2. Review of Literature

CHAPTER 2

REVIEW OF LITERATURE

The following chapter discusses the literature reviewed in the context of child under nutrition, its causes and the behaviour change communication (BCC) strategies to improve the nutritional status of the children by improving the infant and young child feeding (IYCF) practices along with prevention and management of childhood diarrhoea. The chapter comprises of the following heads:

2.1 **Under 5 mortality rate (U5MR)**

- 2.1.1 Global trends in U5MR
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- 2.1.3 Causes of U5MR

2.2 **Under nutrition**

- 2.2.1 Global trends
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- 2.2.3 Causes of undernutrition
- 2.2.4 Consequences of Undernutrition
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2.3 **Trouble shooting under nutrition**

- 2.3.1 IYCF practices
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  - 2.3.1.5 Timely, adequate, safe and proper complementary feeding.
- 2.3.2 BCC intervention

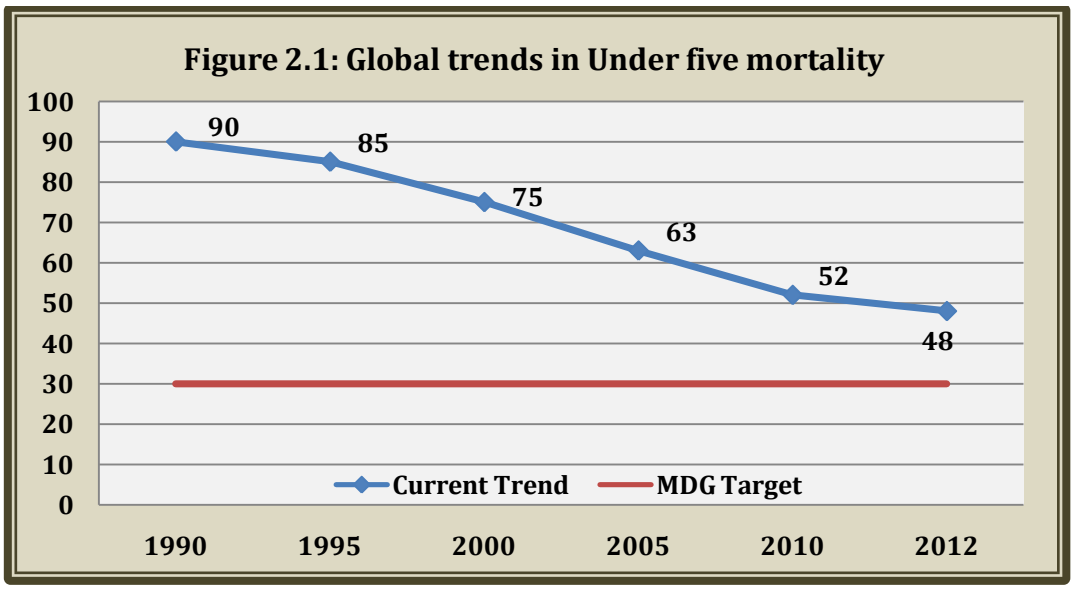
2.1: Under five mortality rate (U5MR)

At the millennium summit in 2000, representatives from 189 countries committed themselves toward a world in which sustaining development and eliminating poverty would have the highest priority(United Nations, 2000).

Millennium Development Goal 4 (MDG 4) calls for reducing the under-five mortality rate by two thirds between 1990 and 2015.

2.1.1 Global trends in U5MR

As per UNICEF2014 report on MDG, child mortality the world has made substantial progress, reducing the under-five mortality rate 47 percent, from 90 deaths per 1,000 live births in 1990 to 48 in 2012 (Figure 2.1)



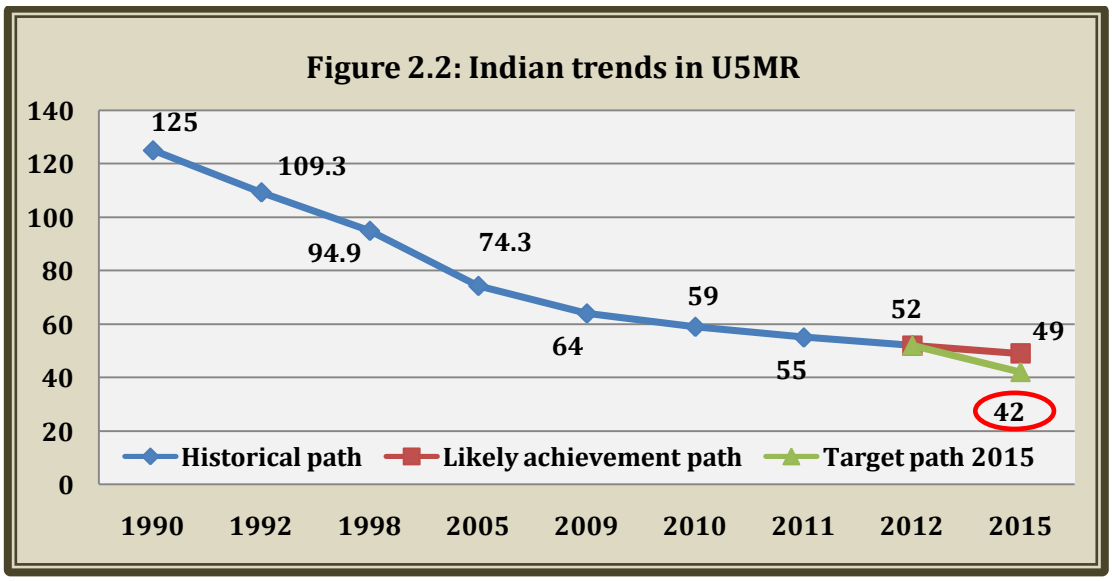
According to the report about 17,000fewer children died each day in 2012 than in 1990. During the past two decades the under five mortality rate has reduced at the fastest rate than at any other time. The global annual rate of reduction in underfivemortality has accelerated steadily from 1.2 percent between 1990 and 1995 to 3.9 per cent between2005 and 2012. But still some regions such as Oceania,sub-Saharan Africa, Caucasus and Central Asia, andSouthern Asia are likely to miss the 2015 target. With this pace it is estimated that by only 2028, the MDG 4 will be achieved globally. The pace of reduction would need to

quadruple inthe period from 2013 to 2015 to meet the target of a twothirdsreduction in the under-five mortality rate.

The report also stated that though Southern Asia has made strong and steady progressin reducing under five mortality to almost half, yet nearly one in every three under-fivedeaths still takes place there. India had the highestnumber of under-five deaths in the world in 2012, with 1.4million children dying before reaching their fifth birthday.According to UNICEF/WHO 2013 report on child mortality,about half of under-five deaths occur in only five countries: India, Nigeria, Democratic Republic of the Congo, Pakistan and China. India (22%) and Nigeria (13%) together account for more than a third of all under-five deaths.

2.1.2 Indian trends in U5MR

Government of India's (GOI) 2014, latest report on the progress towards MDG states that U5MR has declined from an estimated level of 125 per 1000 live births in 1990 to 52 in 2012. The MDG target for U5MR is to achieve 42 per thousand live births by 2015 but with the historical trends India may reach 49 by 2015, missing the target by 7 percentage points. However, considering the continuance of the sharper annual rate of decline witnessed in the recent years, India is likely to achieve the target (Figure 2.2).



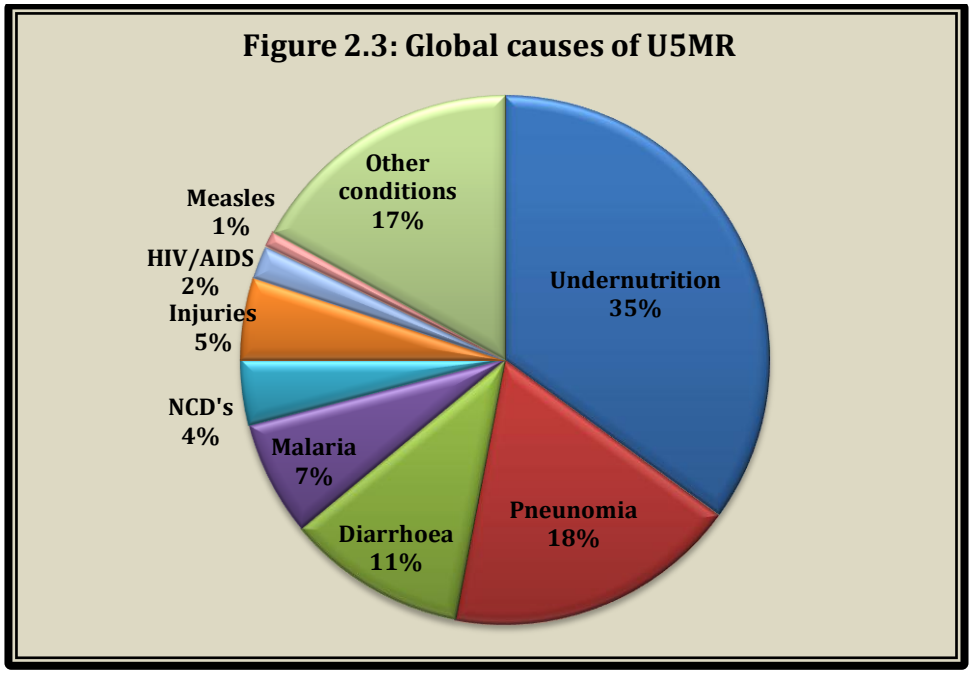
Source GOI, 2014

In *The Lancet Global Health 2013*, Ram and colleagues, discussed the neonatal and 1–59 month mortality data for 597 districts in India. The data of 2012 and 2001 were compared to assess progress towards achieving the 2015 MDG4. The findings state that from 2001 to 2012, under-5 mortality declined by an average of 3·7% per year. Eighty one districts in India accounted for more than one-third of child mortality below five years of age in 2012. The well-off states like Gujarat, Andhra Pradesh, Arunachal Pradesh, Jammu and Kashmir, Himachal Pradesh and Karnataka are on the worst performing districts' list. Paul et al 2014 in their article also emphasised that the overall progress of most Indian states towards achieving MDG 4 is presently unsatisfactory.

