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Management of Nutrition Crisis: Technology-based Transformation in the Field of Healthcare

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ABSTRACT

Background: Acute malnutrition has grown into a big challenge to deal with in different parts of the world. There are areas desolated due to the economic crisis, climate disasters, or wars; many countries are facing a paucity of healthcare professionals, medicines and other health requirements.

Purpose: To identify various methods to manage malnutrition in children in different countries especially in developing countries and hard to reach areas from peer review literature.

Methods: The PubMed, Google Scholar, and Science Direct databases were searched to identify various management techniques for SAM/MAM. A com-bination of MeSH words were used like Malnutrition, Undernutrition, Man-agement, Strategies, Prevalence and Management Strategies.

Results: This paper reviews management strategies for acute malnutrition in children, especially in developing countries facing resource constraints. It high-lights the potential of digital health technologies and community collaboration to address this critical issue, emphasizing the importance of data-driven ap-proaches for effective interventions and policymaking.

1. Introduction

Malnutrition is a state of poor nutritional intake by the individual. This includes under nutrition as well as overnutrition. The term undernutrition has generally been used interchangeably with malnutrition. But to understand the concept better, WHO has defined malnutrition in different headings. WHO defines malnutrition as deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. This is further described under three categories: undernutrition, which includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age); micronutrient-related malnutrition, which includes micronutrient deficiencies (lack of important vitamins and minerals) or micronutrient excess; and overweight, obesity and diet-related noncommunicable diseases (such as heart disease, stroke, diabetes and some cancers) (L. H Allen, 2003). Wasting is an acute form of malnutrition while stunting is a chronic form of malnutrition. Both the forms can sometimes be seen in the same family or even the same person. Malnutrition accompanied by oedema is called edematous malnutrition. Millions of people worldwide are affected, especially children under five years of age, by the hunger crisis. Worldwide 151 million children under five years of age are stunted, 51 million wasted and 38 million are overweight (Webb *et al.,* 2018). Under-nutrition is a state of insufficient intake of nutrients and energy to maintain good health. This hunger crisis is prevalent in countries hit by natural calamities or war. African countries are badly affected. In 2018 itself, wars and climatic conditions have proved to be the biggest enemies of mankind's hunger. In FAO's global report 2019, Yemen, the Democratic Republic of Congo, Afghanistan and Syria are at major risk of famine. Socioeconomic instability in countries affects the poorest of the poor and the human beings with low immune levels. The objective of this paper is to identify various methods to manage malnutrition in children in different countries especially in developing countries.

2. Methods

We searched the PubMed, Google scholar and other published literature databases to identify various management techniques and innovative ideas being used by different countries/nations in the world to combat the problem of malnutrition. A combination of the words "malnutrition",

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"undernutrition", "management", "strategies", "under-five" and "children" were used. We excluded articles related to malnutrition in adults and diseases. A detailed search was carried out to understand different strategies employed in various countries to deal with malnutrition in children. A total of 456 articles were found initially and then 76 articles met the inclusion criteria. Articles in only English language are used. Finally, considering the relevance of the main topic, 31 articles have been selected to summarize the various techniques and their role in dealing with the status of undernutrition in different settings.

3. Causes of Malnutrition

Malnutrition has taken a form of giant around the globe affecting low-and-middle income countries and targets children especially in their initial years of life.

Infectious diseases, unavailability of food, inaccessibility of healthcare facilities, war and chaos, famine or other natural disasters have been the main reasons for the malnutrition prevalence in children. A high burden of mortality and disease has been observed in the refugees, displaced people because of one or the other reason 1999(Orach, 1999). Indirectly most of these are related and this is actually a web of causes and not the individual reason behind a child being malnourished.

There is a direct link between infections and malnutrition. The already malnourished child has lower immunity than his/her peers and can easily become a target of some infectious organism. The diseased individual further loses nutritional reserves of the body and finds it difficult to maintain the energy requirements of the body. This further increases the risk of mortality among children.

