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Nutritional Outcomes in Karnataka: Analysis and Recommendations

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Executive Summary

Karnataka needs to improve its nutritional outcomes. There has been little improvement over the last decade in nutrition related health indicators. The percentage of children with stunting has remained largely the same (NFHS 4 :36, NFHS 5:35) and so has the percentage of children with wasting (NFHS 4 :35, NFHS 5:33). Infant Mortality shows no significant improvement. (NFHS 4: 28 per 1000 live births to NFHS 5: 25 per 1000 live birth). The under-five mortality is estimated to be 30 deaths before the five years of age per 1,000 live births (NFHS 5), a slight reduction since NFHS 4 (32 deaths per 1,000 live births).

We analysed existing nutrition indicators along with government interventions. We recommend certain modifications to improve the state of nutrition in the state. First, there is a need to improve data collection and measure the impact of schemes. Second, a reduction in reliance on the overworked Anganwadi Workforce is advised. We also recommend adding and modifying interventions based on current evidence.

I. Introduction

Malnutrition refers to deficiencies, excesses, or imbalances in a person's intake of energy and/or nutrients. WHO categorises malnutrition into 3 broad groups of conditions:
1. Undernutrition: Includes wasting (low weight-for-height), stunting (low height-for-age) and underweight (low weight-for-age).
2. Micronutrient-related malnutrition: Includes micronutrient deficiencies (a lack of important vitamins and minerals) or micronutrient excess.
3. Overweight, obesity and diet-related noncommunicable diseases: such as heart disease, stroke, diabetes and some cancers.

As India has been developing, there has been a dip in the undernutrition group of malnutrition, but diet-related noncommunicable disease burden is on the rise. Even though factors such as genetics, sedentary lifestyle, stress, influence diet-related noncommunicable diseases, nutrition plays a critical role in children's development and control.

Undernutrition causes a vicious cycle leading to more infections and lower productivity, which in turn leads to further undernutrition. Experts and countries all over the world follow the life cycle approach (Figure 1) to undernutrition. Government of India also follows this approach. The lifecycle approach says that outcome in earlier part of life will affect the next phase of life.

For example, malnutrition affects children under five years of age, the most, and causes a lot of problems. The first 3 years or "first 1000 days" in government parlance are critical for cognitive development of the child. Interventions during the first two to three years of a child's life have maximum potential to reduce malnutrition and promote optimum cognitive development. It is also demonstrated that if proper nutrition and care is not provided to children in these years, the damage may be irreversible.
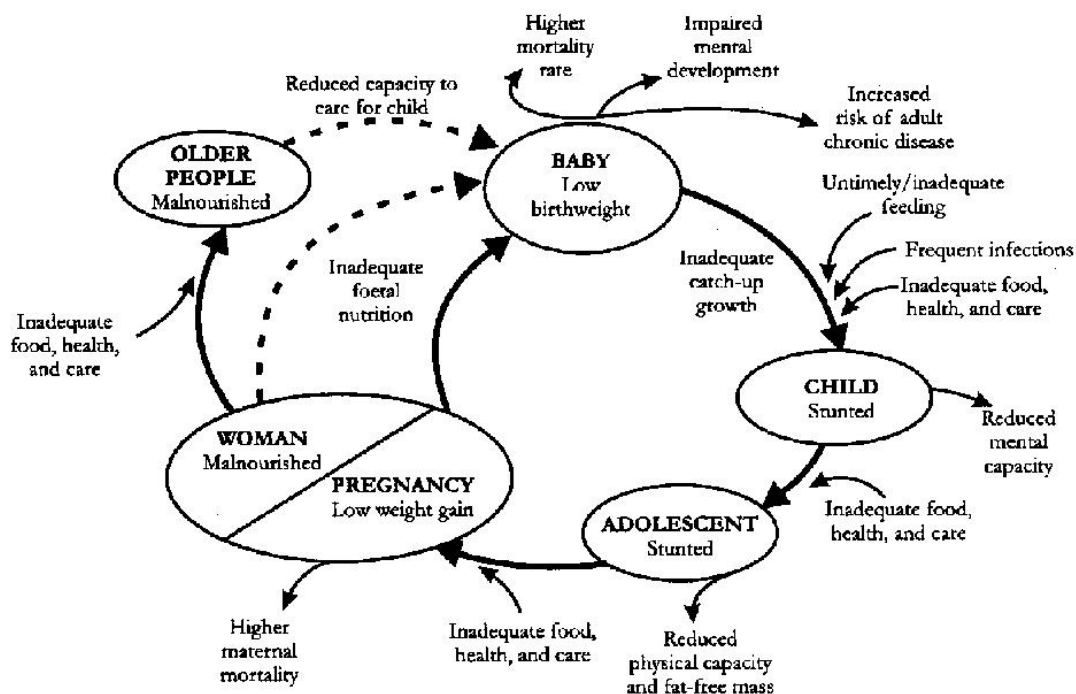
II. *Methodology*

In this document we analyse Karnataka's nutritional health. We have performed a landscape analysis of different nutrition indicators for the state of Karnataka. We have also analysed the government schemes that tackle malnutrition.

For the analysis, we took the following steps.
1. Analysed data regarding nutrition in Karnataka.
2. Analysed existing government schemes in Karnataka.
3. Devised recommendations to improve nutrition in the state.

1. Analysis of data regarding nutrition in Karnataka

We faced great difficulty getting reliable and standardised publicly available health data. Widely-cited databases, such as national family health survey (NFHS) don't provide reliable data for our study. Insufficient sample size at the district level to draw statistically significant conclusions, excessive length of the questionnaire, inadequate training of field workers has led to unreliable data. We have used the Global Burden Disease Study Database (GBD India Compare) as our data source. The GBD database has incorporated multiple data sources (including Census, National Health and Family Survey, Birth and Death Registrations, Health Records) and is used globally by organisations such as the World Health Organisation. GBD India Compare is a collaboration between the Indian Council of Medical Research (ICMR), the Public Health Foundation of India (PHFI), Institute for Health Metrics and Evaluation (IHME) University of Washington.

We have used Disability Adjusted Life Years (DALYs) to measure the impact of malnutrition on the population of Karnataka. DALYs are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. The advantage DALYs have over other metrics such as death rate is that it captures both mortality and morbidity caused by a disease.

DALY
Disability Adjusted Life Years measure the overall burden of disease, expressed as the cumulative number of years lost due to ill-health, disability or early death.

