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POLICY BRIEF
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THE ECONOMIC COST OF SUBOPTIMAL/ NON-BREASTFEEDING IN PUNJAB

A non-breastfed child is 14 times more likely to die in the first six months than an exclusively breastfed child (The Lancet, 2008)

SUMMARY

Punjab, despite being the literate and most populous province in Pakistan, has the suboptimal breastfeeding rates; around 9.5% of mothers start breastfeeding their babies within the first hour of birth, with another 42.1% exclusively breastfeeding their children in 6 months of age. The rates of exclusive breastfeeding in Punjab are increasing but at a slow rate. The suboptimal level of breastfeeding is associated with many healthcare and economic cost. It is evident that substituting any other feeding method for infants and young children comes at a significant cost to the child, mother, family, community, and the national economy. Policy brief has estimated the direct cost of suboptimal/non-breast- feeding in Punjab. It is estimated that the suboptimal level of breastfeeding leads to more than **61 thousand** deaths amongst infants in Punjab. The total cost incurred for the health care system amounts to **US$ 77.7** million annually. The cost of formula milk feeding is about **US$ 63.71** million. The data generated in this brief will be helpful for policy making, particularly in the context of improving breastfeeding support in hospitals, community, and maternity leave programs, raising awareness about the financial burden incurred by poor breastfeeding practices, and highlighting a new area for research in Punjab. Adding the argument of economic cost is expected to make breastfeeding messages more persuasive.

INTRODUCTION

The Global Strategy for Infant and Young Child Feeding (IYCF) jointly developed by the World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) underscores the significance of good nutrition practices for infants and children growth and development.[1] Promotion and integration of good breastfeeding practices alongside social practices are essential components of the IYCF Global Strategy. The benefits of breast feeding for the health and nutrition of infants are incontrovertible. Available literature (Martin et al., 2005) (Horta et al., 2015) suggests that those who are breastfed have lower mean blood pressure, lower total cholesterol, and show improved intelligence test results. Overweight/obesity and type-II diabetes are also less observed among them. . Conversely, poor feeding practices have adverse life-long impact including poor school performance, reduced productivity, and impaired intellectual and social development[2]. Pakistan voted in favor of the International Code of Marketing of Breast milk substitutes during the World Health Assembly in May 1981 and enacted legislation for the protection of breast feeding in 2002 titled the 'Protection of Breastfeeding and Child Nutrition Ordinance 2002'. A National Infant Feeding Board (NIFB) to monitor the implementation of the Ordinance was constituted after in July 2010. After devolution under the 18th Constitutional Amendment, Punjab adopted the 2002 Ordinance and notified it as the 'Punjab Protection of Breastfeeding and Child Nutrition Act 2012.[3,4] An Infant Feeding Board was constituted in 2014. Post devolution interventions introduced by the Punjab Government to improve infant IYCF and nutrition included the integration of reproductive,

maternal, newborn, child health, and nutrition programs i.e. the (IRMNCH&NP); development of Punjab Multi-Sectoral Nutrition Strategy (MSNS) by the Planning and Development (P&D) Department; CM's Stunting Reduction Program in Punjab; establishment of Multi-Sectoral Nutrition Centre (MSNC) at the P&D Department; and establishment of nutrition treatment sites. All these policies and interventions aimed at increasing the breastfeeding rates. Empirical evidence has also suggested that lower breastfeeding rates lead to higher economic costs in terms of economic growth (Smith, 2013), work and productivity (Siregar, 2018), (Siregar, Pitriyan, & Walters, 2018) as well as the social cost in terms of both infant and maternal mortality (Alison, 2009). High breastfeeding rates decreased the incidence of multiple diseases in both breastfed babies and breastfeeding mothers, reducing healthcare costs. Several researchers have calculated the economic costs of healthcare systems in various countries while using different measure of estimations but no attempt has yet to be made in Punjab. This policy brief aims at highlighting the direct economic cost of suboptimal breastfeeding practices in the province of Punjab.