In their report Ram and colleagues emphasized that of the three districts where under-five child mortality has increased in 2012, two are in rich states - Vadodara in Gujarat and Raichur in Karnataka. In all, six districts in Gujarat had high child mortality rate, five in Andhra Pradesh, three in Arunachal Pradesh, two in Jammu and Kashmir and one each in Himachal and Karnataka. Only 222 of 597 districts are on track to meet the MDG by 2015 whereas the remaining would meet the target by 2020. However, states of Kerala (13), Tamil Nadu (24), Maharashtra (28), Delhi (28), Punjab (34), Karnataka (37) and West Bengal (38) have already achieved the national level MDG target of U5MR**.**

2.1.3 Causes of U5MR

Report published by UNICEF in 2013 states that 35% of death in children below 5 yrs of age is attributed to undernutrition. Pneumonia and diarrhoea together account for 29% deaths of results in the loss of 2 million young lives each year (Figure 2.3).



Source UNICEF 2013

2.2 Undernutrition:

The first six years of a child's life are the most vulnerable years when the foundations are laid for cognitive, social and emotional language, physical/motor development and cumulative lifelong learning. The young child under 2 years are most vulnerable to the vicious cycles of malnutrition, disease/ infection and resultant disability all of which influence the overall development of the child. Growth flattering generally begins at the age of introduction of complementary foods that is 6 months. Faulty feeding practices at this age is indicated as the child being underweight (low weight for age) as an immediate effect and can lead to stunting indicating chronic undernutrition which is difficult to reverse.

2.2.1 Global trends

Stunting along with wasting (low weight for height) are the indicators used to define under nutrition in children. The report entitled "Improving child nutrition, the achievable imperative for global progress", issued in April 2013 by UNICEF stated that presently for tackling undernutrition in children there has been a shift from efforts to reduce underweight prevalence to prevention of stunting. The report emphasized importance of nutrition during the critical 1,000-day period covering pregnancy and the first two most crucial years of the child's life,

and of the fact that stunting reflects deficiencies during this period. The World Health Assembly has adopted a new target of reducing the number of stunted children under the age of 5 by 40 per cent by 2025.

As highlighted in the report, globally more than one quarter (26 per cent) children under 5 years of age were stunted in 2011 with Sub-Saharan Africa and South Asia being home to three fourths of the world's stunted children. India ranks number one among the top 14 countries which reside 80% of the stunted under five children contributing to 38% of the global burden (Table: 2.1). Discussing the global trends in decline of prevalence of stunting it was reported that over the past two decades (1990-2011) there has been a reduction of 36%, accounting for 2.1% per year among children under 5 years. Stunting has declined from an estimated 40% in 1990 to 26% in 2011.

The state of prevalence of underweight and wasted children is no better, with approximately 16% of children under 5 being underweight and 8.24% being moderately or severely wasted in 2011. Estimates show that prevalence of underweight and wasted children is highest in South Asia,(33% and 16% respectively) followed by sub-Saharan Africa with figures of 21%.and 9% respectively (Table 2.2).

Table 2.1: Top 14 countries with highest no. of Stunted Children					
Rank	**Country**	**Year**	**Stunting prevalence**	**% Global burden (2011)**	**No. of stunted children (moderate to severe, (in 1000s)**
1	India	2005-06	48	38	61,723
2	Nigeria	2008	41	7	11,049
3	Pakistan	2011	44	6	9663
4	China	2010	10	5	8059
5	Indonesia	2010	36	5	7547
6	Bangladesh	2011	41	4	5958
7	Ethopia	2011	44	3	5291
8	Democratic Repub. of Congo	2010	43	3	5228
9	Phillippines	2008	32	2	3602
10	United Republic of Tanzania	2010	42	2	3475
11	Egypt	2008	29	2	2628
12	Kenya	2008-09	35	1	2403
13	Uganda	2011	33	1	2219
14	Sudan	2010	35	1	1744

Source: UNICEF 2013

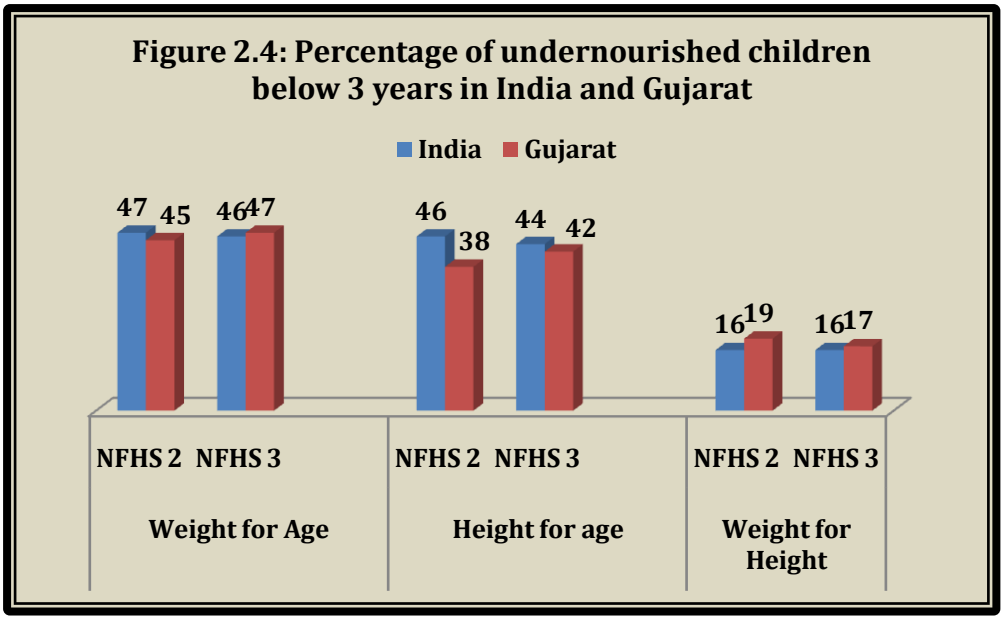
Table 2.2: Top 14 countries with highest no. of wasted Children					
Rank	**Country**	**Year**	**Wasting (%, moderate or severe)**	**Wasting (%, severe)**	**No. of wasted children, 2011 (moderate or severe, in 1000s)**
1	India	2005–06	20	6	25,461
2	Nigeria	2008	14	7	3,783
3	Pakistan	2011	15	6	3,339
4	Indonesia	2010	13	6	2,820
5	Bangladesh	2011	16	4	2,251
6	China	2010	3	–	1,891
7	Ethiopia	2011	10	3	1,156
8	Democratic Repub. of Congo	2010	9	3	1,024
9	Sudan	2010	16	5	817
10	Philippines	2008*	7	–	769

Source: UNICEF 2013

Though the past two decades have shown a decline in the prevalence of under nutrition among children below 5 yrs but as pointed out by Onis et al 2004,neither the world as a whole, nor the developing regions, are expected to achieve the Millennium Development goals. This is largely due to the deteriorating situation in Africa where all subregions, except Northern Africa, are expected to fail to meet the goal.

2.2.2 Indian trends

Figure 2.4 highlights the high prevalence of underweight, stunting and wasting among 0-3 years children in India. As evident there has been only a marginal reduction in percentage of children having underweight and stunting, while wasting increased during the six years period from National Family Health Survey-2 to 3 (NFHS-2 to NFHS-3). Gujarat despite being among the better developed states on the economic front also has markedly high prevalence of under nutrition.



According to census of 2011 (Census 2011), 104.3 million Indian people are categorized as tribal population and 15% of the Gujarat's total population is tribal. Reviewing the report of National Nutrition Monitoring Bureau, 2009 (NIN, ICMR 2009) among the tribal population, the state of Gujarat has come up with alarming statistics with respect to nutritional status of young children (Table 2.3).

Table: 2.3 Percentage of undernourished tribal children			
0-12 Months			
		< Median -2SD	**< Median -3 SD**
Underweight (Weight for age)	India	36	15
	Gujarat	**48.6***	29
Stunted (Height for Age)	India	35	16
	Gujarat	45.7	**32***
Wasted (Weight for Height)	India	24	11
	Gujarat	32	**21***
1-5 years			
Underweight (Weigh for age)	India	52	20
	Gujarat	47	21
Stunted (Height for Age)	India	55	26
	Gujarat	54	30
Wasted (Weight for Height)	India	22	6
	Gujarat	24	**11***

The NNMB 2009, reported that among the infants the overall prevalence of underweight (weight for age <Median–2SD) was about 36%, which tended to increase with age from about 10% among less than one month old infants to about 30% among 1-6 months and about 35-53% among 7-11 months old infants. The overall prevalence was maximum in the State of Gujarat (48.8%), followed by Orissa (45.1%), Maharashtra (43.1%), West Bengal (41.6%), Madhya Pradesh (32.9%), Andhra Pradesh (32.2%), Tamil Nadu (28.3%), Kerala (25.5%) with lowest in Karnataka (23.8%).

The overall prevalence of severe underweight (weight for age <Median – 3 SD) was about 15%, which tended to increase with age from about 8 to 12% in 1-3 months through about 13-17% in 4-9 months to about 21% in 10-11 month old infants The prevalence of severe underweight ranged from 7-9% in the States of Karnataka, Kerala and Tamil Nadu, through 13-19% in Andhra Pradesh, Madhya Pradesh, West Bengal, Maharashtra & Orissa, to a high of about 29% in Gujarat.

The overall prevalence of stunting (height for age <Median–2SD) among infants was about 35%. The overall prevalence was maximum in the State of Kerala (50.7%), followed by Gujarat (45.7%). About 16% of infants in general had severe stunting (height for age <Median– 3 SD) and the prevalence ranged from a

low 5% in the State of West Bengal through 10-20% in Tamil Nadu, Karnataka, Andhra Pradesh, Madhya Pradesh, Maharashtra and Orissa to a high of 29% in Gujarat and 32% in Kerala.

