Linkage between maternal employment and under-five mortality in India during the era of Sustainable development Goals: Evidence from NFHS-4.

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Abstract

One of the targets for the third and fifth Sustainable Development Goals (SDGs) borders on child survival and women's economic empowerment, respectively.Economic globalization will give many women in developing countries access to steady and relatively remunerative employment for the first time, potentially shifting bargaining power within their households and changing the choices that are made for their children.The dilemmas working mothers face as they attempt to perform dual roles of mothering and working is being realized increasingly in our society.This study investigates the relationship between maternal employment and child mortality in India using NFHS-4 data conducted in 2015-16.To address the heterogeneous nature of working mothers, the employment-under five mortality relationship is analysed across various occupational categories.Life Table techniques and multivariate Cox regression analysis were used to calculate the Hazard Rates of mortality and its correlates. High risk of mortality is identified among children of working mothers. Our results also show that high risk of mortality are more prominent among children of mothers working in low-status occupations such as agriculture. The mortality disadvantage of children of working mothers emerges primarily after birth most likely because of inadequate childcare.

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Introduction

India accounts for 24% to all under-five mortality in the world. Residence in rural area, poverty and low levels of mother's education are known confounders of under-five mortality (Rajvir Singh and Vrijesh Tripathi, 2015).Sustainable Development Goals (SDGs) are global set of 17 goals, which are universally applicable. Post-2015 era marked the start of Sustainable development goals (SDGs) (UN, 2015). Child mortality has been at the peak of health discourse since years back. Governments, health professionals, and policymakers have reserved an exclusive interest in reducing the prevalence of childhood mortality globally. This interest has not only extended into the international scene, it has led to the development of sound interventions to reducing child mortality among children under the age of five between 1990 and 2015, and between 2015 and 2030 as tagged in the United Nation's Millennium Development Goals (MDGs), and Sustainable Development Goals (SDGs) respectively (UN, 2015). The SDGs target is to decrease under-5 mortality by not more than "25 per 1000 live births and infant mortality less than 12 per 1000 live births" (Liu et al., 2015). The number of children dying every day has reduced incredibly since 1990 but still the number of dying children under the age of 5 is more than six million per year. Based on the reports of 1992, 1998, and 2005, National Family Health Surveys, the risk of under-five mortality shows decline over time. This decline is due to the progressive and consistent implementation of the health interventions but the, reduction in under five mortality remained negligible.

The central figure of every home is the mother and it is her responsibility to see that all her children are fed and taken well care of. Motherhood confers upon a woman the responsibility of raising her child.This process can change the way in which she is perceived by the society and at her workplace. (Poduval et al, 2009).Women's participation in the workforce in developing countries has been increasing steadily over the last several decades. It is expected that women's employment may translate into

greater control by them over the expending of resources, increased media exposure and access to relevant information about childbearing and rearing and an enhanced ability to work outside home to meet the nutritive, medical and survival needs of children better (Sivakami, 1997).

Linkage of maternal employment to child survival

Several mechanisms have been suggested regarding links between maternal employment and child survival. An important outcome of a mother's employment is an increase in household financial resources. The additional household income is expected to improve living conditions, including better nutrition and health care. Compared to resources controlled by fathers, income in the hands of mothers has been shown to have greater positive impact on child health and survival(Luke & Munshi, 2011).Many of the earlier studies suggest two mutually compensating effects of women's work participation on child survival and care (Kishor Sunitha, 1998, Glazer, 1988). The first one is the positive effect accruing from the mother's income. The mother's work participation enhances the family income, which in turn has a positive impact on child nutrition and health. The labour force participation of the mother can have an adverse effect on child health as the child may not get full attention from its mother and may even have to forego the benefits of breastfeeding. These are probably happening in those families where, because of poverty, the mother must participate in the labour force soon after delivery.