Another most important factor is the maternal nutrition (Fig 1). The birth weight of the baby depends highly on the maternal nutrition during that pregnancy. Inadequate maternal diet during pregnancy seriously affects intrauterine growth of the child and this in turn, affects birth weight of the baby. The growth in the first two years of the baby can thus be affected, which is very crucial phase in the development of a human being. This cycle does not end affecting the health status of child and mother but has many secondary but major effects including decreased earning capacities, poverty in the family further leading to unhealthy environments and unaffordability of the good food and healthcare services (Fig 1).

Statistics from the Centre for Research on the Epidemiology of Disasters and the Centre for Systemic Peace show that the frequency and intensity of disasters, either natural or man-made disasters have increased considerably in the past few years. Effect of the emergencies on this nutritional status of children is alarming. War torn areas are the other worst hit example of the hunger crisis, effecting children the most. Sudan and Yemen are the biggest examples.

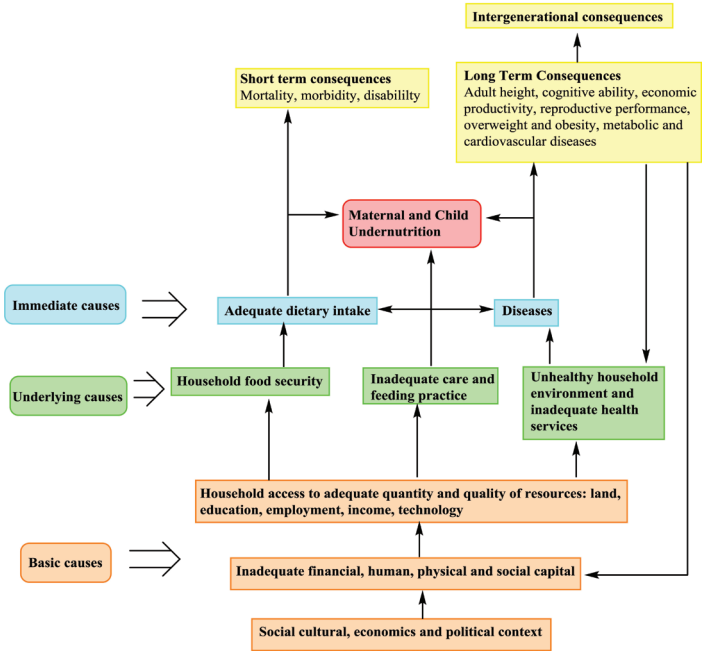

Figure 1: The determinants of child undernutrition: A conceptual framework. UNICEF[i]

4. How the Crisis Worsened with Covid-19 Pandemic?

Research warns that COVID-19 pandemic can leave the world with more serious implications affecting the children health. The flow chart explains how the COVID 19 pandemic that left the life, can still leave its imprints for generations to come globally. It is projected that COVID 19 affected world can have millions of more malnourished children than the one without COVID-19. Only in 2020, this estimate was about additional 6.7 million children getting affected by only wasting, only one form of malnutrition (Headey *et al.,* 2020).

This analysis further proves that telemedicine and other digital health services would be needed much more now than ever and to get maximum out of it, evidence-based decision making by effective data use is a must.

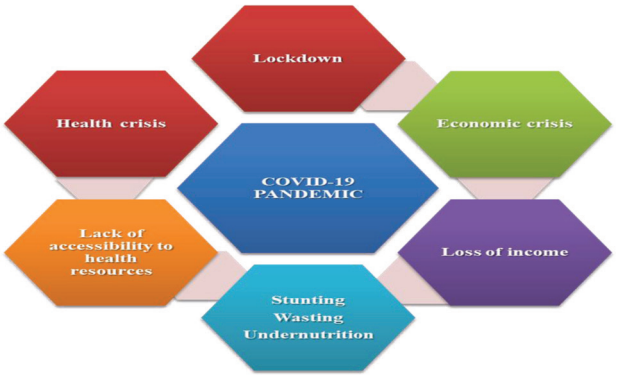

Figure 2: Effect of COVID 19 on children

5. Management Approaches for Under Nutrition

5.1. Hospital based Approach

The old age remedy for under-nutrition had been treating the cases in clinics/hospitals. When the child becomes sick or catches any other disease because of under nutrition, the parents/guardians bring the child to the hospital/clinic for the treatment. The patient is then treated for the chief complaint, for example, the infectious disease, shock and dehydration, micronutrient deficiency. When the acute phase is treated, then the rehabilitation phase starts (Maharaj K Bhan, Nita Bhandari, 2003). In Bangladesh and many other countries, the traditional way to combat malnutrition has been in the clinical settings only (Choudhury *et al.,* 2014). In India also, hospital based is again the traditional treatment approach. Other facilities like nutritional rehabilitation centers and Child Malnutrition treatment centers have also been opened under National rural health Mission (Pandya *et al.,* 2015).