= YLD Years Lived with Disability **+ YLL** Years Life Lost

Healthy life | Disease or Disability | Early death | Expected life years

Source : Wiki Commons

DALYs = Years of life lost due to premature mortality (YLL) + Years lived with disability (YLD)

Fig 2: Explaining Disability Adjusted Life Years (DALYs)

Impact of Malnutrition across Age Groups

Percentage of Total DALYs(%)

87 — 0-5 Years
62 — 6-14 Years
25 — 15-49 Years
24 — 50-69 Years

Age group(in years)

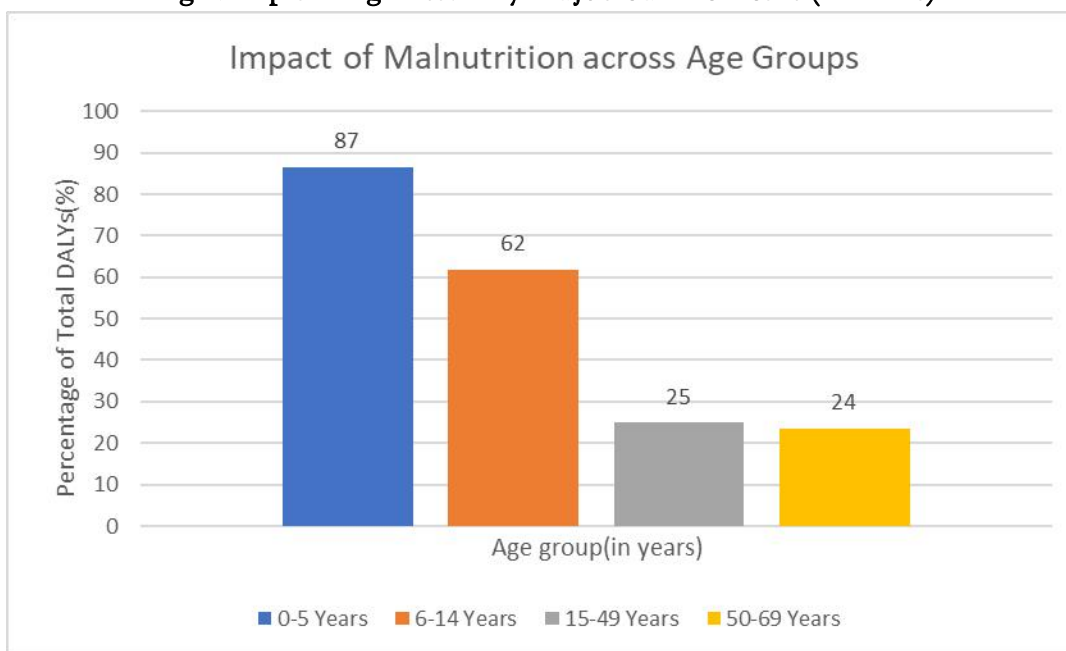■ 0-5 Years ■ 6-14 Years ■ 15-49 Years ■ 50-69 Years

Fig 3: Percentage of DALYs affected by Malnutrition across Age Groups in the State of Karnataka

The impacts of malnutrition are spread across ages, with undernutrition forming a large chunk of disease burden in the early years. The distribution of DALYs is illustrated by Fig 3 which shows that Nutrition related DALYs form a large part of the under 5 age group as compared to the adults (15-49 years) or older adults (50-69 years). Micronutrient related malnutrition and diet related noncommunicable diseases become a larger concern later in life. Hence, we have divided our study focus across age groups.

For our analysis, we have divided the population into 4 groups according to age and distribution of nutrition related factors.

1. Under 5 years

2. 5-14 years

3. 15-49 years

4. 50-69 years

- Note: 5-14 years include people from age of 5 year 0 days to the age of 13 years 364 days and similarly for the other age groups.

2. **Analysis of existing government schemes in Karnataka**

We analysed existing schemes in Karnataka using already published literature. We used a semi quantitative scale to study the impacts of schemes on different aspects of malnutrition in the state. A 3-point scale was used to assess the schemes and their impact on different contributors of malnutrition for different age groups, 1 being the lowest and 3 being the highest.

3. **Recommendations to improve nutrition in the state**

After analysing government schemes and studying their strengths and pitfalls in context of the available nutrition data, we formulated recommendations to improve nutritional health of the population.

III. Analysis of Existing Government Schemes

Both the Union and Karnataka Government have schemes geared to fight malnutrition in the state. Majority of the schemes are primarily run and led by the Union government, although some flexibility is provided to the Karnataka government in their implementation. There is a lot of focus on Mother and Child Health (MCH) as a majority of disease burden in pre-adolescent children can be alleviated by improving MCH. Cost of the programs is variable and is shared between Karnataka and the Union, with ratios varying between 50:50 to 90:10 with the Union and State.

There is an increasing emphasis towards convergence of MCH component of various government initiatives with the launch of POSHAN Abhiyan (National Nutrition Mission) in 2018. In the Union Budget for 2021-22, the government merged the Supplementary Nutrition Program with Poshan Abhiyan to form Mission POSHAN 2.0 to alleviate malnutrition.

An analysis of various government schemes is as follows:
- Note: With the launch of Mission POSHAN 2.0 a lot of nutrition related schemes have merged into one and it will take some time to get clarity on how they function and what components will remain.

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
Anganwadi Services Scheme	Children < 6 years of age, Pregnant Women & Lactating Mothers (PW&LM),	March 2018 As ICDS in Oct 1975	Dept. of Women & Child Welfare	-Early childhood care & education/preschool non formal education - Supplementary nutrition (morning snack, hot cooked meal, take home ration, micronutrient supplementation -Infant & young child feeding promotion & counselling, - immunisation, -Referral services - Regular Health Check-ups - **Karnataka Specific SNP (- Mathrupoorna-hot cooked meal for pregnant & lactating**	-Focus on Behaviour Change communication -Health Education - Community involvement and participation -Ration provided at doorstep. -Serving a large vulnerable - Takes Maternal health into consideration	-Monitoring Indicators indicate uptake of scheme instead of malnutrition etc - Overburdened AWWs (Survey + PSE activities + children related scheme + women related schemes + Immunisation etc.) -Irregular monitoring &supervision by higher authorities -Inadequate/ late dispersal of supplies - Lack of Competitive Salaries

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
				women -Srusti -egg twice a week for all anganwadi kids, & five times a week for severely underweight children -Ksheera Bhagya - milk for five days a week for children between six months & six years)		
Pradhanmantri Matru Vandana Yojna (PMVY)	Pregnant Women & Lactating Mothers (PW&LM) for first live child in family	Jan 2017 Successor to Maternity Benefit Programme	Dept. of WCD	-Rs 6000/ in 3 instalments for the first live child. On completion of registration, ANC check-up, Immunisation of the child.	-Direct Cash Transfer	-Only First-born child included -Slow process since its launch -Lack of suitable IT infrastructure at the block level -Delay in verification process (AADHAR) - consumed a lot of time specifically with regards to creating a list of recipients - No integration

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
						between Public Financial Management System (PFMS), Local Government Directory (LGD) and Aadhaar systems: -Delay in disbursement of payments due to too many stakeholders in the process, thereby creating a complex system
National Creche Scheme	6 months – 6 years old	Jan 2017 (earlier known as Rajiv Gandhi National Creche Scheme)	Dept. of Women & Child Welfare	-Day care Facilities including Sleeping Facilities. -Early Stimulation for children below 3 years & Pre-school Education for 3 to 6 years old children. - Supplement	-First program to provision day care facility for children -Potential to free-up women's time for economic engagement	-Creches not running for full 7.5 hrs - Independent program covering all children below 6 years with no linkages to the existing ICDS program. -No or little community