MEASUREMENT OF ECONOMIC COST OF SUBOPTIMAL/ NON-BREASTFEEDING IN PUNJAB

Breastfeeding is benefited for both mother and child but some of the mothers do not initiate breastfeeding due to different reasons (Ogbuanu et al. 2009). The current pace of an increase in the prevalence rate of exclusive breastfeeding under six months of age is not very impressive in Punjab. The measurement of economic cost of non-breastfeeding may put some additional appreciation to its importance for the children, families as well as the society. In the context of Gross National Product (GNP), value of other substitutes or non-breastfed items such as formula milk, non-milk liquids, and other supplements is calculated. The measurement of the cost of total non-breastfed items used in Punjab and its impact to the economy can be measured based on some assumptions. Non-breastfeeding sometimes leads the child and mother to morbidity and mortality (Alison Stuebe, 2009). The diagnosis and treatment of these illnesses result in medical care use. According to the Pakistan Social and Living Standards Measurement Survey (PSLM)/ Household Integrated Economic Survey (HIES), 2018 data, the monthly out of pocket expenditures (OOPEs) on healthcare are about 3 percent of the total household expenditures in the province of Punjab. These OOPEs put burden on families which are already

[1]World Health Organization (WHO). Global Strategy for Infant and Young Child Feeding http://www.who.int/nutrition
[2]Horta et al. Evidence on the long-term effects of breastfeeding systematic reviews and meta-analyses. World health Organisation http://apps.who.int/iris/bitstream/10665/43623/1/9789241595230_e ng.pdf
[3]https://www.savethechildren.net/sites
[4]https://extranet.who.int/nutrition/gina/sites

living in poverty. These expenditures may likely to be reduced with successful breastfeeding promotion. To estimate the economic cost of suboptimal/not breastfeeding in Punjab, we have used the following data sources and indicators.

DATA SOURCE AND METHODOLOGY

The data of the Multiple Indicator Clusters Survey (MICS, 2017-18), Punjab has been used. In this brief, we have used three categories of indicators for reflecting the cost of suboptimal/non-breastfeeding including;

1. Cost of child mortality due to suboptimal breastfeeding (This cost represents the possible benefit to a country's economy from future earnings over a person's productive years that will be missed as a result of premature death due to not breastfeeding (Dylan D Walters, Linh T H Phan, Roger Mathisen, 2019).

2. Health system and household costs due to child morbidity with suboptimal breastfeeding practices

3. Economic costs of breastmilk substitutes or infant formula milk.

In the studies published in literature on measuring the cost of nonbreastfeeding such as Bagriansky J, Voladet S, (2013), Bagriansky J, (2014), Walters et al., (2016) have also used the same indicators for measuring economic cost of non-breastfeeding. Simple method of multiplication, division, addition and subtraction in excel have been used for calculation in each of the indicator.

Figure 1: Indicators reflecting the cost of suboptimal/non-breastfeeding
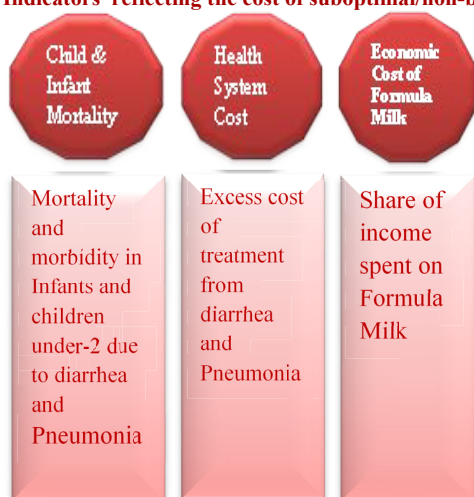
CHILD MORTALITY ATTRIBUTED TO SUBOPTIMAL BREASTFEEDING PRACTICES

According to World Health Organization, Suboptimal breastfeeding practices, includes all non-exclusive breastfeeding practices and it intimidate the child and mother life. The relative risk associated to optimal and suboptimal level of breastfeeding according to age groups is given in table 1. There is least chance of death in children who are exclusively breastfed since early six months of their life. Children who are not breastfed are more likely to consume unsafe water (such as mixed in formula milk) and may less develop immune system, this makes them more vulnerable to pathogens that cause diarrhoea and pneumonia[5]. The consequences will last a lifetime. The Meta data and systematic review of both developing and developed countries conducted in a report by the World Food Programme Pakistan, 2017 indicated that the relative risk of life with suboptimal breastfeeding practices lengths not only during the first 6 months of child life, but also up to 2 years of age. The study quantified the infection-specific pathways to infant and child mortality age 0-6 months and 6-23 months with different level of suboptimal breastfeeding practices. According to results of the study, the risk of mortality in children aging 0-6 months with breastfeeding is 10.53 percent for diarrhea and 15.13 percent for pneumonia, while the relative risk of mortality with pre-dominant and partial breastfeeding in diarrhea is 4.62 percent and 2.28 percent respectively. The children 6-23 months old with non-breastfeeding are at risk of mortality by 2.1 percent in diarrhea and 1.92 percent in pneumonia (table 2).

