at-home mothers				
Bangladesh	1.07	[0.92,1.25]	1.09	[0.55,2.14]
Cameroon	1.11	[0.96,1.27]	1.38	[0.92,2.07]
Congo, DR	0.99	[0.80,1.22]	1.01	[0.44,2.31]
Benin	1.27***	[1.12,1.45]	0.85	[0.53,1.35]
Ethiopia	1.1	[0.96,1.26]	1.98	[0.85,4.60]
Ghana	0.83*	[0.71,0.97]	1.82	[0.60,5.56]
Guinea	1.01	[0.85,1.20]	2.07	[0.88,4.89]
India	1.41***	[1.28,1.55]	1.25	[1.00,1.57]
Cote d'Ivoire	1.21	[0.98,1.50]		
Kenya	1.44***	[1.24,1.68]	1.78*	[1.10,2.88]
Madagascar	0.88	[0.72,1.06]	0.65	[0.30,1.38]
Malawi	1.02	[0.92,1.13]	0.86	[0.63,1.18]
Mali	1.23***	[1.11,1.36]	1.44*	[1.05,1.97]
Morocco	1.21	[0.89,1.63]	1.18	[0.42,3.35]
Mozambique	1.1	[0.91,1.33]	0.87	[0.32,2.40]
Niger	1.19***	[1.09,1.31]	1.37	[0.88,2.14]
Nigeria	1.07*	[1.00,1.14]	0.93	[0.75,1.17]
Pakistan	1.5***	[1.27,1.76]		[...]
Rwanda	0.91	[0.74,1.11]	0.06	[0.00,2.57]
Zimbabwe	1.21*	[1.04,1.41]	1.08	[0.60,1.94]

Table 5 (continued)

Country	Agriculture workers vs stay-at-home mothers			
	OR*	[95% CI]	AOR†	[95% CI]
Uganda	1.27***	[1.09,1.48]	1.71	[0.85,3.47]
Egypt	1.34*	[1.07,1.68]	1.1	[0.62,1.94]
Tanzania	1.12	[0.96,1.32]	1.81	[0.83,3.96]
Burkina Faso	0.9	[0.78,1.04]	1.65	[0.82,3.29]
Yemen	0.94	[0.58,1.51]		
Zambia	1.2***	[1.09,1.32]	1.34	[0.83,2.17]
White-collar workers vs stay-at-home mothers				
Bangladesh	1.03	[0.64,1.67]	0.81	[0.25,2.58]
Cameroon	0.62***	[0.48,0.80]	0.54	[0.22,1.30]
Congo, DR	0.8	[0.61,1.03]	0.61	[0.10,3.93]
Benin	0.74*	[0.56,0.98]	0.41	[0.07,2.34]
Ethiopia	0.44*	[0.23,0.82]	0.75	[0.11,5.33]
Ghana	0.58***	[0.47,0.73]	1.13	[0.09,13.59]
Guinea	0.8	[0.54,1.18]		
India	0.57***	[0.42,0.76]	0.89	[0.53,1.47]
Cote d'Ivoire	0.59*	[0.37,0.93]		
Kenya	0.82	[0.64,1.06]	1.5	[0.80,2.80]
Madagascar	0.58*	[0.38,0.88]	3.89	[0.78,19.28]
Malawi	0.53***	[0.42,0.67]	1.32	[0.65,2.67]
Mali	0.78*	[0.62,0.99]	0.7	[0.30,1.62]
Morocco	0.32*	[0.14,0.72]	0.26	[0.02,3.11]
Mozambique	0.54*	[0.34,0.86]		
Niger	0.46***	[0.30,0.72]	1.4	[0.17,11.61]

Table 5 (continued)

| Country | Agriculture workers vs stay-at-home mothers | | | |
	OR*	[95% CI]	AOR†	[95% CI]
Nigeria	0.61***	[0.55,0.67]	1.04	[0.63,1.72]
Pakistan	0.94	[0.61,1.45]		
Rwanda	0.42***	[0.30,0.58]	0	[0.00,0.00]
Zimbabwe	0.77*	[0.61,0.97]	1.04	[0.44,2.44]
Uganda	0.57***	[0.42,0.78]	0.82	[0.13,5.06]
Egypt	0.71***	[0.59,0.86]	1.21	[0.76,1.90]
Tanzania	0.74	[0.52,1.05]	3.09	[0.64,14.93]
Burkina Faso	0.76*	[0.59,0.99]		
Yemen	0.47*	[0.28,0.80]		
Zambia	0.84*	[0.72,0.99]	1.27	[0.47,3.43]