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
				ary Nutrition -Growth Monitoring. -Health Check-up & Immunization		ownership - No proper training low remuneration for crèche workers - No prioritized focus on vulnerable geographies -Insufficient and delayed funding - No provision of rent for crèches/ remuneration for workers impractical -10 per cent financial contribution from NGOs may be impractical.
Scheme for Adolescent Girls Part of Anganwadi Services	Out of school girls in the age group of 11-14 years	2010 Previously running as Rajiv Gandhi Scheme for Empowerment of Adolescent Girls	Dept. of Women and Child Welfare	- Supplementary nutrition for 300 days in a year- in form of Take-Home Ration or Hot Cooked Meals - IFA	-Well targeted to a at risk group - Beneficiaries receiving IFA supplementation and Nutrition benefits regularly	-Dependent on overworked anganwadi workers - Kishori health cards are not given/maintained - Non utilisation of

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
				supplementation & deworming tablets -Health check-up & Referral services -Nutrition & Health Education		funds by states
Pradhan Mantri Poshan Shakti Nirman (previously known as Mid-Day Meal)	4 years- 14 years (pre-primary to 8th class) of school going children	Aug 1995	Dept. of Primary and Secondary Education	-Covers children in Govt. & Govt. aided schools -1 meal on all working days	- 1 meal to school going children/decreasing malnutrition - Increasing enrolment in schools - Decreasing Child labour	- Lack of quality control - Extra Burden on Teachers - Leakages
Anaemia Mukht Bharat/ Intensified National iron plus initiative (I-NIPI)	Children 6 months -6 years, Adolescents 10-19 years, P&LW, Women -20-49years of age	April, 2018	Dept. of Health and Family Welfare	-Testing of anaemia using digital methods & point of care treatment - Prophylactic IFA -Deworming -Behaviour Change Communication -Mandatory provision of IFA fortified foods in government-funded	- Including 6-19 years -Point of Care treatment protocol -Inclusion of Non-Nutrition determinants of anaemia	-Behaviour Change communication not taken seriously -Training not given to village health and sanitation committees and teachers

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
				health programmes -Addressing non-nutritional causes of anaemia in endemic pockets, with special focus on malaria, haemoglobinopathies and fluorosis		
POSHAN Abhiyan	- <6 years -Women in the age group of 15-49 years.	March, 2018	Multiple Dept. (at union and State level)	Made by convergence of -Anganwadi Services -Pradhan Mantri Matru Vandana Yojana -Scheme for Adolescent Girls of MoWCD -Janani Suraksha Yojana (JSY) -National Health Mission (NHM) -Anaemia Mukt Bharat Indradhanush of MoHFW -Swachh Bharat Mission of Ministry of Drinking Water & Sanitation (MoDWS) -Public Distribution System (PDS) of Ministry of Consumer Affairs Food & Public Distribution (MoCAFP&D) -Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) of Ministry of Rural Development (MoRD) -Drinking Water & Toilets with Ministry of Panchayati Raj (MoPR) and Urban Local Bodies through Ministry of Housing & Urban Affairs (MoH&UA).		

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
National Iodine Deficiency Disorders Control Programme	Everyone	Aug 1992	Dept. of Health and Family Welfare	-Surveys to assess the magnitude of the Iodine Deficiency Disorders. -Supply of iodated salt in place of common salt. -Resurvey after every 5 years to assess the extent of Iodine Deficiency -Disorders and the impact of Iodated salt. -Laboratory monitoring of iodated salt and urinary iodine excretion. -Health education & Publicity.	- Generation of regular, representative and reliable scientific data - Stakeholder analysis and development of partnership - the development of partnership between various stakeholders namely government institutions, academic institutions, international and national non-governmental organization, civil society organization and salt producers	- Universal salt iodisation not achieved -Difference between urban-rural and different zones of the country

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
Targeted Public Distribution System -Antyodaya Anna Yojana(To better target AAY households) - Part of TPDS approach	-Below Poverty Line(BPL) households - Above Poverty Line(APL) Households	June 1947 (as PDS)	Dept. of Food, Civil Supplies and Consumer Affairs	- Provide sustainables (centre provides Wheat, rice, sugar and kerosene) - To Below Poverty Line- Much below market rate - Currently sold though special PDS shops- **changes are ongoing**	- Target the poorer/ vulnerable section - Supply of food grains around the year - Moving towards Direct Bank Transfer	-Large inclusion & exclusion errors. -Leakage of food grains: (Transportation leakages + Black Marketing by FPS owners) + poor quality - Lack of storage capacity by the government & wastage of food grains - Minimum support price (MSP) Land diverted from production of coarse grains(that are consumed by the poor), to rice and wheat and thus, discourages crop diversification + growing of water intensive & environmen

Name.	Target Population	Started in	Dept. Responsible	Major Initiatives	Strengths	Weaknesses
						tally not sustainable crops - Lack of Coarse Grains

We analysed these schemes for the age groups they target. We used a semi quantitative scale of 1-3 with 1 being the lowest score and 3 being the highest. We extracted different components of malnutrition by age groups and gave the schemes score on how they perform. Components are defined as different conditions or diseases which form a part of the malnutrition spectrum or affect nutrition outcomes. An appendix attached at the end of this document defines the different components used. The performance of these schemes was assessed by their structure, reach, and various assessments on them available in public domain.

For Age Group: Under 5 years.

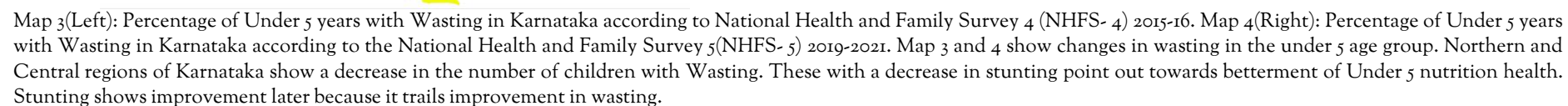| Components of Malnutrition	Percentage of Total Disability-adjusted life years(DALYs)
Low birth weight	39.75
Short gestation	32.93
Child wasting	7.09
Child underweight	3.11
Iron deficiency	1.81
Child stunting	1.01
Non-exclusive breastfeeding	0.72
Vitamin A deficiency	0.17
Discontinued breastfeeding	0.04
Zinc deficiency	0.01
% Of Total DALYs affected by nutrition	86.64

Low Birth Weight and Short Gestation contribute to more than two-thirds of the disease burden in the Under 5 age group. A focus on MCH can decrease this burden. Many of these diseases are affected by factors the mother is facing when the child is in the foetal stage. There is a need to modify these factors to prevent diseases in Under 5 age groups. Malnutrition affects almost all of the disease burden in this group; alleviating nutritional diseases burden can improve the health outcomes of this population.