In these acute cases, the patient is treated for the complications present and checks if the oedema is resolved. Then appetite test is done to confirm if the acute phase of the malnutrition is resolved. If yes, the patient is supposed to enter the rehabilitation phase and is shifted on outpatient treatment (Cloete, 2015).

The major signs in the rehabilitation phase are the return of appetite and a loss of all oedema, which are usually prominent signs in wasting. In this phase, continued weight assessment is done and Ready-to-use-therapeutic- food (RTUF) packages such as peanut paste enriched with various minerals and vitamins or high energy formulas like WHO F-100 (full strength formula 100) include ingredients like milk powder with added sugars, minerals and vitamins can be given (Cloete, 2015).

5.2. Home based Management

Home-based management with RUTF has proved to be very successful as well as resource saving approach for malnutrition treatment. Also, the results have proved to be very promising in some countries like Malawi. In Malawi out of 2131 severely malnourished and 806 moderately malnourished children, 89% and 85% children recovered, respectively. Thirty-four children who were moderately malnourished failed, with 20 fatalities, while 61 children who were extremely malnourished failed, with 29 deaths (Linneman *et al.,* 2007)

The RUTFs have been used successfully in home based as well as community settings.

In contrast to the above, in India the use of RUFT is highly debatable due to its stringent acceptability by the cultural and community (Shah More *et al.,* 2018). Due to the cultural diversity in India, the acceptance and utilization of RUFT also varies in different areas. In program SNEHA, which was implemented in Mumbai, the acceptability was very low but the effective results with this intervention are seen in another program in Rajasthan, named POSHAN for the treatment of malnutrition (Halim *et al.,* 2018). SNEHA CMAM was launched between 2011 and 2016 in four phases catering to children of age 3 years in slum region of Dharavi Mumbai covering approximately 300,000 population and involving 300 Anganwadi centers (Shah More *et al.,* 2018) and POSHAN Abhiyan was launched by PM in 2018 in Rajasthan.

5.3. Community based Approach

5.3.1. Community based Therapeutic Care

In Ethiopia, the CTC approach was implemented to treat SAM among children while reducing the burden of hospitals

and expense burden for families as well. Until a child needed emergency medical treatment for some complications, he was treated as an outpatient and was given home-based treatment with conventional medication and Plumpynut rations along with clinical monitoring. Additionally, awareness programs were run and follow up of severe cases was done (Chaiken *et al.,* 2006).

This nutrient rich food Plumpynut was developed by French company *Nutriset* and this has proved to be very successful in combating malnutrition. In India, the program POSHAN (Proactive and Optimum Care of Children through Social household Approach for Nutrition) was successfully implemented by Government of India with a set of standard guidelines focusing only on treatment aspect of uncomplicated cases of SAM through continuous and vast follow up and quality parental counseling by the frontline workers. In general, key challenges in India include a lack of federal government recognition of the problem and the scale of acute malnutrition, a lack of policies and guidelines (as of today) to address both treatment and prevention, governance mechanisms that are inadequate to address the issue, and insufficient funding (Halim *et al.,* 2018).

5.3.2. Anthropometry and Education

The interventions in community have proved to be very crucial in dealing with the problem of undernutrition. In Indonesia, in community settings, emphasis is given to increase the awareness and knowledge of caregivers regarding the nutritional requirements in addition to regular growth monitoring of children below three years of age. This is the window of opportunity period when the adequate nutrition proves to be very important (Isabelle & Chan, 2011). The exclusive breastfeeding for the first six months of a newborn and additional complementary feeding at six months is considered to be very important.

The anthropometric failure (stunting and underweight) exhibited substantial clustering in the districts of Uttar Pradesh, Madhya Pradesh, Bihar, Gujarat, Jharkhand, and Rajasthan. Moran's I statistics indicated a considerable spatial dependency in variance in levels of several anthropometric inadequacies among states among children aged 0-59 months in India, indicating that geography plays a significant influence in the degrees of stunting and underweight in a region.