The negative association between maternal employment and child survival in India was first reported by Basu and Basu (1991) and Mamta Murthi, Anne-Catherine Guio and Jean Drèze(1995)later, using data from the National Family Health Survey (NFHS), a few studies pointed a higher likelihood of death for children of working mothers than children of nonworking mothers(Guillot & Allendorf, 2010; Kishor & Parasuraman, 1998; Ladusingh & Singh, 2006).Hence, whether the net effect is positive or negative would be context-dependent. However, the findings under which effects are positive or negative are not always be clear.In the United States., an

extensive body of research suggests that if adequate alternative childcare is available, there are no negative influence of a mother's work status in child health (Hoffman, 1989). There is a trade-off between the benefits for children of mothers' increased income and the costs of reduced time of the mother in childcare. Maternal employment typically effects in a loss of childcare time; presumably, the mother is, therefore, less reachable for breastfeeding, making regular meals, etc. However, it is feasible that non-working mothers additionally spend relatively little time in childcare, or those crucial caregiving behaviors proceed to be performed if there is adequate alternative care. Few studies compare these childcare behaviors of working and non-working mothers explicitly.

One of the targets for the third and fifth Sustainable Development Goals (SDGs) borders on children survival and women economic empowerment, respectively. A robust investigation of the relationship between maternal employment and childhood mortality will provide information useful for programs aimed at ensuring the achievement of SDG 3 (healthy life for all) and SDG 5 (gender equality, girls and women empowerment). In India, the studies, particularly focusing on assessing the double burden or double blessing of motherhood and employment is lacking.Most part of India, The proportion of working mothers with young children are increasing tremendously but there is no general consensus on whether mothers work status have any negative effect on child survival. In fact, there have been only few studies in India that analysed the link between the employments of mother to under-five mortality. It is against this backdrop, in the Indian context, we explored the impact of women's work on under-five mortality.

Objectives

The impact of a woman's work on the health and well-being of her children and family is complex, and involves a potential for both positive and negative effects.In this paper we explore to which extent the participation of mothers in the labour market influence the under-five mortality. The specific objectives are

(1) To find out the association of maternal employment on Under-Five (0–59 months) mortality in India

(2) To analyse how the maternal occupational category and decision on spending own earnings modifies the effect of maternal employment on under-five mortality

Data and Methodology

Data

This study was based on National Family Health Survey -4, 2015-16. The data were extracted from Kids File. Data was obtained from mothers having the most recent live births within 5 years prior to the survey.The data used for estimating under-5 mortality rates in this study was based on live births reported by the respondents. The outcome variable for this paper was the risk of under-5 death which was measured from the duration of survival in months. This was defined as the risk of a child dying before reaching its fifth birthday. The analysis was based on children's data, particularly, all deaths from age 0 to 59 months. A sample of 259627 births were included in the data out of it, 11884 deaths (4.6 percentage) were reported. Under-5 mortality; the death of the children from day of birth to fifth birthday of child was the outcome variable in this study. Maternal characteristics are considered only for 45231 mothers who have at least one child under five years of age. Out of these mothers, 2054 mother's children have died before five years of age. Survival analysis such as Life Table techniques and Multivariate Cox PH regression analysis were used to analyse the Hazard Rates of mortality. Using the Cox proportional Hazard Model, we examined the effect of maternal work on under five deaths during 2015-16.Factors associated with under-5 mortality was identified using Cox Proportional hazard method. The estimates were presented as hazard ratio (HR) and their 95% confidence interval (CI). The analysis have been done using SPSS.