STM refers to stay-at-home mothers; The odds ratios are unadjusted. † The OR are adjusted for duration of breastfeeding, birth interval (preceding and subsequent), residence, ANC visits, mother's and father's education, size of child at the time of birth, sex of child, mother's current age and marital status, number of children ever born, household wealth index and women's empowerment and survey wave

Exponentiated coefficients; 95% confidence intervals in brackets

*$P < 0.05$, **$P < 0.01$, ***$P < 0.001$

Table 6 Interaction model between job types and breastfeeding

Under-5 mortality × breastfeeding	Adj OR	95% CI
Agriculture-related jobs		
<6 months	3.943***	[3.126,4.973]
6–12 months	2.445***	[1.967,3.039]
>12 months	1.989***	[1.588,2.490]
Blue collar jobs	1	
<6 months	2.472***	[1.891,3.232]
6–12 months	2.436***	[1.892,3.138]
>12 months	2.036***	[1.571,2.639]
White collar jobs	1	
<6 months	0.953	[0.622,1.460]
6–12 months	0.728	[0.475,1.116]
>12 months	0.939	[0.582,1.517]
Log-likelihood	− 22,553.4	
χ^2	13,273.7	
P	0	

The interaction model involves two variables: job type and duration of the breastfeeding given in months. The reference category is stay-at-home mothers and the group of children who were never breastfed

Exponentiated coefficients; 95% confidence intervals in brackets

*$P<0.05$, **$P<0.01$, ***$P<0.001$

that agriculture and blue-collar jobs posed a greater risk of under-five mortality. In contrast, white-collar jobs were statistically not different from the stay-home-mothers for under-five mortality risk. The interaction of breastfeeding and job types shows that even breastfeeding for more than 12 months fails to reduce under-five mortality risk for the women engaged in the agriculture and blue-collar jobs compared with the baseline group of stay-at-home mothers.

Our study's major finding was that maternal employment increases the risk of under-five mortality is corroborated by some earlier studies (Saabneh 2017; Jafree et al. 2015; Andoh et al. 2007). Little evidence, however, exists regarding the exact pathways and mechanisms linking maternal work with an increased risk of under-five mortality. Existing literature has, nonetheless, highlighted the hazards involved in the women's work in the agriculture sector (Leal et al. 2017; Herrera and Kakehashi 2001) and blue-collar job categories, which may, in turn, be associated with the increased risk of under-five mortality. Increasing feminization of agricultural activities indicates a greater time away from home for the women (Farnworth et al. 2019) and the resulting change in the odds of under-five mortality.

Lack of adequate skills for operating machinery and exposure to harmful pesticides are associated with a range of health hazards for agriculture workers (Carr-harris 1993). A study in Mexico found that dangerous levels of organochlorine pesticide (OCP) residues represent a significant risk for women and children and may be associated with cancer-related mortality among women (Polanco Rodriguez et al. 2017). Pregnant/lactating women spending long hours in the fields, carrying very young babies to the fields and breastfeeding them at regular intervals, or leaving the

older babies behind during intense agricultural activity is a regular feature of Nepal's agricultural workers' lives (Panter-brick 1989). Similar patterns may be observed in developing countries in Africa and South Asia even today. Recently, a rapid transformation of the agrarian structure with a significant focus on the generation of new economic opportunities in developing countries such as Zimbabwe (Scoones and Murimbarimba 2020) needs to be aligned with the objective of reduced under-five mortality.

Blue-collar jobs of women, which generally involve manual work, are associated with lower physical functioning and general health outcomes (Andelic et al. 2015), a higher risk of cardiovascular disease (Fujishiro et al. 2015), higher blood pressure and hypertension (Aginsky et al. 2017; Joseph et al. 2016), poor work-life balance, and poor psychosocial well-being (Yang et al. 2018), workplace injuries (Oenning et al. 2018) and high stress level (Mutambudzi et al. 2018). Women's professional life attributes travel through the generations. A study found that the adolescent children of well-educated mothers had a higher height-for-age than those whose mothers had blue-collar jobs (Kunto and Bras 2018).