[5]https://www.unicef.org/niger/stories/no-water-breastfeed-only

Table 1: Relative risk for infant mortality by suboptimal breastfeeding behavior

	Children 0-5 months		Children 6-23months	
	Predominant breastfeeding	Partial Breast feeding	None	None
Diarrhea	**2.28**	**4.62**	**10.53**	**2.1**
Pneumonia	**1.75**	**2.49**	**15.13**	**1.92**
All Mortality	**1.48**	**2.85**	**14.4**	**3.68**

Source: Extracted from report " The Economic Consequences of Undernutrition in Pakistan: An Assessment of Losses" by WFP Pakistan

Age specific and disease specific direct estimates of neonatal, infant, and child mortality has been calculated on the basis of crude birth rate and crude death rates extracted from MICS, 2017-18 data. The estimated number of deaths in a year 2020 is given below

Table 2: Estimated Loss of neonatal, infant and under-2 lives in 2020

Total Population in 2020 (according to growth rate 2.13)	117,193,035
Crude Birth Rate	29.8
Total Births	3,493,352
Neonatal estimated total deaths at NMR 41/1000 live births	143,227
Infant Estimated Total Deaths at IMR 58/1000 live births in 2020 (growth rate of decline is estimated 1.6 percent between 2003 to 2018)	202,616
Under -2 Estimated Total Deaths at MR 64/1000 live births (growth rate of decline is estimated 3.17 percent between 2003 to 2018)	223,574

Source: Author's Calculations

According to the UNICEF, Pneumonia and Diarrhea are the major contributors of child deaths in Punjab (UNICEF, 2017). A study conducted by Rana, S. M. (2011) estimated that 23.9 percent of deaths occurred in Punjab by the Acute Respiratory Infection (ARI) and 20.4 percent by diarrhea., by applying the same assumption, the total deaths attributed to ARI and diarrhea are given in the table below. Furthermore, it is estimated that in diarrhea and pneumonia related deaths, about 73.9 percent and 63.4 percent of deaths in neonatal period are attributed to suboptimal breastfeeding practices. Similarly, 83.6 percent and 75.6 percent deaths in infants are attributed to diarrhea and pneumonia (World Food Programme Pakistan, 2017).

Table 3: Projected neonatal and infant mortality due to suboptimal breastfeeding practices in year 2020

Total neonatal deaths attributed to ARI	34,221
Neonatal Mortality by ARI due to suboptimal breastfeeding	21,702
Total neonatal deaths attributed to diarrhea	29,218
Neonatal Mortality by diarrhea due to suboptimal breastfeeding	21,592
Total Infant deaths attributed to ARI	41,333
Infant Mortality by ARI due to suboptimal breastfeeding	30,545
Total Infant deaths attributed to diarrhea	48425
Infant Mortality by diarrhea due to suboptimal breastfeeding	30,701
Total monthly income/economic loss due to child mortality (in USD)	2,828,799

Source: Author's Calculations

The income/economic loss due to a child's death have been calculated in terms of future earnings not generated by more than 61 thousand infants who died prematurely due to non-breastfeeding. All the calculation has been made by using simple methods of addition, subtraction, multiplication and division in excel. The income loss is calculated from the year a child turns 18 until the earliest point between his/her expected retirement age i.e. 60. According to calculations by using the neonatal and infants deaths data attributed to suboptimal breastfeeding (61,246 infant deaths) given in table 3 and the average monthly income (PKR 7390 or USD 46 as per the HIES, 2018 data), the monthly loss amounts to 2.8 million dollars with an annual loss of 33.9 million dollars.