Methodology

The first stage in the analysis, the synthetic cohort life table technique was employed to estimate under five mortality.Next, a description of under-

five mortality in India by their maternal employment status and other explanatory variables using contingency table. In the last stage, Cox proportional hazards model was fitted to investigate the relationship between maternal employment and childhood mortality. Two sets of hierarchical models were fitted here. Individual effect of maternal employment on under –five mortality analysed in the baseline model (Model 1) was further analysed for identifying the effect of maternal employment modified by the occupational categories and autonomy of decision on spending their own earnings by the employed mothers in the second model (Model 2). In the first model (Model 1), the independent variables were included all at a time.In the first model, employment is entered as a dummy variable that takes the value of 1 if the woman is employed and 0 otherwise. In the second model, employment is entered as a four-category variable capturing the type of employment. Model 2was fitted for analysing how the effect of employment in model1 modifies it's linkage with under-five mortality by occupational category and decision on own earnings.The significance tests in the hazard models were performed at three levels, that is, "$p<0.05$, $p<0.01$and $p<0.001$". In the multivariate analyses, measure of effect was estimated as hazard ratio (HR) with 95% confidence interval (CI).

Variables Selected

Dependent Variable: Under-5 mortality

The outcome variable (dependent) was the risk of under-5 death (0-59 months), defined as a child dying between birth and the 5th birthday. Under-5 mortality was estimated for the five years preceding the survey. All children between 0 and 59 months of age were included in the estimation and exposure time, and cases were observed during this time frame, with all living children 59 months or younger being considered as exposures, contributing person-time, and all deaths among children 59 months or younger regarded as cases. Children born during the time frame (at birth) or before the time frame (at any age until 59 months) could enter this time frame.As such, the survival

time was age at death (in months). Children who survived the period 0–59 months were censored at their current age at the time of survey data collection.

Independent variables

By referring related studies conducted in India and other countries, we selected independent variables in three aspects such as biological factors, socio economic factors, and environmental factors. The main explanatory variable was maternal occupation.Maternal employment was assumed to enhance household's socio-economic resources, which in turn operate through a set of intermediate or proximate variables to influence child health outcomes such as mortality.

Life-table and Cox Hazard models

Life Table

This study compute cohort measures of mortality. In other words, we follow the children in our subsample from birth and compute probabilities of dying during consecutive age intervals, using the traditional Life-table method. The advantage of the synthetic cohort approach is that mortality probabilities can be readily calculated for time periods close to the survey dat. The life-table computation uses 16 age intervals: 0 months, 1–2 months, 2-3months, 4-5 months6–8 months, 9–11 months, 12–17 months, 18–23 months, 24–35 months, 36–47 months, and 48–59 months. In age intervals (duration of survival) each age interval, up to age one, interval is in months and after that the interval is one year. From these, the following commonly used measures of mortality during infancy and childhood are computed.ie, we considered the classification of under-five mortality as given below.

Neonatal mortality (NNM): The probability of dying in the first month of life (0 –1month)

Post neonatal mortality (PNNM): The probability of dying in the 2nd through 11th month (IMR-NNM)

Infant mortality ($_1q_0$) IMR:	The probability of dying before the first birthday (0-11 months)
Early child Mortality ($_1q_1$):	The probability of dying between the age 1 and 2 years
Late child mortality:	The probability of dying between ages 2 years and 5 years ($_3q_2$)
Child mortality ($_4q_1$):	The conditional probability of dying between the first and fifth Birthday for those who survive the first year
Under-five mortality ($_5q_0$):	The probability of dying before the fifth birthday

The Cox proportional hazards model:

Proportional hazard model is a class of survival models that assesses the relationship between one or more covariates with time. One of the advantages of this model is it does not require strong assumptions on the distribution of data. This model consists of two parts: the underlying hazard function, often denoted as $h_0(t)$, describing how the risk of the event per time unit changes over time at baseline levels of covariates; and the effect parameters describing how the hazard varies in response to explanatory covariates (X is a vector of explanatory covariates and â is a vector of unknown regression parameters). The Cox proportional hazards regression model can be written as follows:

$h(t) = h_0(t) \exp(b_1X_1 + b_2X_2 + ... + b_pX_p)$ Whereh(t) is the expected hazard at time t, $h_0(t)$ is the baseline hazard and represents the hazard when all of the predictors (or independent variables) X_1, X_2 , X_p are equal to zero.ie, h(t) is the hazard function, h0(t) is called the baseline hazard function (the expected hazard without any eûect of the considered factors), e is a base of the natural logarithm,*b1,b2 …, bp* regression coeûcients. The expression h (t)/h0 (t) is called the hazard ratio (HR) and indicates a growth

or decrease of hazard caused by an eûect of factors *X1, …,Xp.* The Cox regression model has a key assumption. The assumption is related to proportional hazards. The proportional hazards assumption states that the hazard ratio is constant over time or the hazard for an individual is proportional to the hazard for any other individual.

Table 1 Survival analysis of children under- five years of age in India using life. Table Techniques, NFHS-4(2015-16)

Duration of survival	Actual number entering in this interval	No. of withdrawn during the interval	No. of exposed of risk	No of terminal events	Proportion terminating	Proportion surviving	Cumulative proportion (Survival function)	Probability density function	Hazard rate
0-1	259627	1774	258740.00	7715	.029818	.970182	.970182	.029818	.030269
1-2	250138	3823	248226.50	785	.003162	.996838	.967114	.003068	.003167
2-3	245530	4073	243493.50	486	.001996	.998004	.965184	.001930	.001998
3-4	240971	4284	238829.00	419	.001754	.998246	.963491	.001693	.001756
4-5	236268	4405	234065.50	243	.001038	.998962	.962490	.001000	.001039
5-6	231620	4483	229378.50	185	.000807	.999193	.961714	.000776	.000807
6-7	226952	4351	224776.50	279	.001241	.998759	.960520	.001194	.001242
7-8	222322	4402	220121.00	139	.000631	.999369	.959914	.000607	.000632
8-9	217781	4453	215554.50	168	.000779	.999221	.959166	.000748	.000780
9-10	213160	4322	210999.00	143	.000678	.999322	.958516	.000650	.000678
10-11	208695	4079	206655.50	77	.000373	.999627	.958159	.000357	.000373
11-12	204539	3846	202616.00	63	.000311	.999689	.957861	.000298	.000311
12-24	200630	53309	173975.50	898	.005162	.994838	.952916	.004944	.005175
24-36	146423	49408	121719.00	198	.001627	.998373	.951366	.001550	.001628
36-48	96817	51401	71116.500	71	.000998	.999002	.950417	.000950	.000999
48-59	45345	45330	22680.000	15	.000661	.999339	.949788	.000000	.000000

Survival Analysis of children born during 2015-16 in India and its union territories are shown in the table1.The life table was calculated for the five years of life of children. In India 259627 birth were reported during this period among which 30 deaths/1000 live births were happened during their first month of life. This means that one in 33 live births died during the neonatal period.

From the life table the probability of deaths in the first month, first year and under five years of life were calculated as follows;

1-S (1) = 1- .970182= 0.029818

1-S (12) =1- 0.957861= 0.0421

1-S (24) = 1- 0.952916 = 0.0470

1-S (36) = 1-.951366=0.04863

1-S (48) = 1- .950417= 0.04958

That is, the IMR is 42 deaths per 1000 live births. Out of this the NMR is 29.8 and PNMR is 11.3which indicates that a lion share of the total infant deaths are occurring during their first month of life. Under- five mortality is 50/1000 live births in India. That means, one in every 20 births dies before they attain their fifth birthday. The hazard rate was 30/1000 live births (1 in every 33 births) which pointed out that the risk of dying during the first month of life of a new born baby was very high in India.

Table 2: Profile of mothers who have at least one child under five years of age according to NFHS 4, India 2015-16.