Visual aids is often accompanied by the Pictorial scale/Growth cards/ Growth charts method and even for normal child, regular checkup for every child. The visual identification of the malnutrition signs and chances of the disease in future can be tracked and more easily recognized by the parents, especially in the rural settings, where mothers are not educated, as evident from a study in Kenya (Mwangome *et al.,* 2015). The other factor associated is the skillset of the healthcare workers associated with the monitoring of children. In a similar study in India, the actual successful implementation of the visual aid's strategy has been in the areas where Anganwadi workers were trained. It has been observed that intensive training of healthcare workers is required to actually implement this strategy (Ray, 2005).

This is more of a preventive measure when every child in the community needs to be regularly evaluated for the weight and height increase and the problem of under nutrition can be targeted at a very nascent stage. This also ensures that the money spent on the treatment is minimal as the beginning of malnutrition can be mostly treated with adjusted diet pattern only.

5.3.3. Maternal Nutrition

The education should also stress the importance of other major factors linked with the nutritional deficiencies. Maternal nutrition is the pioneer of fetal life as it shapes the genetic and intra-uterine environment. Any micronutrient deficiency impacts the Intra-uterine growth of the child and leads to growth retardation. This phenomenon termed "fetal programming" and explains the "fetal origins of adult disease"

But the process can be reversed in the cases of underfed and overfed mothers through fulfillment of the desired micronutrient and is purely enteral.

The One Full Meal (OFM) initiative combines center-based hot-cooked meals (HCM) for pregnant and breastfeeding women with additional nutrition services and behaviour change communication through the Integrated Child Development Services (ICDS) plan to enhance maternal nutrition and health across India. Since 2013, the program has been offered through anganwadi centres (AWCs) in eight Indian states: Chhattisgarh, Gujarat, Karnataka, Andhra Pradesh, Madhya Pradesh, Maharashtra, Telangana and Uttar Pradesh. However, there is no collected data on its efficacy or implementation lessons.

5.3.4. Community Mobilization and Collaboration in Various Sectors

Under the POSHAN II plan, the CMAM method was implemented through the government health system in 20 districts throughout Rajasthan in 2018. After eight weeks, 42.4 % of 1,322 enrolled children were discharged as cured, 4.1 percent defaulted, and 53.5 percent were not recovered and continued therapy, according to an independent review. At the end of 12 weeks, 66.9% were declared cured, 8.1 percent had defaulted, and 25% had not recovered and were referred for inpatient treatment. There were no deaths among the children. It showed that SAM children with no

complications could be effectively treated in the community in India utilising locally built EDNS and the current health system.

In Thailand, community health volunteering is done (Tontisirin & Bhattacharjee, 2008)2008. The community volunteers act a change-inducing agent in the society and work in association with the leaders in that community. They are also trained by the government programs organized in special reference to enhance nutritional knowledge and motivate them to enhance outreach activities and cover most of the population. The basic idea is to identify the issues at grassroot level and then work with senior level government officials. Moreover, the coordinated work of different sectors including public health, agriculture and education is stressed upon.

5.3.5. Home Based Food Solutions

In Laos, the innovative home garden pilot project was implemented and proved successful in decreasing the prevalence of malnutrition in children below five years of age. The Government collaborated with Food and Agriculture organization to set up home grown gardens to enhance home grown vegetables consumption (Tontisirin & Bhattacharjee, 2008). The same had been emphasized and acknowledged by the women in southernmost rural areas of Illinois and in Bangladesh also (Carnahan *et al.,* 2016).

It is also seen under program UMANG which was launched by World Vision in India was successful platform for improving SAM affected children as it promotes 'Nutrition Garden'. Similarly Action Against Hunger-India was launched in Rajasthan, promoting kitchen garden to prevent malnutrition (Halim *et al.,* 2018).

An effort to establish edible terrace gardens in schools and anganwadi centres in a rural border area of Mizoram has enhanced self-sufficiency in fruits and vegetables. During their mid-day meals, children are encouraged to eat fruits and vegetables.