The overall prevalence of wasting (weight for height <Median–2SD) among infants was about 24% with Gujarat having a figure of 32%. About 11% of infants in general had severe wasting (weight for height <Median–3 SD) indicative of severe acute malnutrition (SAM). Gujarat again topped all the states with a prevalence of 19-21% along with Madhya Pradesh.

Anthropometric data for children between 1-5 years showed an overall prevalence of underweight (weight for age <Median–2SD) was about 52%. The prevalence was higher in the State of Maharashtra (about 64%) followed by Orissa (58%), West Bengal, Madhya Pradesh and Andhra Pradesh (about 51-52%), Tamil Nadu and Gujarat (47% each) with lowest in Kerala and Karnataka (43-44%). The overall prevalence of severe underweight (weight for age <Median-3SD) was about 20% and in Gujarat it was 21%.

The overall prevalence of stunting (height for age <Median-2SD) among 1-5 year children was about 55%.The prevalence was highest (64-65%) in the States of Madhya Pradesh & Orissa, followed by Maharashtra (61%), 54% each in Kerala & Gujarat. The overall prevalence of severe stunting (height for age <Median-3SD) was about 26% and in Gujarat it was 29-30%.

The overall prevalence of wasting (weight for height <Median-2SD) among 1-5 year children was about 22% and in Gujarat 20-24%. The overall prevalence of severe wasting (weight for height <Median-3SD) was about 6% with Gujarat having the highest figures of 11% among all states.

These finding can be supported by various studies carried out in different tribal areas of the country (Table 2.4). The data reveals that malnutrition of all types among tribal children is a cause of concern. Moreover it has been pointed out that tribal communities are isolated from general population and are socially and

economically disadvantaged. Geographical isolation, primitive agricultural practices, socio-cultural taboos, poor health seeking behavior, poverty etc., leads to the development of various morbidities and undernutrition. Moreover the alarming data from the state of Gujarat suggests immediate action to improve the situation.

Table 2.4: Studies on nutritional status of children in tribal population

S.No	Population	N	Age (yrs)	Percentage			Study area	Reference
				WAZ	HAZ	WHZ		
1.	Tribal children	529	<1	90	-	-	Tapi District, Gujarat, India	Desai et al 2014
2.	Tribal children	1013	<5	48.4	48.4	23.6	Andhra Pradesh	Sukhdas et al 2014
3.	Tribal children	540	<6	60.9	66.4	18.8	Melghat villages of central India	Talapalliwar and Garg 2014
4.	Tribal children	426	<5	54.2	-	-	Orissa	Agrawal 2014
5.	Tribal children	500	<5	29.0	30.4	21.6	Dibrugarh District, Assam	Islam et al 2014
6.	Tribal children	14,587	<5	49	51	22	Andhra Pradesh,Gujarat, Kerala, Karnataka, Maharashtra, MadhyaPradesh, Orissa, Tamil Nadu and West Bengal	Meshram et al 2012
7.	Bauri children	219	2-6	48.4	37.8	21.5	Purulia, West Bengal	Das and Bose 2009
8.	Dhur Gond	68	< 5	60.3	-	-	Chhatisgarh, India	Chandraker et al 2009
9.	Saharia tribal children	238	1-5	72	68	13	Rajasthan, India	Rao et al 2006
10.	Gond tribal children	1022	1-5	61.7	51.7	32.8	Madhya Pradesh	Rao et al 2006
11.	Kodaku children	182	1-5	59.8	43.0	35.0	Chattisgarh	Dolla et al 2005

2.2.3 Causes of undernutrition

The UNICEF 2013 conceptual framework encompasses the various causes determining children under nutrition (Figure 2.5). Nutritional status is influenced by three broad factors: food, health and care. Optimal nutritional status results when children have access to affordable, diverse, nutrient-rich food; appropriate maternal and child-care practices; adequate health services; and a healthy environment including safe water, sanitation and good hygiene practices. Joshi et al (2011) in their paper on undernutrition among children under 6 years children found its direct association with caste, poor housing and environmental sanitations and low standard of living index. It is well established that these factors directly influence nutrient intake and the presence of disease. The interaction between undernutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status. Food, health and care are affected by social, economic and political factors.

As mentioned by Smith and Haddad 2000, the effects of poverty on child mal nutrition are pervasive. Poor households and individuals are unable to achieve food security, have inadequate resources for care, and are not able to utilize (or contribute to the creation of resources for health on a sustainable basis. The Government of India 2012, in its report titled “Children in India” mentioned that the percentage of underweight children in the lowest wealth index category (56.6%) is nearly 3 times higher than that in the highest wealth index category (19.7%). Kanjilal et al 2010 also supported the fact in their review of 15 states across India stating that across all fifteen major states and the rural-urban locations, children from poorer households share the higher burden of sub-optimal growth due to undernourishment.

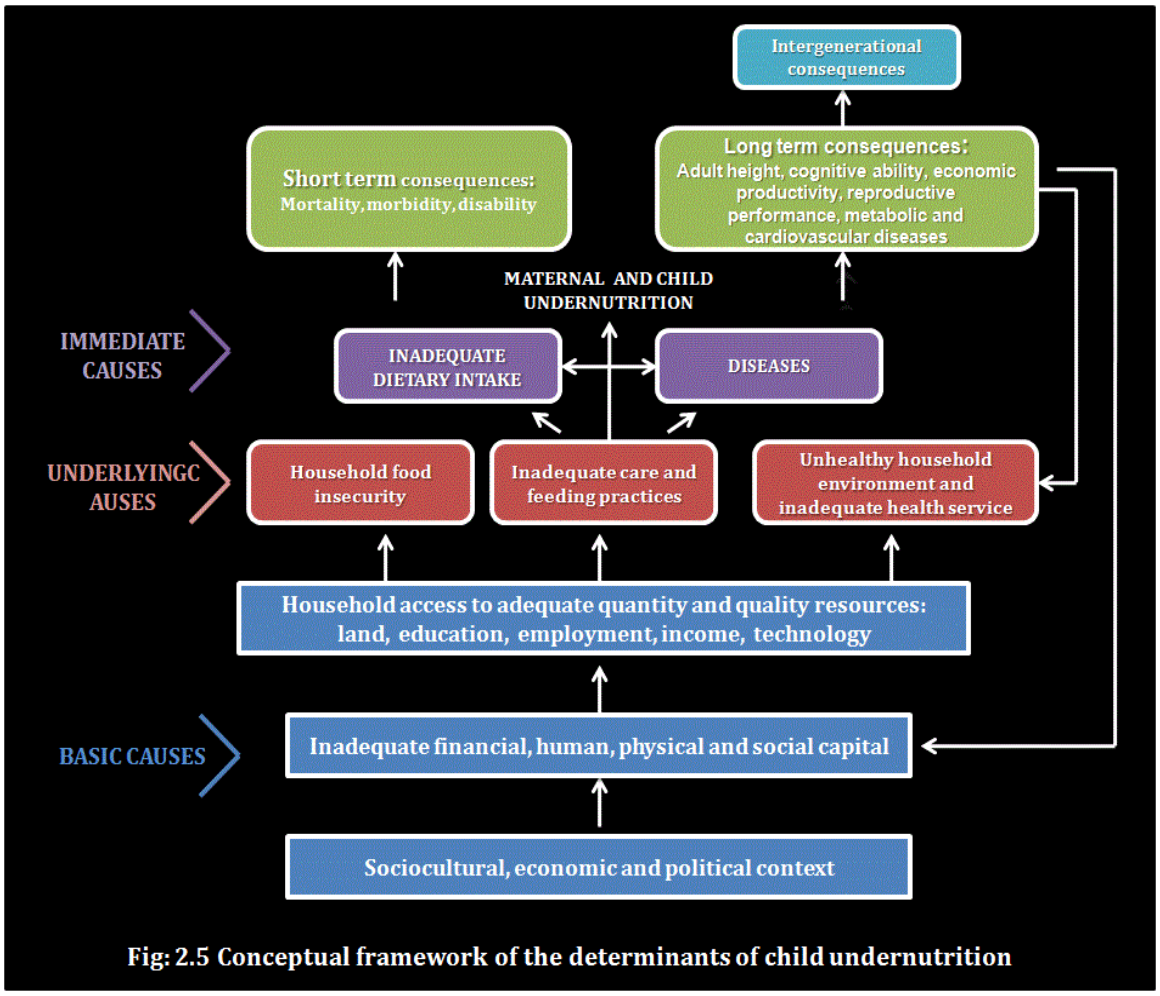


Fig: 2.5 Conceptual framework of the determinants of child undernutrition

2.2.4 Consequences of undernutrition

The report by UNICEF 2013, on improving child nutrition discusses that under nutrition weakens the immune system, putting children at higher risk of more severe, frequent and prolonged bouts of illness. Undernutrition is also a consequence of repeated infections, which may further worsen the child's nutritional status at a time of greater nutritional needs. This interaction between undernutrition and infection creates a potentially lethal cycle of worsening illness and deteriorating nutritional status. An estimated one third of deaths among children under age 5 are attributed to under nutrition. Under nutrition puts children at far greater risk of death and severe illness due to common childhood infections, such as pneumonia, diarrhoea, malaria, HIV and AIDS and measles. A child who is

severely underweight is 9.5 times more likely to die of diarrhoea than a child who is not, and for a stunted child the risk of death is 4.6 times higher (Table 2.5).

Table 2.5: Odds ratio of dying from diarrhea or pneumonia among undernourishedchildren relative to well-nourished children, in selected countries (Bangladesh, Ghana, Guinea-Bissau, India, Nepal, Pakistan, the Philippinesand Senegal)

	ODDS RATIO			
	Severe under nutrition	**Moderate under nutrition**	**Mild under nutrition**	**No under nutrition**
Underweight				
Diarrhea	9.5	3.4	2.1	1.0
Pneumonia	6.4	1.3	1.2	1.0
Stunting				
Diarrhea	4.6	1.6	1.2	1.0
Pneumonia	3.2	1.3	1.0	1.0
Wasting				
Diarrhea	6.3	2.9	1.2	1.0
Pneumonia	8.7	4.2	1.6	1.0

Kandala et al 2011, Schaible and Kaufmann 2007 and Nandy et al 2004 also mentioned that children with more than one anthropometric failure are susceptible to contacting diseases like diarrhoea and acute respiratory infections. Caulfield et al2004in their study to derive relative risk of dying as a result of underweight by cause of death also emphasized the need to tackle under nutrition among children for prevention of infectious diseases.