The women working in the hazardous atmosphere are also vulnerable to physical and mental health conditions that might adversely affect their childcare ability and might increase the risk of under-five mortality. Workplace exposure to toxic elements is a likely cause of cancer (Talibov et al. 2018). Occupational lifting and job strain increase the risk of abnormal fetal growth (Sejbaek et al. 2018). Emotional exhaustion and perception of problems as challenges are associated with the mental health problem (Talavera-Velasco et al. 2018). Stress at the workplace, intense physical activity, and exposure to noise and chemicals are associated with major depressive disorder (MDD) among women (Oenning et al. 2018). Suicidal ideation is associated with work-related emotional demands in women (Younes et al. 2018). The employed mothers of infants have to face significant challenges in reconciling the workplace demands and breastfeeding, and discontinuation of breastfeeding can cause adverse health outcomes for the children (Spitzmueller et al. 2018). These problems pinpoint the areas where policymakers in the developing world may need to step in to ensure that good child care options are being provided to working women and free access to counseling services.

Our estimates find that stay-at-home mothers and mothers engaged in white-collar jobs are similar with respect to the risk of under-five mortality. While it is evident that income generated from the white-collar jobs helps maintain a relatively better childcare standard, stay-at-home mothers may have some advantage with respect to the risk of under-five mortality. Stay-at-home mothers are more likely to provide exclusive breastfeeding or breastfeeding for a longer duration (Teka et al. 2015; Kimbro 2006). The eating patterns of the working mothers and stay-at-home mothers might be different with the former more frequently dining out (Park et al. 2014) which might explain the difference in the risks for child health. Better nutritional standards are also observed among stay-at-home mothers (Park et al. 2013; Li et al. 2012). In some contexts, stay-at-home mothers have been more satisfied and less depressed than working mothers (Yeoh et al. 2017). Some studies have found that women engaged in market work and housework may have similar life satisfaction levels (Baslevent and Kirmanoglu 2017). In some contexts, housewives rather than employed women were found to have better self-rated health (Dubikaytis et al. 2014).

Conclusion

This study has found that maternal employment is a risk factor of under-five mortality. Given the wide disparities in job types with respect to physical activity, exposure to workplace hazards, and economic returns, we stratified the maternal jobs into three types, including agriculture jobs, blue-collar jobs, and white-collar jobs. We found that maternal engagement in agriculture and blue-collar jobs was significantly associated with an increased risk of under-five mortality. The women engaged in white-collar jobs were statistically no different from stay-at-home mothers with respect to the risk of under-five mortality.

Since we used data from 26 countries from South Asia, Africa, and the Middle East from multiple waves from 1987 to 2016, various job types may correspond to different achievement levels in various countries at different points in time. Agriculture jobs may involve different health risks in different countries, depending on the state of technology and how it is made available to the people. On the other hand, stay-at-home mothers may not be a homogenous group and may widely differ with respect to their life circumstances. Though the disaggregation of women's work follows previous literature, it is not free from arbitrariness and may call for further refinement. The institutional factors, such as the level of gender parity and admissibility and maternity leave duration, while significant for the odds of child mortality, could not be included in this study and require further exegete. However, we have incorporated information related to a wide range of individual, household, and community-level characteristics to ensure that the effects of confounding factors and different types of individual heterogeneity are controlled for. The 26 countries in the sample are all developing countries, and the results may be generalized to other developing countries.

The study provides important insights for policymakers to explore how and why women's working status, particularly in white-collar jobs, does not act as a protective factor of under-five mortality, given the constraints that childcare services have limited coverage and are often under-utilized in many developing countries. Policymakers tend to assume that women doing paid work have greater sources to draw from, which automatically translates into better life circumstances, including reduced risk of child morbidity and mortality. The reality is that workplace dynamics are diverse and are associated with diverse life circumstances. Educating the policymakers and practitioners to understand the higher risk of child mortality associated with maternal paid work is a crucial first step. The policymakers need to carefully consider the terms of women's jobs, especially in the informal sector. Paid maternity leave and regulated working hours and monitoring of women's working conditions are expected to reduce child-mortality risk significantly.

Declarations

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