5.3.6. Targeting Micro-Nutrient Deficiencies

Supplementation, fortification and dietary improvement are three important strategies which have proved to be important in different circumstances (Allen, 2003) particularly increased animal source food (ASF.

LNS (Lipid based nutrient spreads) is a nutrient specific intervention that has proven to be effective and consistent in preventing stunting in children through many clinical trials conducted in Asian, Africa and American countries. LNSs have been observed equally useful in preventing risk of anemia and iron deficiency (Perez-Escamilla *et al.,* 2018)obesity, and micronutrient deficiencies must take into account the inequities in which these diseases are rooted, argue Rafael Perez-Escamilla and colleagues \n\n### Key messages\n\nSocial determinants of health are understood to be key to grasping why inequalities in health outcomes exist within, and between, populations. They are also implicated in the differences in dietary intake, dietary patterns, and dietary quality seen in some groups, leading to an unequal burden of disease and morbidity. Nutrition disparities are reflected in the higher prevalence of undernutrition; overweight and obesity (overnutrition.

MNP (micronutrient powder) is another therapeutic intervention accepted economically, socially and ethically effective in reducing the anaemia and iron deficiency in Asia, Africa and Caribbean by 30% and 50% respectively. Thus, lowering the burden of malnutrition. MNP are found to be equally benefitting in many comparable studies with standard iron supplementation for lowering the prevalence of anaemia (Perez-Escamilla *et al.,* 2018)obesity, and micronutrient deficiencies must take into account the inequities in which these diseases are rooted, argue Rafael Perez-Escamilla and colleagues \n\n### Key messages\n\nSocial determinants of health are understood to be key to grasping why inequalities in health outcomes exist within, and between, populations. They are also implicated in the differences in dietary intake, dietary patterns, and dietary quality seen in some groups, leading to an unequal burden of disease and morbidity. Nutrition disparities are reflected in the higher prevalence of undernutrition; overweight and obesity (overnutrition.

5.4. Nutrition Specific Interventions

'Nutrition specific interventions' are specially designed as therapeutic supplements with a focus to reduce malnutrition, especially in lower-income countries. Therapeutic supplements are used to address specific health conditions and deficiencies often with higher doses, even for the use of these therapeutic supplement. Food products like RUFTs such as Plumpy' Nut has been launched for the treatment of uncomplicated SAM, Ready-to-use supplementary food product (RUSF), such as Plumpy'Sup is aimed to treat MAM and similarly, the Medium-quantity lipid-based nutrient supplement (LNSs) such as Plumply'Doz is used as supplement food products to reduce the burden of MAM (The World Bank, 2016). These interventions have shown both, therapeutic as well as preventive actions. Therefore, these can successfully act as a source of not only reducing the treatment cost but also the opportunity costs by prevention of further progression of malnutrition to severe stages. The production of these therapeutic foods can be costly if developed on a small scale but are often could be less expensive if produced in-country especially, if these are produced in local areas. Valuable local economic

opportunities can also be created with the decentralized production of these therapeutic foods (The World Bank, 2016). The cost further gets reduced when these strategies are implemented at a larger scale at the community level (Goudet S *et al.,* 2018).

Between 2006 and 2016, data from India's NFHS show an increasing trend in the coverage of nutrition treatments across the continuum of care, despite substantial policy changes linked to health and nutrition. The extended set of coverage indicators is already being used by India's new National Nutrition Mission (started in March 2018) to assess baseline levels and monitor district performance.

5.4.1. Role of Breastfeeding

The behavioral interventions have proved to be very effective in this context of nutrition specific interventions. To tackle a high prevalence of anemia and iron deficit conditions, extremely precise micronutrient fortification interventions are a key solution. For example, in Brazil, a well-organized framework and multisectoral approach of sensitive and specific interventions on a socially and ecologically accepted path are proposed as a stepping stone to eliminating anemia (Perez-Escamilla *et al.,* 2018)obesity, and micronutrient deficiencies must take into account the inequities in which these diseases are rooted, argue Rafael Perez-Escamilla and colleagues \n\n### Key messages\n\nSocial determinants of health are understood to be key to grasping why inequalities in health outcomes exist within, and between, populations. They are also implicated in the differences in dietary intake, dietary patterns, and dietary quality seen in some groups, leading to an unequal burden of disease and morbidity. Nutrition disparities are reflected in the higher prevalence of undernutrition; overweight and obesity (overnutrition.