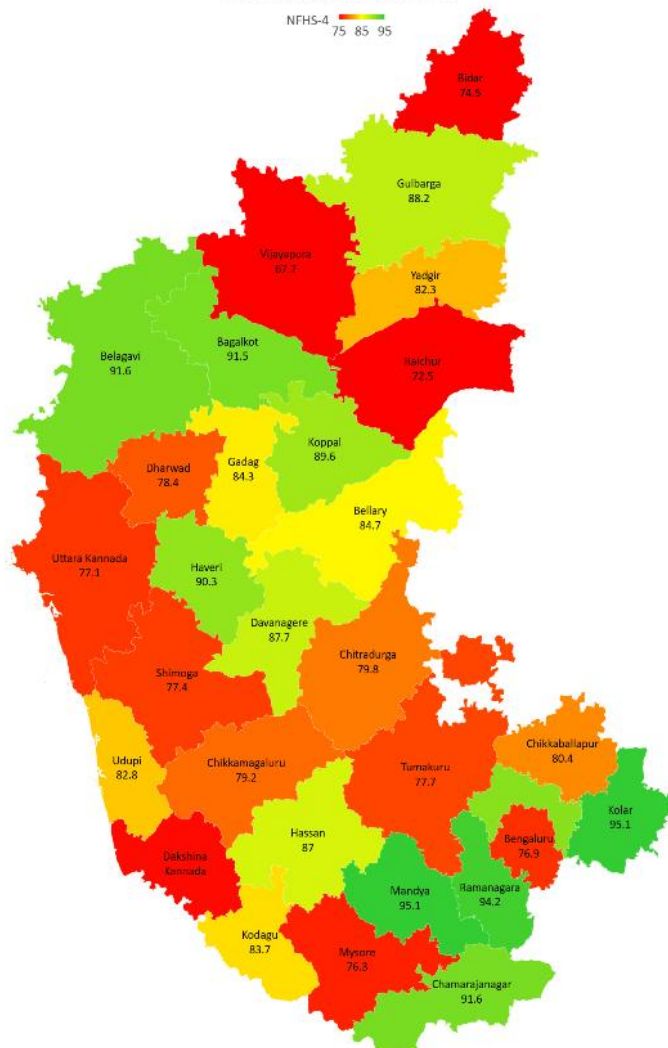| Name	Low birth weight	Short gestation	Child wasting	Child under weight	Child stunting	Discontinued breastfeeding	Non-exclusive breastfeeding	Iron deficiency	Vitamin A deficiency	Zinc deficiency
Pradhan mantri Matru Vandana Yojna	1/3	1/3	0	0	0	0	0	0	0	0
Anganwadi Services Scheme	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/3	2/3	0
National Creche Scheme	0	0	2/3	2/3	2/3	0	0	0	0	0

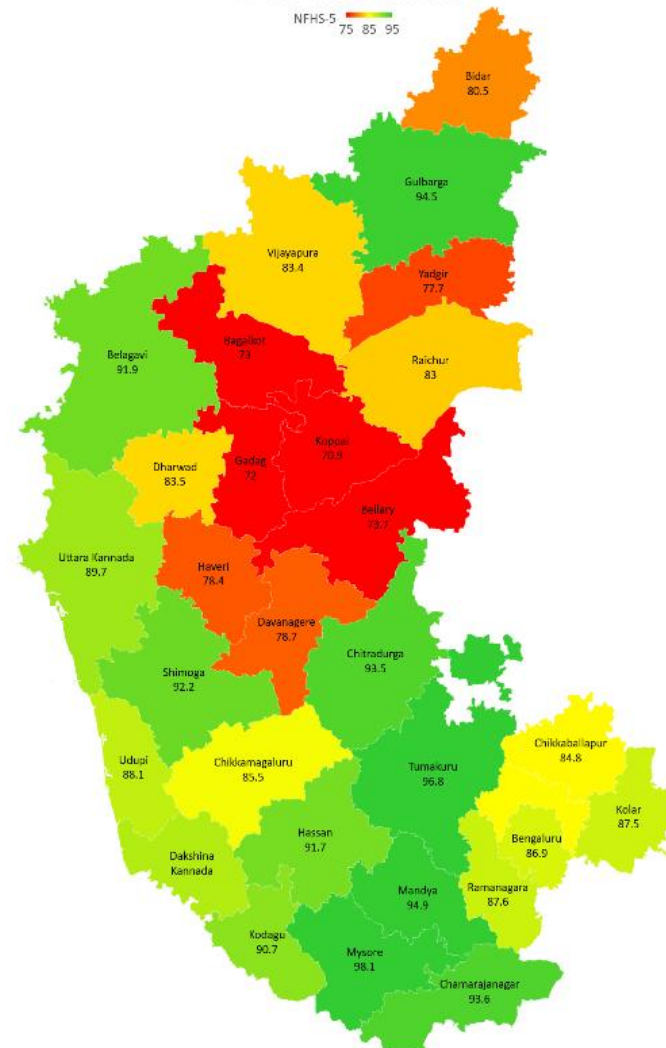Government interventions/schemes targeted at the under 5 age group quantified on the 3-point scale.
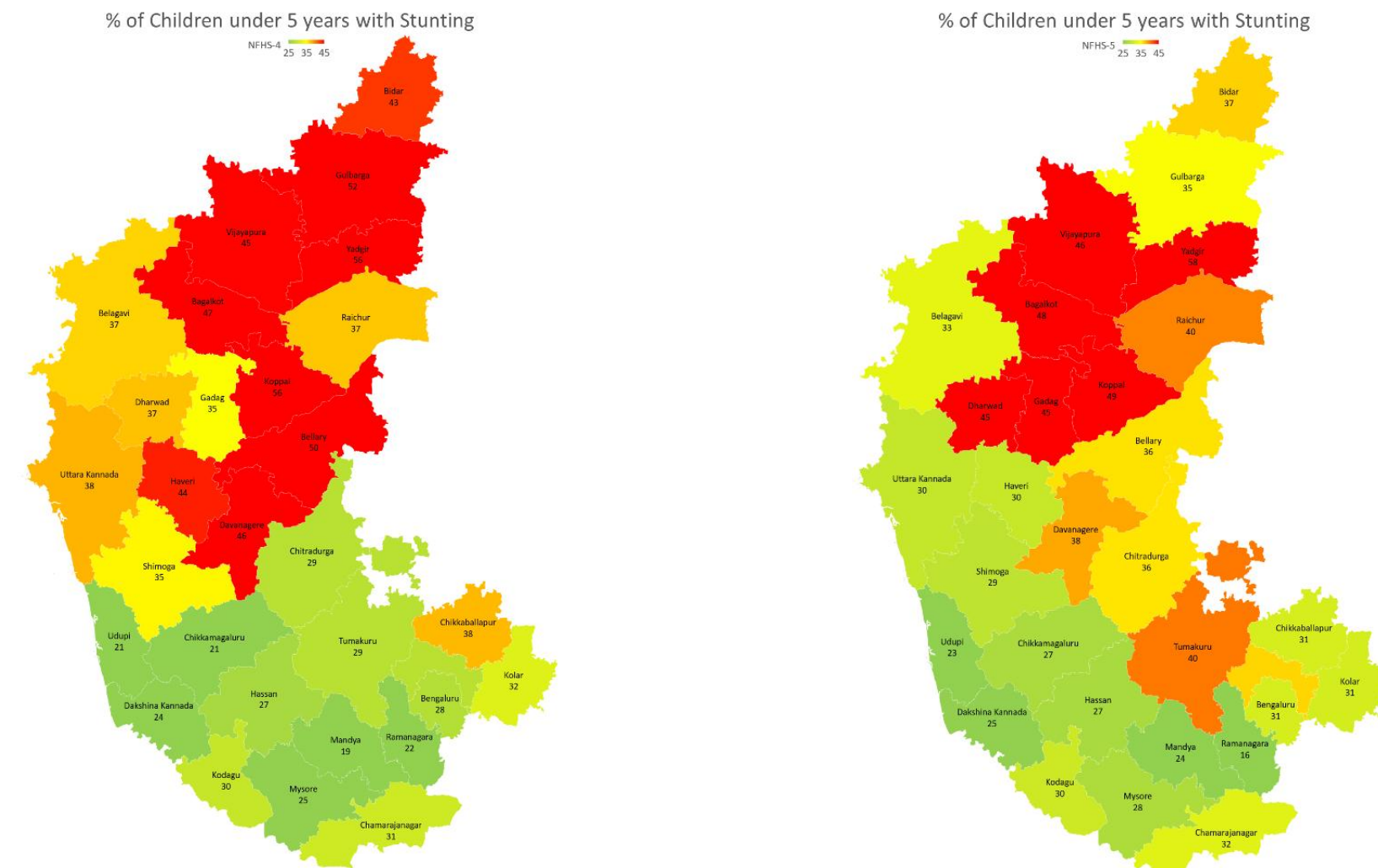
Map 1(Left): Percentage of Under 5 years with Stunting in Karnataka according to the National Health and Family Survey 4(NHFS- 4) 2015-16. Map 2(Right): Percentage of Under 5 years with Stunting in Karnataka according to the National Health and Family Survey 5(NHFS- 5) 2019-2021. Map 1 and 2 show a reduction in under 5 stunting in Northernmost and Central districts. Although, Southern districts show a slight increase over the 5-year period, more efforts are required in Bagalkot, Vijayapura, Yadgir and Raichur. Stunting has been increasing in Dharwad, Koppal and Gadag. This has to be reduced.