2.2.4.1 Diarrhoea

An estimated 801,000 children younger than 5 years of age perish from diarrhoea each year, mostly in developing countries. This amounts to 11% of the 7.6 million deaths of children under the age of five and means that about 2,200 children are dying every day as a result of diarrheal diseases (Liu et al 2012). Reducing diarrheal deaths by more than 1.4 million per year would be a major contribution towards MDG4 (Walker et al 2011). India stood at number one position for global mortality rank for pneumonia and diarrhoea deaths in under five, with 4,36,000 children

dying annually being infected by these two easily preventable diseases (UNICEF 2013).

World health organization 2009, in its report on diarrhea mentioned that children with poor nutritional status and overall health, as well as those exposed to poor environmental conditions, are more susceptible to severe diarrhoea and dehydration than healthy children. Children are also at greater risk than adults of life-threatening dehydration since water constitutes a greater proportion of children's bodyweight. Young children use more water over the course of a day given their higher metabolic rates, and their kidneys are less able to conserve water compared to older children and adults.

The WHO defines diarrhoea as the passage of three or more loose or liquid stools per day, or more frequently than is normal for an individual. It is caused by bacterial, viral, and parasitic organisms and is usually a symptom of gastrointestinal infection. Diarrheal disease is transmitted through the fecal oral route and is spread through contaminated food and drinking water or from person to person as a result of poor hygiene and sanitation.

There are three major diarrhoea syndromes:

1. Acute watery diarrhea is the type that most likely leads to rapid dehydration. This form is the most deadly in young children and is commonly associated with rotavirus, enterotoxigenic E. coli, or V. cholerae (cholera).
2. Persistent diarrhea, a less common form, is typically connected with malnutrition and is disproportionally associated with an increased risk of death.
3. Bloody diarrhea is often related to malnutrition, intestinal damage, and secondary sepsis. It is often associated with dysentery (Keusch et al 2006).

Diarrhoea has both short-term and long-lasting effects, ranging from severe dehydration to malnutrition, which leads to weakening of the immune system of the

patient making him more susceptible to future diarrhoea episodes as well as other illnesses. Children who are malnourished are also more susceptible to the consequences of diarrhoea. Black et al 2008 stated that most children dying of diarrhoea are likely to survive if they are adequately nourished. Studies indicate that diarrhoea can also lead to long-term physical impairments such as stunted growth and reduced intellectual development (Keusch et al 2006).

The various causes of diarrhoea include

a. Microbial infections
b. Undernutrition
c. Zinc Deficiency
d. Vitamin A Deficiency
e. Inadequate hygiene and sanitation
f. Lack of awareness

a. *Microbial infections*

A wide range of pathogens are responsible for causing diarrhoea including bacteria, viruses and protozoa. However, just a handful of organisms are responsible for most acute cases of childhood diarrhoea. Rotavirus is the leading cause of acute diarrhoea, and is responsible for about 40 per cent of all hospital admissions due to diarrhoea among children under five worldwide (Weekly Epidemiological Record 2008).

Rotaviruses cause 30–50% of severe diarrhoea casesin children younger than 5 years, leading to about 450 000 deaths every year (O'Ryan and Clemens 2015) and more than 80% of these deaths occur in low-income countries (Parashar et al 2006). As stated by Bines and Kirkwood 2015, rotavirus ishighly contagious, spreading from person to person mainly viafaecal contamination of hands and objects. Irrespective of wherea child lives, almost all children have had an episode of rotavirusinfection by the age of 5 years. Almost all rotavirus deaths occurin less developed countries where access to medical care andrehydration is limited. Studies between over the past few years in India have shown an increasing trend of

rotavirus isolation from 23.5 to 39.2% among hospitalized children with diarrhoea(Parashar et al 2009, Kang G et al 2009; Bahl et al 2005; Banerjee et al 2006). Taneja and Malik 2012, also mentioned that rotavirus infection claims about 1 lakh lives in India annually. Most children become infected with rotavirus, with the highest risk being from (6 months when circulating maternally acquired immune factors decline in infants) through 3 years of age (Newburg 2012).

Rotavirus infects all children worldwide in the first few years of life be it from a developed or developing country, hence it is hard to implicate its transmission through poor sanitation and hygiene. However children in the low economic settings were infected earlier in life and their illnesses were often fatal, primarily because of suboptimal access to medical care (Glass 2012). Hence improvements in sanitation and hygiene have had little impact on the incidence of severe rotavirus gastroenteritis, therefore vaccination is considered to be the best means of controlling this disease (Villa 1999; WHO 2000).

b. *Undernutrition*

Acute and chronic infections contribute to malnutrition by causing decreased food intake, impaired absorption, increased losses of fluid, electrolytes, protein, and iron, and by altering the normal metabolism (Keusch G & scrimshaw 1986). Evidence from numerous studies of children under five years of age in developing countries suggests that both acute and persistent episodes of diarrhea predispose to or aggravate malnutrition (Richard et al 2014; Richard et al 2013; Marsden 1964; Mata 1977; Martorell et al 1975), and conversely chronic malnutrition may be a risk factor for diarrhoea (Briend 1990). Data from Sub-Saharan Africa illustrate the complex interaction between diarrhoea and malnutrition that has been found in other developing regions of the world. Community-based studies in The Gambia, Uganda, and Sudan indicate that diarrheal disease leads to impaired weight gain (Keusch &Scrimshaw 1986; Rowland 1988; Rowland 1977; Eccles et al 1989; Zumrawi 1996; Cole and Parkin 1977).

According to Caulfield et al 2004, among the principal causes of death in young children, 60.7% of deaths as a result of diarrhoea are attributable to undernutrition and 81,000 diarrhoea deaths, can be prevented by eradication of child undernutrition. Black et al 2008 also supported the fact by stating that many children dying of diarrhea are likely to survive if they were adequately nourished PATH in its 2009 report mentioned that diarrheal diseases have long lasting implications apart from the potentially devastating and immediate impact on the child's health causing more illnesses than any other ailment. Children who survive persistent diarrhea are likely to suffer from malnutrition, stunted growth, and learning difficulties (Keusch et al 2006).

c. *Zinc deficiency*

Zinc deficiency is mainly due to inadequate dietary intake and is estimated to be common in many countries (IZiNCG 2004; Wagstaff 2004; Hess 2009). High levels of zinc are found in 'expensive foods' (eg: meat and fish). Zinc is also present in nuts, seeds, legumes, and whole grain cereal, but the high phytate content of these foods interferes with its absorption. Zinc cannot be stored in the body, and nearly 50% of zinc excretion takes place through the gastrointestinal tract and is increased during episodes of diarrhoea. Young children who are regularly exposed to gastrointestinal pathogens and have diets low in animal products and high in phytate-rich foods are most at risk (Lazzerini and Ronfani 2013).

Lazzerini and Ronfani 2013 pointed out that there are several different mechanism of action of zinc on acute diarrhoea. Zinc influences the activity of over 300 enzymes, some of which are responsible for DNA replication and transcription. Zinc promotes immunity, skin and mucosal resistance to infection, growth, and development of the nervous system. It is also an important anti-oxidant and preserves cellular membrane integrity. At the level of gastrointestinal system, zinc restores mucosal barrier integrity and enterocyte brush-border enzyme activity, promoting the production of antibodies and circulating lymphocytes against intestinal pathogens and has a direct effect on ion channels, acting as a potassium

channel blocker of adenosine 3-5-cyclic monophosphate-mediated chlorine secretion.

Zinc deficiency is common in children in developing countries because of low food intake, particularly from animal sources, limited zinc bioavailability from local diets, and losses of zinc during recurrent diarrhoeal illnesses. In developing countries a significantly lower incidence and prevalence of diarrhoea has consistently been observed in children given zinc supplements (Bhandari et al 2002).

d. *Vitamin A deficiency*

Vitamin A is an essential nutrient needed in small amounts for normal functioning of the visual system, growth and development, maintenance of epithelial cell integrity, immune function, and reproduction. (Bhan and Bhandari 1998).

Vitamin A maintains the physical and functional integrity of epithelial tissues that serve as a barrier against infection. It acts at multiple sites in the immune system. In the deficient state, there is impairment in the antibody response to bacterial polysaccharides and proteins, cytotoxic activity, and natural killer cell numbers are decreased (Bates1995). A reduction in diarrhea-specific mortality through improvement in vitamin A status may occur by a decrease in diarrhea incidence or by reduction in its severity by preventing dehydration and persistent diarrhea (Widermann et al 1993). Vitamin A also plays a role in the production of cell glycoprotein and in the regulation of cell division in the intestine which has a bearing on intestinal epithelial renewal during and after acute enteric infections and thereby on the absorption of water, electrolytes, and other nutrients (Deluca et al 1972, Zile et al 1977; Henning et al 1992).