	CHARACTERISTICS	PERCENTAGE (%)
Age	<20	2.4
	20-34	87.6
	35-44	9.7
	45+	0.3

Marital status	Married	98.5
	Widowed	0.8
	Divorced	0.3
	No longer living together/separated	0.4
Education	No education	31.6
	Primary	14.6
	Secondary	44.8
	Higher	9.0
Occupation	Not working	76.8
	Professional/managerial	1.8
	Clerical/service	3.6
	Agriculture/manual	17.9
Place of Residence	Urban	23.7
	Rural	76.3
Religion	Hindu	71.9
	Muslim	15.8
	Christian	8.3
	Others	4.0
Wealth Index	Poor	50.1
	Middle	19.9
	Rich	30.0
Decision on spending own earnings	Respondent alone	14.8
	Respondent and husband/partner	64.5
	Husband/partner alone	19.1
	Someone else	1.6

The profile of mothers of under five children in India, 2015-16 are summarised in Table 2. Majority of mothers (87.6 percent) belong to the age group 20-34 and a negligible percentage (0.3%) are above 45 years of age. Most of the women are married and nearly one percentage are widowed, divorced or separated. Most of the mothers have secondary education (44.8%) and 76.3 percentages are domicile in rural area. A lion share of mothers does not work at the time of survey and around 2 percentage are working as professional or managerial workers. About 4 percent mothers working in clerical or service sector jobs while 18pecentge mothers are working in agriculture. Overall 72 percentage mothers belong to Hindu religion, 16 percent belong to Muslim and remaining belong to Christian or other religion. By considering the decision on spending the own earning, most of the mothers preferred a joint decision while 14.8 percent involved in self decision on own earnings. Half of the mothers belong to poor wealth background and 20 percent belong to middle income family and remaining in rich family.

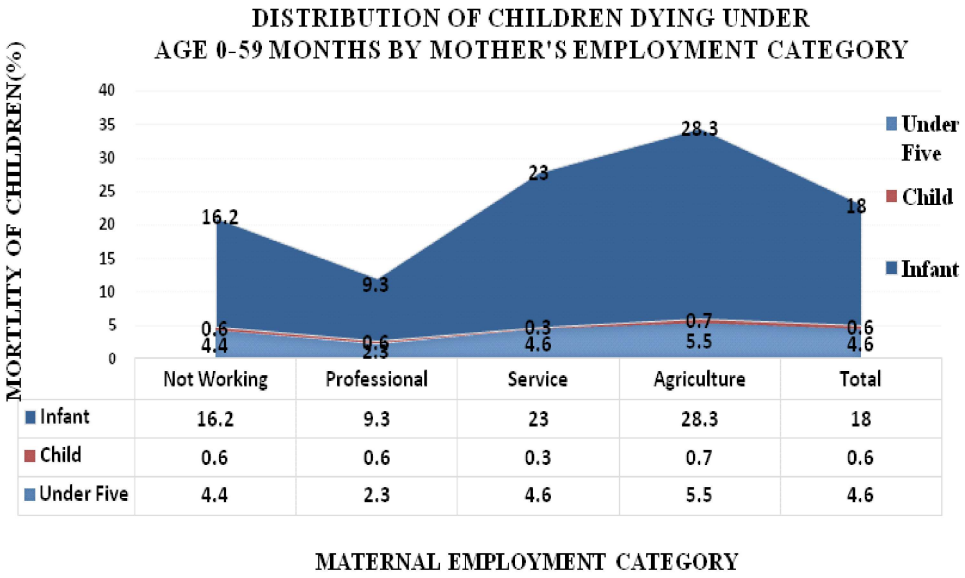

Figure 1:Distribution of children dying at age 0-11months,12-59 months and 0-59 months by mother's employment status.

To clarify further the effect of mother's employment on child mortality, Figure 1 shows the percentage of children dying at ages 0–59 months by type of employment.From the figure it is very clear that the probability of a child dying before its first birthday vary significantly by mother's employment status; however, having survived to the first birthday, a child's survival to its fifth birthday is significantly in higher risk if the mother works than if she does not.