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% of Children under 5 years with Wasting

NFHS-4   13   20   28

% of Children under 5 years with Wasting

NFHS-5   13   20   28

Map 3(Left): Percentage of Under 5 years with Wasting in Karnataka according to National Health and Family Survey 4 (NHFS- 4) 2015-16. Map 4(Right): Percentage of Under 5 years with Wasting in Karnataka according to the National Health and Family Survey 5(NHFS- 5) 2019-2021. Map 3 and 4 show changes in wasting in the under 5 age group. Northern and Central regions of Karnataka show a decrease in the number of children with Wasting. These with a decrease in stunting point out towards betterment of Under 5 nutrition health. Stunting shows improvement later because it trails improvement in wasting.

Map 5(Left): Percentage of Children 6-35 months who received a Vitamin A dose in the last 6 months in Karnataka according to the National Health and Family Survey 4 (NHFS- 4) 2015-16. Map 6 (Right): Percentage of Children 6-35 months who received a Vitamin A dose in the last 6 months in Karnataka according to National Family and Health Survey 5(NFHS- 5) 2019-2021. Map 5 and Map 6 point to overall decrease in percentage of children who have received a Vitamin A dose in Central Karnataka. Decrease in healthcare access due to the ongoing COVID-19 pandemic could be one of the primary reasons.

% of Mothers who had at least 4 antenatal care visits

NFHS-4 60 72 84

% of Mothers who had at least 4 antenatal care visits

NFHS-5 60 72 84
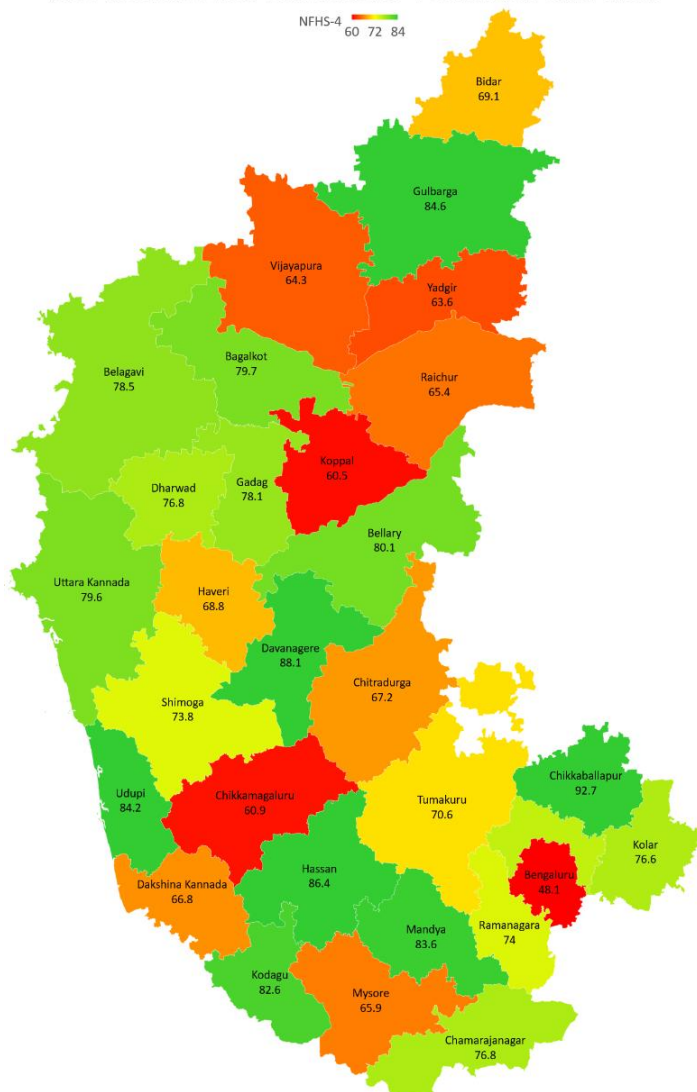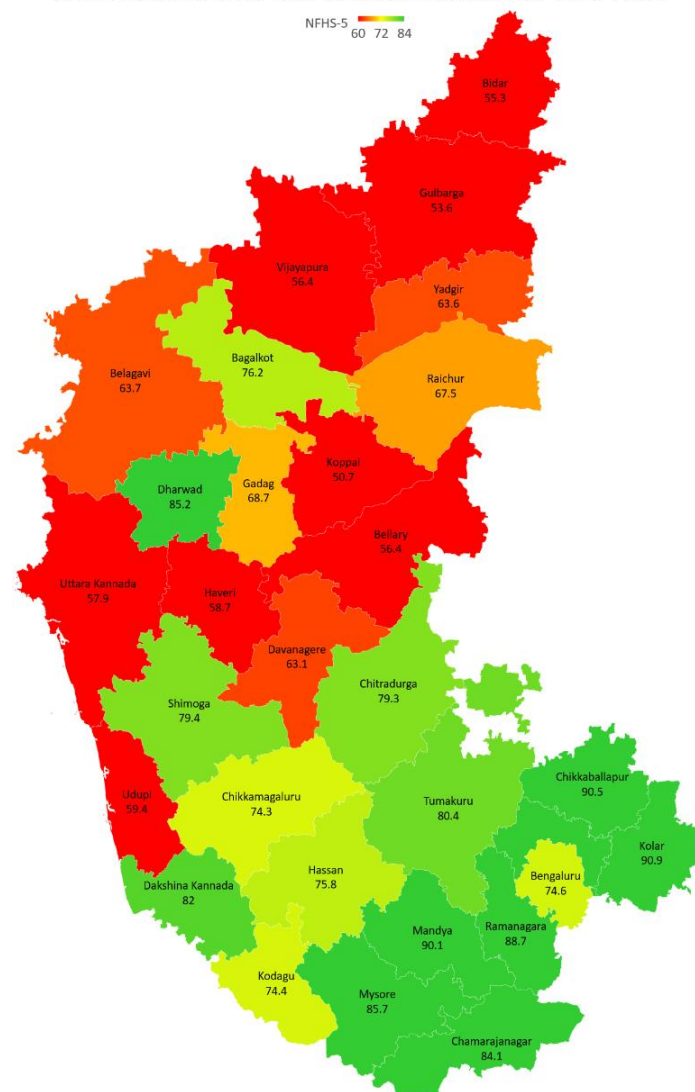
Map 7(Left): Percentage of Mothers who had at least 4 antenatal care visits in Karnataka according to National Family and Health Survey 4 (NFHS- 4) 2015-16. Map 8(Right): Percentage of Mothers who had at least 4 antenatal care visits in Karnataka according to the National Family and Health Survey 5(NFHS- 5) 2019-2021. Map 7 and Map 8 point to a decrease in ANC visits all across Karnataka. One of the primary reasons for this can be a lack of access due to the ongoing COVID 19 pandemic.