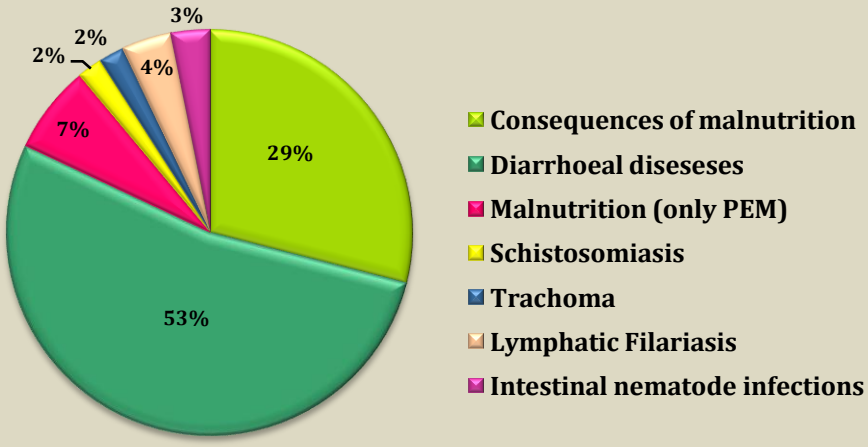
Sommer et al 1984, recognized the association between vitamin A deficiency and diarrhoea when it was observed that preschool-aged children with mild xerophthalmia, which is characterized by night blindness and/or Bitot spots, had an incidence of diarrhea that was 3-fold higher than that of preschool-aged children

without mild xerophthalmia ($P < .001$). Beaton et al 1993 reviewed the results and published a pooled 23% overall reduction in the mortality rate for children 6–59 months of age. It was also found that vitamin A supplementation reduced the diarrhea-specific mortality rate by 32%.

e. *Inadequate hygiene and sanitation*

Path 2009, mentioned that diarrhoea is targeting mostly the poor community due to poor environmental sanitation, inadequate water supply, poverty and poor education. As per WHO 2008 estimates 81% cases of diarrhoea worldwide are attributable to unsafe water, inadequate sanitation or insufficient hygiene. These cases result in 1.5 million deaths each year, most being the deaths of children. In addition the total number of deaths caused directly and indirectly by malnutrition induced by unsafe water, inadequate sanitation and insufficient hygiene is 860 000 deaths per year in childrenunder five years of age. Bartram and Cairncross (2010) also mentioned that globally, around 2.4 million deaths (4.2% of all deaths) could be prevented annually if everyone practised appropriate hygiene and had good, reliable sanitation and drinking water. These deaths are mostly of children in developing countries from diarrhoea and subsequent malnutrition, and from other diseases attributable to malnutrition (Figure 2.6).

Figure 2.6 Contributions in DALYs of individual diseases to the total burden of ill-health preventable by improvements in hygiene, sanitation and water



Karambu et al 2013 stated that according to estimations, 88% of all diarrhoeal diseases are as a result of contaminated water and inadequate hygiene and sanitation. Other researchers also pointed out that that among the main childhood diseases that is directly linked to poor hygiene and sanitation is diarrhea (Curtis and Cairncross 2000; Elaine and Allison 2001; Fewtrell et al 2005; Agustina et al 2013, Ramani et al 2010, Walker et al 2012, Emina and Kandala 2012).The findings of the study by Oloruntoba et al (2015)identified six important risk factorsthat could predispose children below five to the incidence ofdiarrhoea. These factors included poor drinking water handling;lack of hand- washing with soap after defecationand before food preparation; clogged drainage aroundor near the house; breeding places for flies/insects nearthe house; and total hygiene practice level.

Hygiene is not restricted to individual households only but also involves the community as a whole. Unhygienic community with respect to open drainage, inadequate garbage collection and disposal facilities, availability of toilets are breeding grounds for pathogens along with mosquitoes and flies, which in turn spread infectious diseases. Hygiene encompasses three broad areas namely environment, food and personal hygiene.

United Nations 2013, in its report on MDG mentioned that experts on water supply, sanitation and hygiene have identified three priorities for the years to come:

1. No one should practice open defecation;
2. Everyone should have safe water and sanitation facilities at home and practice good hygiene;
3. All schools and health centres should have water and sanitation, while promoting good hygiene.

In 2010, the United Nations General Assemblyexplicitly recognized the right to safe, clean water and sanitation and acknowledged that they are essential to the realization of all human rights.

Environment hygiene refers to cleanliness in and around of an individual's residence which can be ensured by closed drainage system and defecation, proper disposal of household waste so to prevent breeding of flies and mosquitoes which are carrier of many infectious diseases. The sanitation facility available to the households has a huge impact on the living conditions and it is closely related to the health and hygiene of the members of households. One of the targets of MDG 7 is to half by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation. From 1990 to 2011, 1.9 billion people gained access to a latrine, flush toilet or other improved sanitation facility (United Nations 2013). The National sample survey 2012 (NSS 2012) shows that 59.4% and 8.8% households in rural India and urban India respectively had no latrine facilities. "Nirmal Gujarat" an initiative by Government of Gujarat was implemented in 2005 with the target of bringing every household in each and every village under the coverage of sanitation by the year 2010 through

a) Elimination of practice of open defecation,

b) No visible solid or liquid waste,

c) A toilet for all.

Still only 40.7% households in the rural areas and 93.6% in urban areas had access to improved sanitation facilities. (NSS 2012).

Food hygiene refers to ensuring that the food is free of any kind to physical, chemical and biological contamination which can cause harm or illness to the consumer. Proper handling, use of clean cooking, storage and feeding utensils and ideal temperatures of storage needs attention to ensure safety of foods. Young children due to under developed immunity are highly susceptible to infections that are caused by contaminated food and water.

Working towards the MDG 7 target of ensuring safe water to people more than 2.1 billion people have gained access to improved drinking water sources since 1990, exceeding the targets. During 2012, in rural India, 88.5% households had improved source of drinking water while in urban India 95.3% households had improved source of drinking water (NSS 2012). Referring to the past and present trends it has

been attributed that the MDG target of providing safe drinking water to half the population will be achieved by 2015. In Gujarat 95.6% urban and 92.6% rural households were reported to have access to safe drinking water.

Personal hygiene plays an important role in preventing cross contamination and handwashing is a key to personal hygiene. Public health importance of handwashing as well as it importance in reduction of communicable diseases like diarrhea and acute respiratory disorders has been emphasized by many researchers (Takanashi et al 2009, Tambekar and Shrisat 2009, Sheth and Dwivedi 2006, Kanani et al 2005,).

f. *Lack of awareness*

Lack of knowledge of the caregivers as one of the causative factors. Various studies about the maternal awareness of proper diet of children with diarrhea suggested that knowledge of the etiologic factors, symptoms, treatment, and caring methods in diarrheal children among mothers is inadequate (Adimora 2011, Kolahi and Shekarriz 2008, Khalili 2013, Mwambete and Joseph 2010, Masangwi et al 2012, King et al 2010). Knowledge regarding the early signs and symptoms of diarrhoea can help in worsening the situation hence preventing dehydration and subsequent deaths.

Prevention

Walker et al (2012), in their review on diarrhea incidence in low and middle income countries mentioned that diarrhea incidence has declined from 3.4 episodes/child year in 1990 to 2.9 episodes/child year in 2010. They emphasised that although diarrhea incidence rates may have declined slightly, the total burden on the health of each child due to multiple episodes per year is tremendous and additional funds are needed to improve both prevention and treatment practices in low- and middle-income countries.

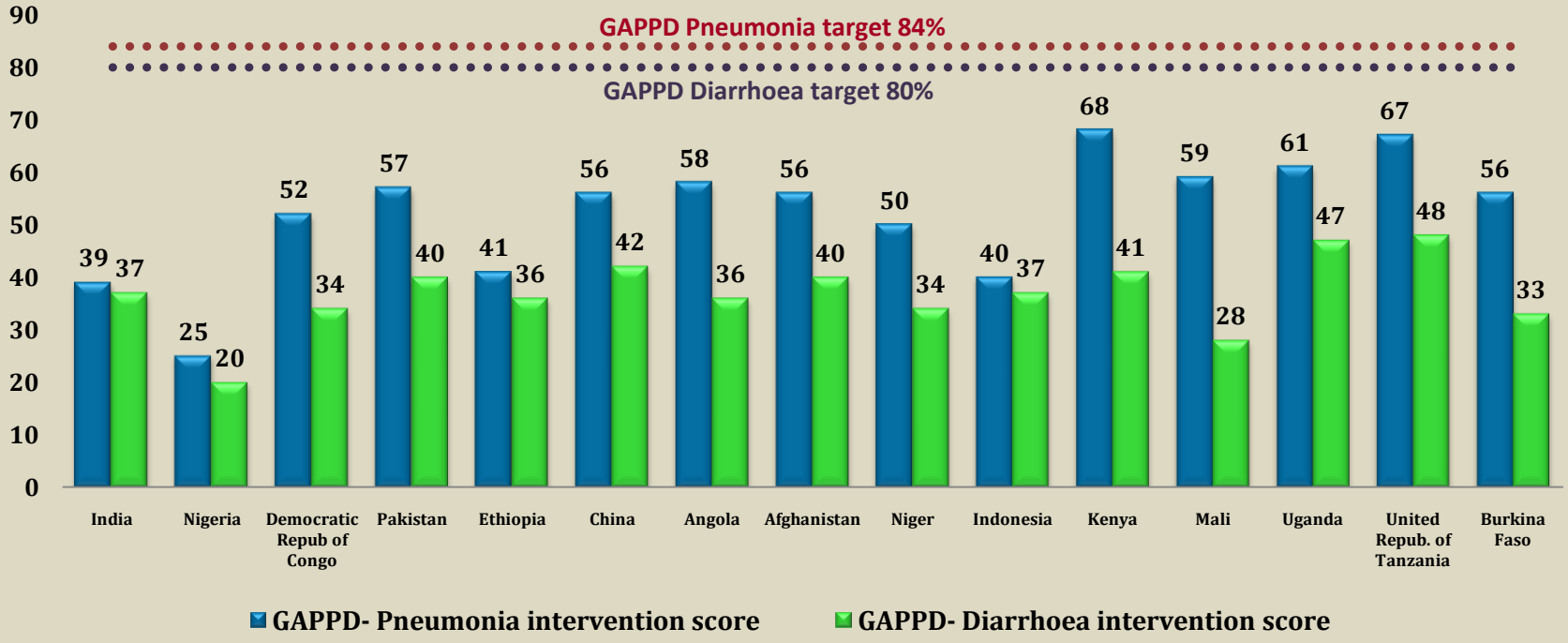
In 2009, UNICEF and WHO published a report on diarrhoea that included a package of key diarrhea prevention and treatment interventions to reduce diarrhoea morbidity and mortality. The complete package includes improving access to safe water, community-wide promotion of sanitation, routine rotavirus and measles immunization, vitamin A supplementation and promotion of breastfeeding, and treatment with ORS and zinc.