HEALTH SYSTEM AND HOUSEHOLD FORMULA COSTS

Punjab incures high medical cost for treatment of diarrhea and pneumonia (UNICEF, Pakistan, 2017). The annual average cost of non-breastfeeding-related diarrhoea and pneumonia care is calculated by multiplying the number of cases receiving outpatient and inpatient services by the unit cost of treatment for infants. (Dylan D Walters, Linh T H Phan, Roger Mathisen, 2019). In Punjab, diarrhea prevalence is 19 percent and ARI is about 14 percent (MICS, 2018). Based on the morbid population numbers and the number of episodes of these two diseases (using MICS 2018), the total healthcare cost is calculated. World Food Program (WFP), Pakistan in a study titled 'The Economic Consequences of Undernutrition in Pakistan: An Assessment of Losses, found the mean cost of diarrhea treatment US$ 7.91 per primary health care consultation and the same was found for pneumonia treatment. The cost of treatment included all direct (cost of medicine and health facility) and indirect cost (family time and travel). The same cost of treatment is used in this policy brief for calculations of total healthcare cost in both morbidities in Punjab. After adjustment of inflation in 2019-20, the estimated cost increased as US$ 8.11 for both diseases. According to the MICS 2018, some families did not seek treatment of diarrhea and ARI/Pneumonia at public or private health facilities. A separate calculation has been made in the WFP study to measure the cost incurred to families for treatment of diarrhea and pneumonia at home. Based on their in-depth review of literature, they found the per unit cost US$ 4.01 for diarrhea and US$ 2.29 for ARI for home treatment. After adjustment of inflation, the estimated calculation is US$ 4.11 for diarrhea and US$ 2.34 for ARI/pneumonia in 2019-20. The total number of cases of diarrhea and pneumonia has been derived from the MICS survey 2018; the mother was asked if her child had diarrhea or pneumonia in last two weeks. It is evident from the literature that over the course of a year, children under-2 years of age suffer approximately 6 episodes of diarrhea and 4 episodes of ARI (UNICEF, Pakistan, 2017). Assuming the 2 weeks snapshot of prevalence of both diseases, the total provincial burden of diarrhea with its average episodes is approximately 6.3 million cases and ARI/Pneumonia cases are about 2.24 million. The population of under-2 children has been extracted from the total population in Punjab (population in 2020 according to growth rate 2.13) on the biases of percentage distribution of population by age (Labour Force Survey, 2018).According to the WFP study, about 22 percent of diarrhea and 8 percent of ARI/Pneumonia cases can be attributed to suboptimal breastfeeding in Pakistan in under-2 year of age. By applying the same assumption, the total cases attributed to suboptimal breastfeeding in diarrhea and ARI/Pneumonia are 1.39 million and 0.179 million respectively. It was also reported in MICS, 2018 that 65.7 percent mothers seek treatment in health facilities for their children in the diarrhea cases and 74.7 percent in ARI cases. It suggested that 0.92 million seeking treatment of diarrhea at health facility and 0.48 million seeking treatment of diarrhea at home. Likewise, about 0.134 million mothers seeking treatment of their children for ARI/Pneumonia at public or private health facility and 0.045 million at home. The total cost of avoidable health care treatment of childhood diarrhea and ARI/pneumonia attributable to sub-optimal breastfeeding is about US$ 77 million annually in Punjab.

Table 4: Projected illness cases and healthcare cost due to suboptimal breastfeeding practices in 2020

Total Population under-2 (4.77% of total population in Punjab)	5,590,107
Total Diarrhea Cases in Punjab as MICS prevalence rate under- 2 (18.95%) and 6 episodes per year	6,355,953
Total Diarrhea Cases attributed to suboptimal breastfeeding	1,398,309
Total ARI Cases in Punjab as MICS prevalence rate under- 2 (10.05%) and 4 episodes per year	2,247,223
Total ARI/Pneumonia Cases attributed to suboptimal breastfeeding	179,777
Cost of avoidable health care treatment of childhood diarrhea attributable to suboptimal breastfeeding (US$) if seeking treatment at facility.	74,550,571
Cost of avoidable health care treatment of childhood diarrhea attributable to suboptimal breastfeeding (US$) if seeking treatment at home.	1,971,239
Cost of avoidable health care treatment of childhood ARI/Pneumonia attributable to suboptimal breastfeeding (US$) if seeking treatment at health facility.	1,089,124
Cost of avoidable health care treatment of childhood ARI/pneumonia attributable to suboptimal breastfeeding (US$) if seeking treatment at home.	106,432
Total health system cost of suboptimal breastfeeding (US$).	77,717,366