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Majority of Under 5 disease burden is affected by malnutrition. Although, a lot of government schemes focus on the Under 5 age group, the state still lags behind in Under 5 nutrition indicators. There is a need to increase resource allotment and make better schemes.

For Age Group: 5-14 years

Components of Malnutrition	Percentage of Total Disability-adjusted life years (DALYs)
Iron deficiency	33.30
Short gestation	10.61
Low birth weight	10.61
Child underweight	3.11
Child wasting	3.11
Vitamin A deficiency	1.19
% Percentage of Total DALYs affected by nutrition	62.02

The disease burden shifts from consequences of MCH to Micronutrient Malnutrition (Iron Deficiency) although the data shows that suffering from malnutrition earlier in life (age group under 5 years) still affects health outcomes in pre-adolescent years. A life cycle approach to nutrition is a good way to tackle this.

	Iron deficiency	Short gestation	Low birth weight	Child underweight	Child wasting	Vitamin A deficiency
Scheme for Adolescent Girls	1/3	0	0	2/3	2/3	0
Anaemia Mukt Bharat	3/3	0	0	0	0	0
Pradhan Mantri Poshan Shakti Nirman (previously known as Mid-Day Meal)	0	0	0	2/3	2/3	0

Government interventions/schemes targeted at the 5–14-year age group quantified on the 3-point scale.

Ages 5-14 are an important part of human growth and the health conditions in this group have a large influence on outcomes later in life. The government needs to broaden its focus from select components like anaemia to a more holistic approach.

For Age Group: 15-49 years

| Components of Malnutrition	Percentage of Total Disability-adjusted life years (DALYs)
High body-mass index	7.05
Iron deficiency	3.50
Diet low in fruits	2.43
Diet low in legumes	2.38
Diet high in trans fatty acids	1.60
Diet low in vegetables	1.48
Diet high in sodium	1.43
Diet low in nuts and seeds	1.26
Diet low in whole grains	1.21
Diet low in fiber	1.08
Diet low in polyunsaturated fatty acids	0.90
Diet low in seafood omega-3 fatty acids	0.71
Diet high in sugar-sweetened beverages	0.26
Diet high in processed meat	0.23
Diet high in red meat	0.18
Diet low in milk	0.07
Vitamin A deficiency	0.04
Diet low in calcium	0.03
% Of Total DALYs affected by nutrition	25.82

For Age Group: 50-69 years

Components of Malnutrition	Percentage of Total Disability-adjusted life years (DALYs)
High body-mass index	7.84
Diet low in fruits	2.76
Diet low in legumes	2.19
Diet high in sodium	1.89
Diet high in trans fatty acids	1.46
Diet low in vegetables	1.42
Diet low in whole grains	1.10
Diet low in nuts and seeds	0.98
Diet low in polyunsaturated fatty acids	0.78
Diet low in fibre	0.72

Iron deficiency	0.71
Diet low in seafood omega-3 fatty acids	0.62
Diet high in processed meat	0.44
Diet high in sugar-sweetened beverages	0.27
Diet high in red meat	0.23
Diet low in milk	0.11
Diet low in calcium	0.04
Vitamin A deficiency	0.01
% Of Total DALYs affected by nutrition	23.57

Both age groups show an increase in the contribution of Micronutrient Malnutrition and Diet related Noncommunicable Malnutrition and a decrease in Undernutrition.

The Targeted Public Distribution System is not targeting this change. It targets access to food and basic necessities (Wheat, Rice, Sugar, Kerosene). We also want to focus on this increasing disease burden.