As discussed earlier, acceptance of embracing the RUTF under SNEHA program was low, but overall, the results for reduction of wasting were good and the credit goes to the intensive community engagement of the workers. The medical nutritional therapy, a dense nutritional preparation infused with peanut butter and milk) provided by the frontline workers to the children of age 7 -36 months for the treatment of severe malnourishment proved to be effective in treating SAM as it achieved high levels of population coverage and lower levels of severe wasting. The supplements are provided door to door and monitoring of consumption is also done (Shah More *et al.,* 2018).

5.5. Combating Climatic Change

Another strong and important, but lesser touched upon factor that directly and indirectly effects the fetal growth is climatic change. In highly vulnerable geographical areas the extremes of weather affect both urban and rural people by threatening food security system (Session & Lanka, 2016). This questions the availability, accessibility and utilization of the secured food in war prone areas, lands affected by famine and draught, or any other natural calamity.

South Africa set a perfect example for effectively implementing mitigation strategies against natural disasters prioritizing the strengthening of food security system to combat the consequences like malnutrition. South African Development Community (SADC) launched various successful adaptation strategies to affect agriculture, indirectly affecting food security and shaping national policy. Under Sustainable Livelihood Approach (SLA) program, 'Living with floods' is one of the strategies useful for the people living frequent flood-prone areas which enable the locals to take the advantage of fertile soil for agriculture that results from floods. Regional Vulnerability Assessment & Analysis (RVAA) is another application under SLA which monitors the capability and vulnerability of a nation towards poverty and proved to be successful in many countries to tackle food insecurity (Tirivangasi, 2018) .

Even in the United States, the country with strong public health experts and policy supporters, the incidences of environmental catastrophes are high which ultimately has a disastrous effect on the public, especially children. The local communities prove to be very helpful in fighting the reasons for the disasters as well as providing relief mechanism after any tragedy (Sheffield & Landrigan, 2011).

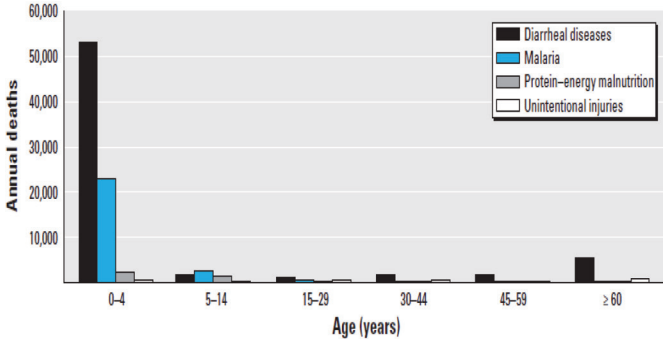

Figure 3: Deaths attributable to Global Climate Change: 2004 annual data in total numbers divided by age categories (adapted from WHO 2008).

Nutrition Sensitive Approaches like agriculture, early childhood development, education and WASH could help in building basic unit for nutrition specific interventions to combat the malnutrition in disadvantaged population (*UNICEF's Approach to Scaling up Nutrition*, 2012). A greater positive impact of integrated intervention of improved hygiene (WASH) and diversified diet patterns among infant & children has been demonstrated in India especially effecting wasting (The World Bank, 2016). Environmental factors like poor sanitation, poverty-stricken conditions, food insecurity and hunger, lack of access and utilization of equitable and quality healthcare are the characters contributing to chronic malnutrition among infants and children producing stunting. LMICs like Brazil, Chile, and Peru where these characteristics are more concentrated have successfully tackled the issue through more equitable social and economic policies. Brazil successfully focused on engagement of multisectoral strategies tackling, cultural diversity, eating styles, and both local and global food systems and access to clean water and sanitation, healthcare, and education (Perez-Escamilla *et al.,* 2018)obesity, and micronutrient deficiencies must take into account the inequities in which these diseases are rooted, argue Rafael Perez-Escamilla and colleagues \n\n### Key messages\n\nSocial determinants of health are understood to be key to grasping why inequalities in health outcomes exist within, and between, populations. They are also implicated in the differences in dietary intake, dietary patterns, and dietary quality seen in some groups, leading to an unequal burden of disease and morbidity. Nutrition disparities are reflected in the higher prevalence of undernutrition; overweight and obesity (overnutrition.