Source: Author's Calculation

ECONOMIC COST OF BREASTFEEDING SUBSTITUTES

The child is usually fed with formula milk when not breastfed, the 'cost of formula' for infants is significant for households especially in the lowest wealth quintiles. Families pay for infant formulae, feeding bottles, sterilizing equipment and fuel, etc. in case of non-breastfeeding. In Punjab, the formula milk prevalence under 6 months of age is 19.7 percent as per MICS, 2018 data. The average daily requirement of formula milk in each month has been calculated by reviewing the feeding guidelines given on national and international brands of infant formula milk. Similarly, the price of formula milk is calculated by taking average price of economy brand formula milks in Pakistan through an online search for e-commerce vendors, the same methodology has been using in a study conducted by Dylan D Walters, Linh T H Phan, Roger Mathisen, (2019). As a result, the average cost of artificial feeding per child per month is about PKR 6809/- or US$ 42.56 (see table 5). The minimum monthly wage in Pakistan is PKR 17,500/- or US$ 109.37 per month. The amount spent on infant formula milk is equivalent to 39 percent of the minimum wages of a skilled labour. In Pakistan, formula manufacturing is a multi-billion-dollar industry. Besides, the volume of imports of formula milk is rapidly growing due to highest sales of infant and child formula in this region. According According to study conducted by Dylan D Walters, Linh T H Phan, Roger Mathisen, (2019), the households spent 18.8 percent of their nominal income on formula milk to feeding their children in Pakistan. Nationally, we spent US$ 1.2 billion on purchase of formula milk for children (Alive & Thrive (A&T) data). The projected population for year 2020 is extracted from the sixth population and housing census 2017 on the basis of percentage distribution of population by age in Labor Force Survey, 2018 that is the percentage population under one year of age is 2.33% of total population. By applying the assumption of uniformity, we have 1.17 % of the population in under six months. The estimated population of under 6 months of age is about 1,371,158. In Punjab, according to prevalence rate of formula milk feeding, it is estimated that 270,118 children are fed through the artificial formula milk.

The total expenditures on formula milk incurred to every family in six months (exclusive breastfeeding period) are about US$ 80 million. Although, it is worth mentioning here that all cost of formula milk cannot be saved even in best practices of breastmilk since mothers need to consume additional food to account for the additional caloric requirements. But due to data and time limitation, this cost is not measured.

Table 5: Cost of formula milk feeding

Months	Average cost of Bottle	Average daily requirement of Infant formula milk in grams	Average monthly requirement of infant formula milk in grams	Unit cost for price of lowest economy brand of formula per gram US$	Total cost of formula feeding in US$
First	520*	92	2760	0.009	26.96
Second		115	3450	0.009	33.69
Third		138	4140	0.009	40.43
Forth		138	4140	0.009	40.43
Fifth		161	4830	0.009	47.17
Sixth		161	4830	0.009	47.17
total consumption			**24150**		255.34
Average Consumption per month+ cost of bottle			**4205**		45.69
Total population of children under 6 feeding with formula milk					270,118
Total Cost (USD)					63,707,383

Source: Author's calculation based upon the feeding guide of children given on national and international brands of infant formula milk

*It is assumed that one bottle is sufficient for feeding in six months

Total Cost Attributed to Suboptimal Breastfeeding

The direct economic losses included the future income loss due to infant and neonatal mortality. The treatment of diarrhea and pneumonia also involved high cost. The projected total cost incurred to individuals, families, and society in year 2020 due to suboptimal breastfeeding is US$ 143.32 million.

Table 6: The total cost of all three components

Loss of future income due to infant and neonatal deaths	**33,945,588**
Diarrhea Treatment (US$)	**76,521,810**
ARI treatment (US$)	**1,195,556**
Infant formula Milk (US$)	**62,781,363**
Total Direct Cost due to suboptimal breastfeeding (US$)	143,327,528

POLICY IMPLICATIONS

The results generated in this brief showed that about 61,000 deaths of infants could be saved every year by increasing the breastfeeding practices. Similarly, the cost incurred due to diarrhea and ARI/ pneumonia treatment, loss of future income due to infant and neonatal, cost of infant formula milk

in suboptimal breastfeeding practices could also be saved by increasing breastfeeding practices at the most intimate level in Punjab. This result will be helpful for policy making, particularly in the context of breastfeeding support in hospitals, breastfeeding support in the community, and maternity leave programs, raising awareness about the financial burden incurred by poor breastfeeding practices, and highlighting a new area for research in Punjab. Adding the economic cost argument is expected to make breastfeeding message more persuasive. With strong advocacy, better communication, and interpretation of suboptimal breastfeeding cost to the mothers, the breastfeeding rates may be improved; The health system costs could be turned into health budget cost savings if breastfeeding rates increase. Furthermore, formula feeding is neither effective for improving infant health or cognitive growth, nor is it affordable for the vast majority of Punjabi families living in poverty. The cost of buying infant formula milk will be reduced as the breastfeeding rate improves

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