Table 3 Relationship between maternal employment and under five mortality adjusted for maternal occupational category and decision on spending own earnings using Cox Proportional Hazards Regression models.

VARIABLES	CATEGORY	MODEL 1 HR[CI 95%]	MODEL 2 HR[CI 95%]
Work status	Not Working®		
	Working	1.11[0.745,1.652]	0.926 [0.734, 1.169]
Occupation	Not working ®		
	Professional		1.251[0.767 2.042]
	Clerical/Sale		0.456***[0.286,0.728]
	Agriculture		0.831 [0.6121.129]
Decision on spending own earnings	Respondent alone®		
	Respondent and husband/partner		0.711[0.336,1.506]
	Husband/ partner alone		0.801[0.396,1.622]
	Someone else		1.001[0.486,2.063]
Mother's Education	Illiterate®		

	Primary	2.519*** [2.31, 2.748]	
	Secondary	2.236***[2.037, 2.454]	
	Higher	1.593***[1.46, 1.738]	
Caste	SC®		
	ST	1.381***[1.30, 1.467]	
	OBC	1.208***[1.137, 1.285]	
	Others	1.236***[1.17, 1.305]	
Religion	Hindu®		
	Muslim	1.474***[1.32, 1.645	
	Christians	1.481***[1.318, 1.665]	
	Others	1.108[0.974, 1.262]	
Wealth Index	Poorest®		
	Poorer	2.581***[2.397, 2.779]	
	Middle	2.131***[1.975, 2.299]	
	Richer	1.745***[1.611, 1.89]	
	Richest	1.422[1.306, 1.547]	
Place of Birth	Home®		
	Hospital	0.708***[0.681, 0.736]	
Delivery Type	Normal®		
	Caesarean	1.519***[1.428, 1.615]	
Birth Weight	Large®		
	Normal	0.46[0.435, 0.487]	
	Small	0.404 [0.388, 0.421]	
Sex of Child	Male®		
	Female	1.113***[1.073, 1.154]	

Child is Twin	Single ®		
	Multiple	0.191***[0.179, 0.205]	
Place of Residence	Urban®		
	Rural	0.712***[0.679, 0.746]	
Source of Drinking Water	Piped®		
	Well	1.11***[1.05, 1.173]	
	Others	1.019[0.939, 1.106]	
Shared Toilet	No®		
	Yes	0.762[0.702, 0.827]	
Type of Toilet	Flush®		
	Pit	0.879[0.801, 0.964]	
	Other	1.198[1.113, 1.289]	

***P<0.01- Significant at 1%, ® Reference Category

This table explains the independent effect of maternal employment and other socio economic, biological and environmental factors on under five mortality in Model 1 and the adjusted effect of maternal occupational categories and decision on spending own earnings on under five mortality in Model 2. Concerning childhood mortality, there is no convincing evidence on the role of maternal employment, especially in countries like India. Some research endorse that children of women who are employed have greater riskof mortality due to the fact that such women do not have adequate time for child care. Our study also showed a negative relation of maternal employment on under-five mortality. The risk of under- five mortality is higher among children of working mothers in the base model. In Model2, after adjusting other employment factors, the effect significantly decreases the risk of dying of under five children.Model 1 revealed that the risk of

death (0–59 months) was higher among children whose mothers were working (HR = 1.11), that means there is 11% higher likelihood of mortality among children of working mothers than nonworking.The highly significant effect of mother's employment on child mortality at ages 0–59 months translates into a risk of dying is higher if the mother is employed, andis less otherwise. This effect was modified by a slight decrease in the risk of under-five mortality among children of employed mother's (HR=0.926)while adding the occupational category of mothers and autonomy of decision to spend their earnings.Religion plays an important role in the under-five mortality.In general, the effects of all controls appear to be in the expected direction. The higher the mother's education, the lower the probability of a child dying.Both Muslim and Christian children have about 53 percentage more risk of mortality than Hindu children before attaining their fifth birthday. The overall result revealed that maternal work status, education, household wealth index and source of drinking water have significant effect on the under-five mortality and attaining higher education by women can reduce the risk of under- five mortality. The result also calls for the importance of independent toilets rather than shared toilets which can be indirectly affect mortality of children through morbidities like diarrhoea.