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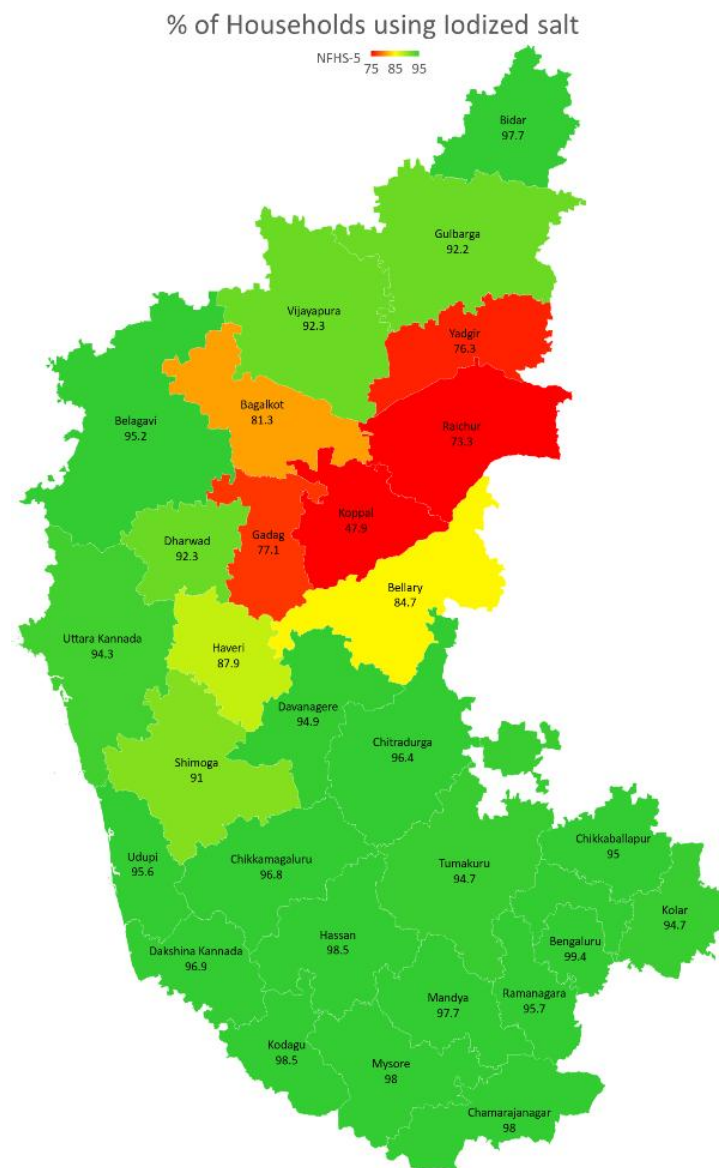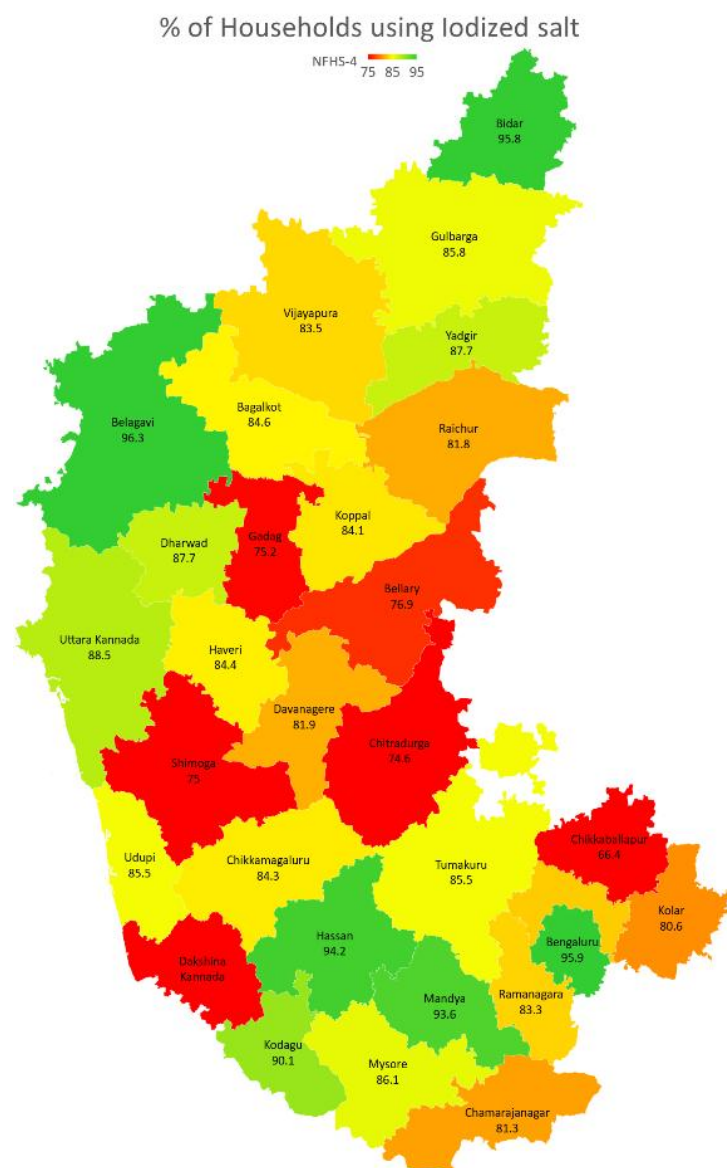
Map 9(Left): Percentage of Households using iodized salt (%) in Karnataka according National Health and Family Survey 4 (NHFS- 4) 2015-16. Map 10 (Right): Percentage of Households using iodised salt in Karnataka, according to National Health and Family Survey 5(NHFS- 5) 2019-2021. Map 9 and Map 10 shows an overall increase in households using Iodised salt

IV. Recommendations

Based on the analysis of the prevalence of malnutrition in the state of Karnataka and existing government schemes being implemented, we make the following recommendations:

1. Better and Recurrent Data Collection.

There is a paucity of reliable data regarding health indicators. Although, a data source like the National Family and Health Survey provides trends about the health of the state, it has many flaws. First of all, the sample size is insufficient at the district level to draw conclusions. The questionnaire is too long. For instance, the women's questionnaire has more 1000 questions and the field workers are not trained well to collect data for the survey. Data from existing healthcare infrastructure (public and private hospitals, Primary Healthcare Centres) can be taken and consolidated to get inferences about disease prevalence and incidence. A step in the right direction is being taken with taking data from Anganwadi Workers being given phones to log data for POSHAN abhiyan. Evidence-based policy can only be made when reliable data is available.

2. Focus on measuring Impact of the Schemes

Existing schemes focus on collecting data regarding the uptake of the schemes. For instance, Pradhanmantri Matru Vandana Yojna focuses on the numbers of pregnant females who received payments under the scheme instead of focusing on what benefit the payments had on the mothers and child health. The focus should shift to collect data about the impact of the scheme. This will help in forming a feedback loop and in providing course correction in government's efforts to tackle malnutrition.

Examples of indicators that could be used.

Scheme	Indicator*
Anganwadi Services Scheme	Percentage of 0–6-month infants getting exclusively breastfed
Pradhanmantri Matru Vandana Yojna (PMVY)	Percentage of new borns with low birth weight
National Creche Scheme	Percentage of children with Wasting/Stunting
Scheme for Adolescent Girls	Percentage of girls aged 11-14 years with anemia
Pradhan Mantri Poshan Shakti Nirman (previously known as Mid-Day Meal)	Percentage of school children with Wasting/Stunting
Anaemia Mukht Bharat/ Intensified National Iron Plus Initiative (I-NIPI)	Percentage of Adolescents aged 10-19 years with Anemia
Targeted Public Distribution System -Antyodaya Anna Yojana (To better target AAY households)- Part of TPDS approach	Percentage of adults with BMI < 18.5 kg/m^2

* Indicators are meant to be used for the population which is enrolled in the scheme.

3. Overreliance on over-worked and undertrained Anganwadi Workforce

The first point of contact for a lot of government schemes such as Anganwadi Services Scheme, Pradhan Mantri Matru Vandana Yojana is the Anganwadi. Successful implementation of these schemes is dependent on these workers. They are underpaid however, the non-nutrition related schemes such as Immunisation, preschool education are dependent on them. There is also a deficiency in training with regards to nutrition. There is a need to increase the size of the workforce and offload some of the responsibilities given to the anganwadi workforce. Creation of a separate Nutrition worker can also be considered. A nutrition worker can form a separate cadre which works at the Sub Centre level and focuses on all nutrition related government schemes. Nutrition Worker could be formed under the Dept. of Health and Family Welfare.

4. Adding components from local cuisines.

Integrating components from local cuisines could increase acceptance of the government provided schemes. For instance, adding coarse grains such as Ragi, Jowar to the Targeted Public Distribution System(TPDS). Diversification of the food options under TPDS can also be done to increase acceptance of government provided food. For instance, in this project done under ICDS in Telangana, millets when added to Hot Cooked Meals led to better uptake of the scheme.