In 2013, the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD) was developed and issued by the WHO and UNICEF, outlining key interventions that should be universally adopted, with the goal of ending preventable pneumonia and diarrhea mortality in children by 2025. GAPPD set forth coverage targets of 90% for vaccinations, 90% for access to pneumonia and diarrhea treatments, and 50% for exclusive breastfeeding of children during their first six months of life.

The GAPPD 2013 reports that India and Nigeria, the countries with the two largest pneumonia and diarrhea disease burdens, continue to have low coverage levels for prevention and treatment interventions, causing them to also have the lowest

GAPPD scores, which are calculated averages of countries' coverage rates for key GAPPD interventions (Figure 2.7).

Figure 2.7: GAPPD- Pneumonia and diarrhoea intervention scores (%) 2013 for countries shown from left to right in order of highest child pneumonia and diarrhoea mortality.



Walker et al 2011, in their paper tried to find out the availability of proven diarrhoea saving interventions to children below 5 years of age in 68 countries with highest child mortality. The data for India was as follows:

a. Access to drinking water : 88%
b. Access to treated water: 22%
c. Access to improved sanitation: 31%
d. Following hand washing: 42%
e. Access to ORS: 26%
f. Access to antibiotics for dysentery: 13%
g. Rotavirus vaccination: 0%
h. Zinc supplementation : 0%
i. Vitamin A supplementation: 53%

These results indicate that the Indian children have a limited access to proven interventions to diarrhea.

Despite these sobering statistics, strides made over the last 20 years have shown that, in addition to rotavirus vaccination and breastfeeding, diarrhoea prevention focused on safe water and improved hygiene and sanitation is not only possible, but cost effective: every $1 invested yields an average return of $25.50 (Tindyebwa et al 2004).

The GAPPD report enlists interventions and activities that prove beneficial against fighting diarrhoea (Figure 2.8):

- Exclusive breastfeeding for six months and continued breastfeeding with appropriate complementary feeding as it reduces the onset and severity.
- Use of vaccines
- Use of simple, standardized guidelines for the identification and treatment for example integrated management of childhood illness (IMCI).
- Use of zinc supplements with ORS to treat children with diarrhea.
- Innovative demand creation activities which can be effective in achieving behavior change and sustaining long-term preventive practices

- Water, sanitation and hygiene interventions, including access to and use of safe drinking-water and sanitation, as well as promotion of key hygiene practices.

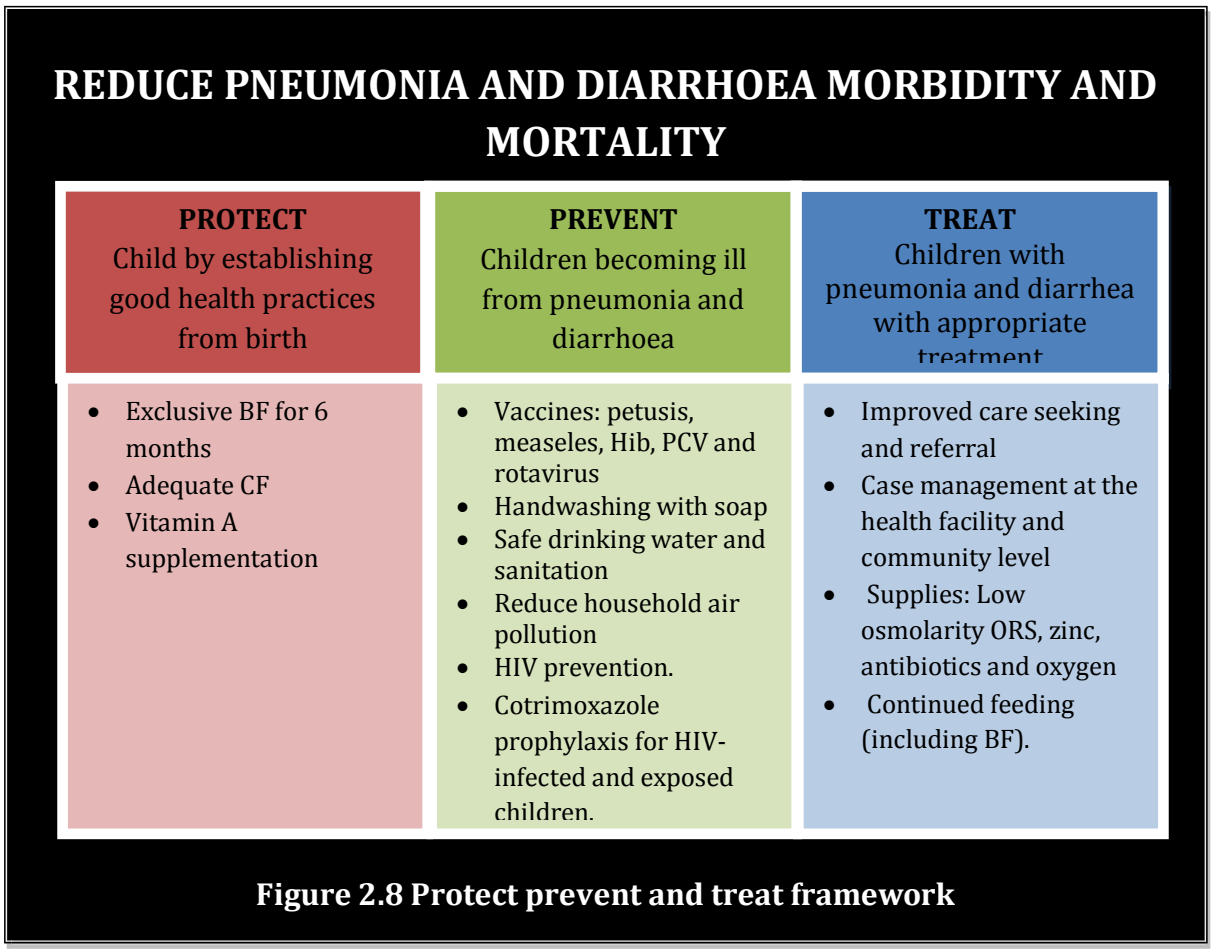


Figure 2.8 Protect prevent and treat framework

Khalili et al 2013 in their paper on maternal knowledge and practices regarding diarrhoea pointed out that various techniques including hygiene, diet, breastfeeding, immunization, supplemental zinc, and probiotics could be used as a preventive measure. Simple remedies like oral rehydration solution (ORS) continued feeding and breastfeeding are proven treatments that can be adapted to reduce mortality.

Hence the preventive measures in diarrhea involve

1. Roatvirus vaccination
2. Promotion of early exclusive breastfeeding
3. Zinc and Vitamin A supplementation
4. Promotion of hygiene

Treatment involves Oral rehydration therapy.

The table below enlists the documented reductions in diarrhoea morbidity and mortality with selected interventions.

Table 2.6: Interventions to reduce diarrheal morbidity and mortality		
Interventions to protect		**Reference**
Exclusive breastfeeding for 6 months	10.5 times greater risk of death from diarrheaif not breastfed.	Black 2008
	Not breastfeeding associated with 165% increase in diarrheal incidence in 0-5 month-old infants.	Bhutta et al. 2013
	Notexclusively breastfeeding resulted in excessive risk of diarrheal incidence (RR 1.26 – 2.65), prevalence (RR 2.15 – 4.90), mortality (RR 2.28 – 10.52) and all-cause mortality (RR 1.48 – 14.40) in infants 0-5 months	Lamberti et al 2011
	When compared to the EBF infants, the risk of diarrhea was higher and statistically significant in both the partially breastfed (48.7% vs 32.5%) and in the non-EBF (37.3% vs 32.5%, p<0.001).	Ehlayel 2009
Continued breastfeeding from6 – 23 months	2.8 times greater risk of death from diarrhea if not breastfed	Black 2008
	No breastfeeding associated with 32% increased diarrhea incidence in infants 6-23 months.	Bhutta et al. 2013
	No breastfeeding resulted in excessive risk of diarrhea incidence (RR 1.32) in infants 6-11 months and prevalence (RR 2.07), mortality (RR 2.18) and all-cause mortality (RR 3.69) in infants 6-23 months.	Lamberti et al 2011
Vitamin A supplementation	Reduced diarrhea mortality by 30% [RR 0.70; 95 % CI 0.58-0.86] in children between 6-59 months.	Imdad et al 2011
	Incidence was 20% lower in the vitamin A treated group than in the placebo group	Barreto et al 1994
Interventions to prevent		
Rotavirus vaccination	Reduction in very severe rotavirus infection by 74%	Munos et al 2010
	56% reduction in rotavirus-associated deaths and a 50% reduction in hospital admissions.	Blasio et al 2010

	Samples testing positive for rotavirus decreased from 46% to 29% (P < 0.001) in 2 years.	Msimang et al 2013
	83% reduction of diarrhea admissions due to rotavirus among children 1-23 months. Statewide hospital costs for rotavirus hospitalizations in children <2 years of age were reduced $10 million.	Chang et al 2010
	a significant reduction in rates of hospitalization for rotavirus infection (P < .001).87% reduction in the 6-11-month, 96% in 12-23-months and 92% in the 24-35-month-old age group.	Payne et al 2011
Handwashing with soap	31% diarrhea risk reduction.	Cairncross et al 2010
	48% diarrhea risk reduction.	Black et al 2008
	2.6 fold reduction in diarrhoeal episodes.	Shahid et al 1996
	27% less episodes of diarrhea.	Peterson et al 1998
	53% lower incidence and 39% fewer days with diarrhea as compared to control group.	Luby et al 2004
Improved sanitation	36% diarrhea risk reduction	Black et al 2008
	25% fewer episodes of diarrhea	Aziz 1990
	Prevalence of diarrhea reduced from 91.3 % to 78.3 %	Kariuki et al 2012
Safe water supply, household water treatment and safe storage (to ensure safe drinking-water	31 – 52% diarrhea risk reduction (greater reductions realized when used correctly and exclusively by vulnerable populations)	Bhutta et al 2013, Clasen et al 2007
	Reduction of 39% (p < 0.05) in mortality from diarrhea	Rasella 2013.
	57%reduction of diarrhea prevelance	Majuru 2011
Increasing access to appropriate care through community-based case management of diarrhoea	35% reduction CM of diarrhoea with ORS and zinc reduced diarrhoeal deaths among underfives by 93%.	Munos et al 2010
	Reductions of 31% (95% CI: 20%-40%) in mortality rates from diarrheal diseases	Rasella et al 2010