Results and Discussion

Motherhood depends on the quality of care provided by mother on her child. Being an employed mother is a tough responsibility especially for the health outcomes of underage children. Working mothers with a good adjustment between workplace and family can provide quality care for their children (Poduval et al., 2009). Previous studies on the relationship of maternal employment with child health outcome have yielded mixed results. This study therefore contributes new evidence on the link between the two. Concerning childhood mortality, there is no convincing evidence on the role of maternal employment, especially in developing countries. Earlier research from India showed that mortality rate of children under age of 5 is more for the employed mother (Kishore Sunita et al., 1998). A negative effect of

maternal unemployment on child mortality is consistent with previous studies on child health outcomes such as nutritional status. A qualitative study conducted to observe the impact of maternal employment on nutritional and health status of child found that mothers working long hours effect the children's nutritional status and adequate care arrangements (Nair et al., 2017). Our study also supports this results.However, when mother's employment is disaggregated bytheir job category, the risk mortality turned decreased from 11 percentage higher risk to 7 percentage lower risk concerning employment status. In the univariate model, children of employed mothers showed higher risk of mortality compared to their counter parts.

Conclusion

Globally, the under-five mortality rates have steadily declined but in India, years to go for achieving the sustainable development goals.In general, our study finds that under five mortality vary in great extent by whether the mother is employed or not, and mother's employment does have negative consequences for child survival if the mother works in agriculture.Since two-thirds of India's population lives in rural areas, mothers employed in agriculture present a particularly vulnerable population in the Indian context and it is imperative that concerns of this sizeable population are addressed in order to achieve MDG4 targets of reducing under five mortality.In fact, in India, there have been very few studies that link the employment of mother to under-five mortality.Updated evidence on the relationship between maternal employment and childhood mortality are needed to make suggestions useful to fine tune policies and programmes in pursuit of SDG 3 and SDG 5. In summary, previous studies about the relationship between maternal employment and childhood mortality in India depict some knowledge gaps, which the present study was designed to fill. This study contributes to a better understanding of how the maternal employment could be beneficial in the sense that they are positively linked to the under-five

mortality. Even though the economic effect of working mother is positive, the time spend for child care responsibilities may be lacking and negatively associated with child survival. Mother's employment consistently reduces the probability of survival from ages one to five for children. If a woman is employed in a job that is compatible with childcare responsibilities, then the relationship would not be negative. However, examining the influence of the type of work of mother on under five mortality sheds some light on possible explanations. It is evident from the result that children of professional mothers have lesser chance of mortality than children of mothers working in service sector or manual workers. The information about the quality time spend with children are missing in this data. Poor or polluted environments tend to expose children to disease-causing agents, predisposing them to high mortality risks and it is clear from the results that households who shared toilet with other households are at a higher risk to experience under-five mortality.Furthermore maternal education plays a major role in under-five mortality.Women unemployment needs to be addressed as a development priority. Increased participation of women in the formal labourforce will positively affect child survival. Because the majority of women are employed in the informal sector (sales, agriculture, and manual work), it may be beneficial to design special advocacy programmes on child survival and targeted at these group of women.This study's finding suggests that working women are unable to devote as much time and resources as those who do not work to ensure the survival of their children.The negative association between maternal employment and child survival is usually attributed to the reduction in time that working mothers can spend providing childcare. Support of this explanation, however, is limited. This results thus leads to further research which analyse the time spend by mothers on child care and the nature of the employment- child survival association by examining gaps between children of working and nonworking mothers in India. Moreover, in this study results calls for attention on further research on time spend for child care and its impact on under five mortality.

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