5.6. Technological Innovations

5.6.1. mHealth Technology

In India and Africa, the successful involvement of mobile health technology has shown improvement in the timely follow up rates as well as improved tracking by empowering frontline workers (Shah More *et al.,* 2018). Promising technologies are arising especially focusing the need of underserved women and her family. According to a study emerging technology like sensors, wearables and lab-on-a-chip would be helpful to produce and collect high quality data for mobilizing the pregnant females to routine follow-up, a call from health educator, a visit from a home visitor, or an appointment with a specialist (Lu, 2018).

5.6.2. Telemedicine

Telemedicine is a tool designed to bridge the gap between accessibility and availability of quality healthcare services by overcoming geographical barriers (remote areas and war-torn areas) across the world by enhancing better communication channels between healthcare professionals and community. Further advent of telemedicine in the healthcare sector has improved accessibility of the healthcare services in rural areas. A perfect example could be seen in Mongolia where telemedicine was launched in 2007 and was successfully extended further to reduce infant and maternal mortality, supported provinces of high-risk pregnancy consultation, prenatal ultrasound diagnostics, fetal monitoring and screening for cervical abnormalities. The uniqueness of this project is mutual effort and shared learning between health care workforce therefore lowering the hierarchy among urban and rural staff (World Health Organization, 2010).

Also, in war torn region of Somalia, telemedicine launched and supported by Médecins Sans Frontie`re (MSF) in a district hospital cater to a large number of affected and vulnerable population. To acknowledge this issue a huge step was taken by MSF, by introducing tele-consultations and tele-mentoring for exchanging information between the health-work professionals situated poles apart. This helped in addressing and preventing many life-threatening conditions by providing culturally accepted consultations, prescription knowledge and follow-up requirements. Thus, improving quality of healthcare and functioning of health facilities (Zachariah *et al.,* 2012).

5.6.3. Data as a Savior of Resources

Numerous survey tools like SMART (Standardized Monitoring and Assessment of Relief and Transition) are proved to be effective in critically analyzing the data at state and national level for shaping the national policies as demonstrated in high-risk areas of India by rigorously assessing levels of malnutrition. Another tool Nutritional Causal Analysis (NCA) works comprehensively on every aspect of under-nutrition by thoroughly analyzing the connection among various causal factors of 'at risk population'. To assess the effectiveness of CMAM intervention Semi-Qualitative Evaluation of Access and Coverage (SQUEAC) which analyses the coverage of any CMAM program. The above tools act as facilitator in effective implementation of program (Halim *et al.,* 2018).

6. Conclusion

Nutritional deficiencies are not the consequence of one single dietary factor but different factors like economic conditions, climate, healthcare resources, knowledge about food, political and social factors, etc. Each of these factors performs an indispensable role in interacting with one another. In the same way, approaching the problem from

one single method cannot give fruitful results. Technology in various forms, including mobile phones, internet services, telemedicine, data management software, etc., can play a crucial role in transforming the field of healthcare.

- Technology can act as a backbone, supporting the implementation of various programs to eradicate malnutrition and strengthening the policies by providing robust data.
- Evidence based decision making is crucial in resource constraint settings and to get maximum output from the limited resources. Therefore, proper data utilization is needed.
- Predictive models can enhance the operational success of the Projects aiming to improve child health.

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8. Authorship contribution

Conceived and designed the manuscript: Didar Singh, Nisha Jain, Thakur Gurjeet Singh. Analyzed the data: Thakur Gurjeet Singh, Sanjana Mehta. Wrote the manuscript: Didar Singh, Nisha Jain. Visualization: Gaber El-Saber Batiha, Thakur Gurjeet Singh. Editing of the Manuscript: Thakur Gurjeet Singh, Sanjana Mehta, Sarita Jangra. Critically reviewed the article: Thakur Gurjeet Singh. Supervision: Thakur Gurjeet Singh.

9. Conflict of interest

There are no conflicts of interest.

10. Declaration

It is an original data and has neither been sent elsewhere nor published anywhere.

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