(CCM)		
ORS	ORS reduces diarrhoea mortality by 69% with current coverage, or 93% if 100% coverage	Munos et al 2010
	ORS usage increased from 66.5% to 89%	Habib et al 2013
Zinc supplementation	Zinc for the treatment of diarrhoea reduces diarrhoea mortality by 23%	Walker and Black 2010
	Utilization of zinc tablets increased from 68.5% to 91.8%	Habib et al 2013
	Reduced diarrhea incidence by 27% among children 12 to 59 months of age	Brown et al 2013.
	Reduced the incidence of diarrhea by approximately 20%, the relative risk of diarrhea was reduced by 27%.	Brown et al 2009
	18% and 13% reduction in diarrheal mortality and incidence respectively.	Yakoob et al 2011

As mentioned by Khalili et al 2013, since 1970s, ORS has been the cornerstone of management in order to prevent life-threatening dehydration associated with diarrhea. Global reports indicated that in 2008, despite the recommendations about the success of ORS, only 38% of children less than five years old received ORT (Oral Rehydration Therapy) and continued food intake during diarrheal episode. Pahwa et al 2010 and Alkizim 2011, reported that only less than 40% of children with diarrhea in developing countries received the recommended treatment and there has been a little progress toward the trend in the last decades. According to an analysis based on data from 34 countries in 2007, 68% of surveyed countries have reduced the use of ORT in diarrheal children less than 3 years of age (Olson 2011).

2.3 Trouble shooting Undernutrition

The Coalition for Sustainable Nutrition Security in India, 2008 in its report highlighted the most critical and effective actions to improve nutrition security in India. These include:

1. **Optimal Infant and young child feeding practices (IYCF):** Researches have proved that following the IYCF guidelines brings about health outcomes in terms of a well nourished child. The optimal IYCF practices include
    - Timely initiation of breastfeeding within one hour of birth,
    - avoiding prelacteals
    - exclusive breastfeeding during the first six months of life,
    - timely introduction of age appropriate complementary foods at six months (adequate in terms of quality, quantity and frequency),
    - hygienic child feeding practices.
2. **Integrated management of neonatal and childhood illnesses (IMNCI**): One of the components of IYCF, IMNCI involves appropriate and active feeding of children during and after illness, including oral rehydration with zinc supplementation during diarrhoea and timely, high quality therapeutic feeding and care for all children with severe acute malnutrition

3. **Promote Hygiene**: Promote personal hygiene, environmental sanitation, safe drinking water and food safety.
4. **Behaviour change communication (BCC) intervention**: Expand and improve nutrition education and awareness as well as involvement and accountability for improved nutrition at the community level.

2.3.1 Infant and young child feeding (IYCF) practices

Optimal infant and young child feeding (IYCF) practices form the cornerstone of child care and development (Deoki and Shariqua 2009). Infant and Young Child Feeding (IYCF) practices are simply a set of recommendations to achieve appropriate feeding of new-born and children under two years of age so that they achieve optimal nutrition outcomes in populations (Ministry OF Health And Family Welfare 2013).

IYCF includes the following care practices:

1. Early initiation of breastfeeding; immediately after birth, preferably within one hour.
2. Exclusive breastfeeding for the first six months of life i. e 180 days (no other foods or fluids, not even water; but allows infant to receive ORS, drops, syrups of vitamins, minerals and medicines when required).
3. Timely introduction of complementary foods (solid, semisolid or soft foods) after the age of six months i. e 180 days.
4. Continued breastfeeding for two years or beyond.
5. Age appropriate complementary feeding for 6-23 months. Children should receive food from 4 or more food groups and feed for a minimum number of times with continued breastfeeding.
6. Active feeding of children during and after illness.

2.3.1.1 Early initiation of breastfeeding

Breastfeeding should be initiated within half an hour of birth (BPNI 2001) because are most active during first 30-60 minutes, suckling reflex is most active at birth, ensures intake of colostrums, promotes emotional bonding between mother and

child, prevents the problem of breast engorgement, postpartum bleeding and helps uterine involution in mothers.

In spite of continued efforts to promote early initiation of breastfeeding very few mothers are practicing the same. According to NFHS-3 data only one quarter of children started breastfeeding within one hour of birth and almost half (45%) did not start breastfeeding within one day of birth. Similar low rates of initiation of breastfeeding were prevalent in Gujarat (28% within one hour of birth, 58% within one day of birth). In a study conducted among 475 women in Udiapur by Jain et al, 2013 it was reported that only 36.84% mothers initiated breast feeding immediately after birth. Even lower figures were reported in studies carried out in Bankura district in West Bengal (Sinhababu et al 2010) and Paroja community in Orissa (Patro et al 2012) where only 14% and 8% mothers initiated breastfeeding soon after birth respectively. In contrast to this a high percentage of tribal mothers (76%) from Karnataka (Dakshayani and Gangadhar 2008) initiated breastfeeding immediately after birth, 20% on the second day and 4% on the third day of child birth. High percentage (79.3%) of tribal mothers of Andhara Pradesh (Sanneving et al 2013) were also reported to have initiated breast feeding within 24 hours of child birth.

2.3.1.2 Colostrum Feeding

Colostrum ,the milk secreted in the first 2-3 days,must not be discarded but should be fed to newborn as it contains high concentration of protective immunoglobulins and cells. Thus acting as a first natural immunization of the baby, protecting it from various infectious diseases like diarrhea, to which the child might be exposed during the first few weeks after birth.

Traditionally in India colostrums is discarded due to various reasons. Women residing in slums of Bhavanagar had a wrong religious belief that colostrum was dirty and infectious. With this belief only 36% mothers fed colostrums to their child (Raval et al 2011). In another study conducted in urban slums of Lucknow about

56.5% mothers did not feed colostrums Of these 66.9 % did not give it because they thought that it is harmful for the baby. Mothers were also reported to be unaware about the advantages of colostrums feeding and were prohibited by elderly females (Gupta et al 2010).

2.3.1.3 Prelacteal Feeding

National guidelines on IYCF emphasizes that no prelacteal feeds should be given to newborns as it can cause infection and lead to diarrhea. Prelacteal feeding involves feeding liquids or foods like honey, jaggery, ghutti, etc prior to initiation of breastfeeding to the newborn.

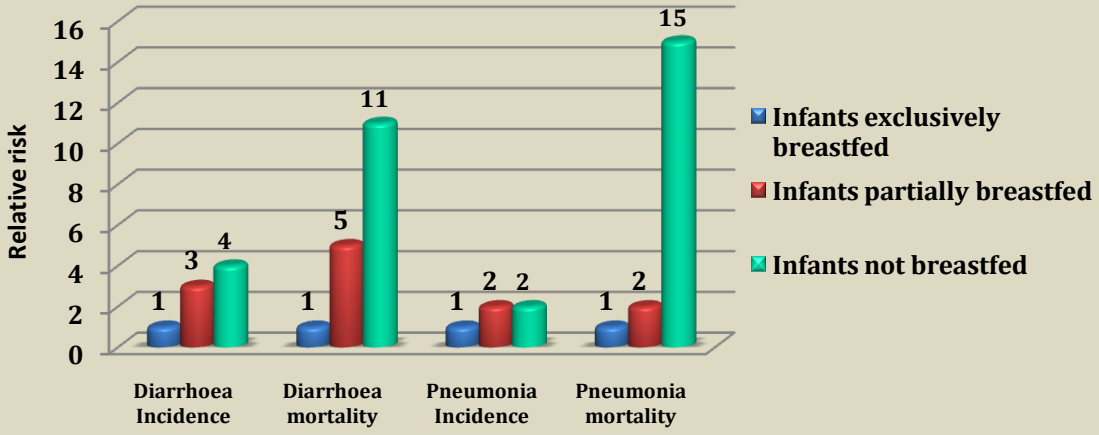
Statistics from NFHS-3 survey reported that more than half the mothers (57%) gave prelacteal feeds like milk, honey, sugar or glucose water and plain water to their newborns. Similar figures were reported from Gujarat with 57% mothers feeding prelacteals to their newborns. In urban slums of Nagpur, out of 384 mothers surveyed 302 (78.61%) gave prelacteals (Bagul and Supare 2012). Sharma and Kanani 2008, studied the IYCF practices of mothers residing in rural Vadodara. Prelacteals like *patasa* water, honey and jaggery water were given by 40.6% mothers. Reasons for giving prelacteals included initially no milk and child is hungry, dirt in childs stomach is removed, child will not cry, family members instructed.

2.3.1.4 Exclusive breastfeeding till 6 months.

During the first few months, exclusively breastfed infants generally remain free from infections and are not predisposed to further undernourishment. However, introduction of animal milk between 3 months and 5 months triggers a rise in morbidity due to infections and an increase in the rates of underweight and stunting (Paul et al 2011). Darmstadt et al 2005, in their publication in Lancet series on newborn survival summarized that 13% to 15% of under-five deaths in resource poor countries could be prevented through achievement of 90% coverage with exclusive breastfeeding alone.

The report by WHO 2013 also points out that infants not breastfed are 15 times more likely to die from pneumonia and 11 times more likely to die from diarrhoea than children who are exclusively breastfed. Similarly, all-cause mortality is 14 times higher for infants not breastfeeding than for exclusively breastfed children (Figure 2.9).