5. Adding Evidence based practices

Utilising latest evidence-based measures that emerge is vital. Streamlining this process will make it easier for newer innovations to be tested and integrated into our measures. Doing Pilot studies and tweaking programs according to the feedback we get using frequent reliable data will add to the strength of implementation. We recommend that the government does pilot studies for all new interventions. Trying different versions of pre-existing interventions as studies is also recommended. We also recommend that the government make pilot study data publicly available, bringing in transparency to the policy making process A 2021 study done in The Lancet is a good framework of doing this. For instance, small-quantity lipid-based nutrient supplements have been advocated by the Lancet study to fight malnutrition, we can try these interventions such as these, do our own studies accommodating for local conditions, then go ahead with their implementation.

6. Convergence and Coordination between departments/ministries.

POSHAN 2.0 is a good example of how this can be done. POSHAN 2.0 will bring 3 important programmes/schemes under its ambit, viz., Anganwadi Services, Scheme for Adolescent Girls and Poshan Abhiyaan. Poshan abhiyan already has the convergence of nutrition related schemes in one place. Although issues regarding coordination between different departments have to be figured out first.

7. Freedom to choose according to local conditions and suitability

Freedom to choose between a toolkit of nutrition related policy interventions for districts. This flexibility in our approach along with better nutritional data can help in better outcomes.

V. Conclusion

Malnutrition is a cause of a lot of morbidity and mortality in Karnataka. The State like most of the country has an Under-5 age group facing the maximum brunt of this. As we move up the age groups, we see a shift from malnutrition related to undernutrition to malnutrition related to obesity, non-communicable diseases. The population's nutrition status has improved over the decades but the improvement is slow and far from satisfactory. The improvement to an extent can be attributed to Central and State run interventions. Other factors such as poverty reduction, better economy, advancement in medicine and agriculture contribute a lot to this betterment. We recommend improving data collection and analysis, measurement of outcomes, evidence-based interventions, nutrition workers, freedom to choose according to local conditions and better convergence between departments as ways to improve nutrition outcomes.

VI. *Appendix*

These are definitions for various components of malnutrition we have used.

1. **Low birth weight:** Low birthweight for gestation quantifies the burden of disease attributed to birth at a lower birthweight than the lowest-risk birthweight, after adjusting for the influence of gestational age.
1. **Short gestation:** short gestation for birthweight quantifies the burden of disease attributed to birth at a gestational age shorter than the lowest-risk gestational age, after adjusting for the influence of birthweight.
2. **Child wasting:** Child wasting is defined as weight-for-height more than one standard deviation (SD) below the reference median on the weight-height growth curve based on WHO 2006 growth standards for children 0–59 months.
3. **Child underweight:** Child underweight is defined as weight-for-age more than one standard deviation below the reference median on the weight-age growth curve based on WHO 2006 growth standards for children 0–59 months.
4. **Iron deficiency:** Iron deficiency is defined as inadequate iron to meet the body's needs. Exposure is quantified in terms of haemoglobin concentration and calculated as the cumulative effects of all GBD diseases that manifest as iron deficiency, including dietary iron deficiency and other diseases that lead to absolute or functional iron deficiency.
5. **Child stunting:** Child stunting is defined as height-for-age more than one standard deviation (SD) below the reference median on the height-age growth curve based on WHO 2006 growth standards for children 1–59 months.
6. **Non-exclusive breastfeeding:** Non-exclusive breastfeeding in infants <6 months has three categories: none (no breastmilk), partial (breastmilk, other liquids, and foods), and predominant (breastmilk and other liquids).
7. **Vitamin A deficiency:** Vitamin A deficiency is defined as serum retinol <0·70 µmol/L and is a risk factor for diarrhoea and measles.

8. **Discontinued breastfeeding:** Discontinued breastfeeding is defined as the proportion of children who no longer receive breastmilk as a source of nourishment. We estimate this for two age groups: 6–11 months and 12–23 months.

9. **Zinc deficiency:** Zinc deficiency is defined as zinc consumption (in mg/day) less than 2–3 mg from all dietary sources.

10. **High body-mass index:** High BMI for adults (ages 20 and older) is defined as BMI greater than 20–25 kg/m2. High BMI for children (ages 1–19) is defined as being overweight or obese based on International Obesity Task Force standards.

11. **Diet low in fruits:** Diet low in fruit is defined as average daily consumption (in grams per day) of less than 310–340 grams of fruit including fresh, frozen, cooked, canned, or dried fruit, excluding fruit juices and salted or pickled fruits.

12. **Diet low in legumes:** Diet low in legumes is defined as average daily consumption (in grams per day) of less than of 90–100 grams of legumes and pulses, including fresh, frozen, cooked, canned, or dried legumes.

13. **Diet high in trans fatty acids:** Diet high in trans fatty acids is defined as any intake (in percentage daily energy) of trans fat from all sources, mainly partially hydrogenated vegetable oils and ruminant products.

14. **Diet low in vegetables:** Diet low in vegetables is defined as average consumption (in grams per day) of less than 280–320 g of vegetables, including fresh, frozen, cooked, canned, or dried vegetables and excluding legumes, salted or pickled vegetables, juices, nuts and seeds, and starchy vegetables (e.g., potatoes).

15. **Diet high in sodium:** Diet high in sodium is defined as average 24-hour urinary sodium excretion (in grams per day) greater than 3 grams.

16. **Diet low in nuts and seeds:** Diet low in nuts and seeds is defined as average daily consumption (in grams per day) of less than 10–19 grams of nuts and seeds, including tree nuts and seeds and peanuts.

17. **Diet low in whole grains:** Diet low in whole grains is defined as average daily consumption (in grams per day) of less than 140–160 grams of whole grains (bran, germ, and endosperm in their natural proportion) from breakfast cereals, bread, rice, pasta, biscuits, muffins, tortillas, pancakes, and other sources.

18. **Diet low in fibre:** Diet low in fibre is defined as average daily consumption (in grams per day) of less than 21–22 grams of fibre from all sources including fruits, vegetables, grains, legumes, and pulses.

19. **Diet high in sugar-sweetened beverages:** Diet high in sugar-sweetened beverages is defined as any intake (in grams per day) of beverages with ≥50 kcal per 226·8 gram serving, including carbonated beverages, sodas, energy drinks, and fruit drinks, but excluding 100% fruit and vegetable juices.

20. **Diet high in processed meat:** Diet high in processed meat is defined as any intake (in grams per day) of meat preserved by smoking, curing, salting, or addition of chemical preservatives.

21. **Diet high in red meat:** Diet high in red meat is defined as any intake (in grams per day) of red meat including beef, pork, lamb, and goat but excluding poultry, fish, eggs, and all processed meats.

22. **Diet low in milk:** Diet low in milk is defined as average daily consumption (in grams per day) of less than 360–500 grams of milk including non-fat, low-fat, and full-fat milk, excluding soy milk and other plant derivatives.

23. **Diet low in polyunsaturated fatty acids:** Diet low in PUFA is defined as average daily consumption (in percentage daily energy) of less than 7–9% total energy intake from PUFAs.

24. **Diet low in seafood omega-3 fatty acids:** Diet low in omega-3 fatty acids is defined as average daily consumption (in milligrams per day) of less than 430–470 milligrams of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA).

25. **Diet low in calcium:** Diet low in calcium is defined as average daily consumption (in grams per day) of less than 1·06–1·10 grams of calcium from all sources, including milk, yoghurt, and cheese.