Figure 2.9: Relative risk of diarrhoea and pneumonia incidence and mortality among infants (0–5 months)



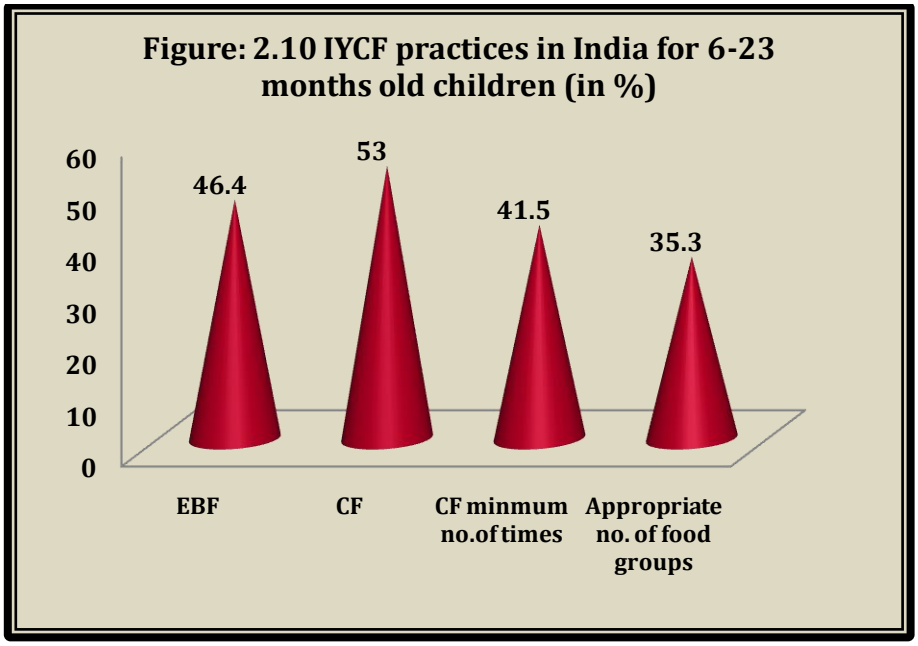
In India, figures available from the DLHS 3 (2007-'08) illustrates a poor picture with respect to this practice as only 46.4 per cent of the children aged 0-5 months are exclusively breastfed, for atleast 6 months. Study among the tribal mothers of West Bengal reported that less than half (46%) children were exclusively breastfed for 6 months (Mondal et al 2014). Mothers from Udaipur (Jain et al 2013) and Kanpur (Midha et al 2010) who practiced exclusive breastfeeding for 6 mothers were 22% and 51% respectively.

2.3.1.5 Timely, adequate, safe and proper complementary feeding

Complementary feeding means complementing solid/semi-solid food with breast milk after child attains age of six months as breast milk is no longer sufficient to meet the nutritional requirements of infants. However infants are vulnerable during

the transition phase, from exclusive breast milk to introduction of complementary feeding over and above breast milk. For ensuring the nutritional needs of a young child are met breastfeeding must continue along with observing the following practices for appropriate complementary feeding. The term "complementary feeding" and not "weaning" should be used.

- Timely – meaning that they are introduced when the need for energy and nutrients exceeds what can be provided through exclusive breastfeeding.
- Adequate – meaning that they provide sufficient energy, protein and micronutrients to meet a growing child's nutritional needs;
- Safe – meaning that they are hygienically prepared and stored, and fed with clean hands using clean utensils, and not bottles and teats.
- Properly *fed* – meaning that they are given consistent with a child's signals of appetite and satiety, and that meal frequency and feeding method – actively encouraging the child, even during illness, to consume sufficient food using fingers, spoon or self-feeding –are suitable for age.



Source NFHS-3 (2005-06)
EBF: Exclusive breastfeeding for <6 months
CF: Children between 6-8 months given complementary foods.
CF minimum no. of times: Children 6-8 months old fed semi-solid food at least twice a day, ≥3 times/day for other breastfed children and ≥4times/day for non breastfed children.
Appropriate no. of food groups:≥ 3 food groups for breastfed children and ≥ 4 food groups

In the report titled "Global strategy for infant and young child feeding WHO (WHO 2003) pointed out that appropriate complementary feeding depends on accurate information and skilled support from the family, community and health care system. Inadequate knowledge about appropriate foods and feeding practices is often a greater determinant of malnutrition than the lack of food. Moreover, diversified approaches are required to ensure access to foods that will adequately meet energy and nutrient needs of growing children, for example use of home- and community-based technologies to enhance nutrient density, bioavailability and the micronutrient content of local foods.

Gupta et al2010 pointed out that promotion of breastfeeding and appropriate complementary feeding could prevent about 19% of child death worldwide. A meta-analysis by Bhutta et al, 2008, of complementary feeding strategies and linear growth showed that education strategies alone are of most benefit in populations that have sufficient means to procure appropriate food, whereas in populations without this security, educational interventions are of benefit when combined with food supplements. It further concludes that improvement of complementary feeding through strategies such as counselling about nutrition for food secure populations and nutrition counselling, food supplements, conditional cash transfers, or a combination of these, in food-insecure populations could substantially reduce stunting and related burden of disease.

Data from NFHS-3 reveal dismal figures with respect to complementary feeding also. Introduction of complementary feeding along with continued breastfeeding in 6-9 month age is only 55.8%. The DLHS-3 data reveals that introduction of complementary feeding along with continued breastfeeding in 6-9 month age is only 23.9%. (Lahariya and Khandekar, 2007). The quality of complementary foods fed is also poor with only one third of breastfeeding children and half of non breastfeeding children (6-23 months) consuming fruits and vegetables that are rich in Vitamin A and only 10% of breastfeeding children and 20% of non

breastfeeding children under three years of age consuming meat, fish, poultry or eggs.

A study conducted in urban slums of Vadodara (Katara et al 2010) reported that 27% children had started receiving complementary feeding at 6 months of age.64.7% of children were receiving feeding with appropriate number of food articles and 53.2% of children were receiving feeds at least minimum number of times. Ganda mothers of Raipur district who reported initiation of complementary feeding before 6 month of age were 25%, at 6 months of age were 63.75% and after 6 months of age were 11.25% (Thakur and Kumar 2010).

Hygiene

Ensuring the safety of the complementary feeds along with its quality and quantity has been emphasized by the IYCF guidelines. Safety means that the food is hygienically prepared and stored, and fed with clean hands using clean utensils. The importance of hygiene has already being discussed under the topic of diarrhoea.

2.3.2 Behavioral change communication

India in spite of spending huge amounts on child health continues to lag behind with high child mortality and morbidity rates. Integrated Child Development Scheme, the largest program for the country's children even after almost 4 decades of implementation shows unsatisfactory results. As a result India is expected to fail in meeting the MDG targets.

In 2005, India embarked on the National Rural Health Mission, an extraordinary effort to strengthen the health systems. Paul et al 2011, in their article pointed out that the coverage of priority interventions remains insufficient, and the content and quality of existing interventions are suboptimum. Infants and young children do not get the health care they need; access to effective treatment for neonatal illness, diarrhoea, and pneumonia shows little improvement; and the coverage of nutrition programmes is inadequate.

Requejo et al 2014 in their paper mentioned that for addressing the high prevalence of stunting a comprehensive approach is required, including nutrition-specificinterventions for women and children, and multisectoral efforts that combat food insecurity and women's low social status and improve access to safewater and sanitation facilities. Researchers in the past have carried out interventions at community levels to educate mothers on importance of child health. These interventions have proven to be beneficial and have given out significant results. Nutrition health education imparted by Bhandari et al 2004, Kilaru et al 2005, Vir 2013 in Haryana, Karnataka and Uttar Pradesh respectively have shown to have improved the IYCF and IMNCI knowledge and practices of the mothers.

Shishu Mangalam project by Essar Foundation, 2012 was taken up in Khambhaliya taluka of Jamnagar district with the aim of improving the nutritional status of children under five. The project showed improvement in the nutritional status of children with a 4% reduction in severe under nutrition from 6.3% to 2.3% and moderate under nutrition from 28.2% to 24.19 % in a period of 6 months. The number of severely undernourished children reduced from 876 to 350 indicating a 60% reduction. Parents-mothers and grandmothers were mobilized to actively engage in growth monitoring, readiness for health check up and improving the feeding practices. The project also lead to increased concern among the families regarding the weight of their child and the efforts to seek treatment for illnesses.

Intervention to improve hygiene practices and diarrhea management practices have also lead to adaption of desirable practices for preventing and managing diarrhea. Interpersonal communication strategies used by Ray et al 2010 brought about significant changes in handwashing practices of urban slum dwellers of Eastern India. Datta and Boratne 2010 also carried out interventions to improve the handwashing practices of mothers in rural Wardha to bring down diarrheal and ARI morbities. Post intervention adoption of handwashing before activities like food preparation and feeding the child along with after defecation lead to reduction in diarrheal and ARI morbidities.

Pahwa et al 2010, in their community based health and nutrition-education intervention in the management of diarrhea in a slum of Delhi showed significant results. The intervention involved one to one interaction with the mothers. After the intervention, there was a significant (p=0.000) improvement in acquaintance to the term 'ORS' (65-98%), along with its method of reconstitution from packets (13-69%); preparation of home-made sugar-salt solution (10-74%); role of both in the prevention of dehydration (30-74%) and importance of their daily preparation (74-96%); and continuation of breastfeeding during diarrhea (47-90%) in the intervention area.

The above review suggest that changes can be brought about through a holistic approach. Ramji 2009, in his review articles suggested that household level behavioural changes could be achieved by using appropriate behaviour change communication principles, change agents specially trained to address some of these issues, consistent messages, multiple channels to saturate population coverage and engaging communities in a participatory manner and encouraging their ownership of such interventions.

Rationale for the present study

The above review highlights the importance of optimal child feeding practices along with prevention and management of childhood illnesses as a key to a healthy child. The statistics from the state on child health points towards immediate action to handle the situation from worsening.

To add on limited data is available on the with respect to child feeding practices from the tribal areas of the region. The IEC material developed and available to the masses focuses on IYCF, IMNCI but food safety and hygiene is under covered. Though the importance of handwashing is emphasized but importance of other aspects of hygiene and sanitation needs to be discussed with the caregivers.

In view of the above, the present study was undertaken to study knowledge and practices of the mother with respect to child feeding practices, prevention and management of diarrhoea and hygiene and sanitation. Further an intervention in the form of nutrition health and food safety education was carried out for capacity building of mothers.