

Supplementary Table IV. Cross-cutting research options in maternal, newborn & child health and nutrition

Programme and systems strengthening

1. AYUSH: Generate evidence on efficacy and effectiveness
2. Context-specific innovations
 - (i). Development/identification and evaluation of context-specific innovations (particularly targeting EAG States) for accelerated improvement in MNCHN
 - (ii). Document traditional remedies, & new and innovative community/system practices and interventions to prevent/reduce (MNCHN) morbidities
3. Implementation research for effective delivery of evidence-based care at different levels of care
4. ARSH: Novel strategies to improve ARSH
5. Integration of MNCHN care packages for continuum of care
6. Quality of care: Instituting quality benchmarks; logistic and supply chain management; process and impact evaluation of clinical care services offered (public and private facilities)

7. Process and impact evaluation of (MNCHN) programmes (including ICDS) and strategies to improve
8. Strategies to leverage on community resources and platforms
Utilize VHNDs and VHSCs for delivering (MNCHN) services at the village level; engagement of PRIs and developing processes and indicators of social accountability

Use of technology

1. ICT and maternal health to improve
 - (i). Community: Improve coverage and outreach, awareness, access, entitlement avail
 - (ii). Health worker: Training and distance learning, job-aids, beneficiary tracking, monitoring, community mobilization
2. Cost-effective technological solutions (point-of-care diagnostics, mobile-based detection systems) technologies and strategies for screening and early identification of MNCHN conditions in the community and at different levels of the health care system
3. Medical equipment: Developing low cost, feasible, portable technological innovations in equipments to improve capacity (diagnosis, identification, management) and outreach

Issues related to HR for health

1. Comprehensive skill building and their retention
 - (i). Integrate, revise and evaluate curriculums for health personnel involved in MNCHN services at all levels of care
 - (ii). Designing and evaluating undergraduate medical curricula for skill building in MNCHN (including emergency care)
2. HR management interventions (*e.g.*, selection, role rationalization and diversification, postings, structuring of pay and incentives, *etc.*)
3. Establishing monitoring, supervision and accountability frameworks (*e.g.*, physical supervision; engaging PRIs and clients; use of ICT, telemedicine, maternal health)
4. Generate evidence that a cadre of certified family medicine physicians can deliver quality specialist MNCHN services

Conditions of morbidity and mortality (epidemiology, strategies to mitigate)

1. Vector borne diseases
2. Helminthic & protozoal infestations (context: These infestations reflect the developmental state of the society)
3. Haemoglobinopathies and enzyme deficiencies
4. Food intolerances: lactose, gluten
5. Unintentional injuries in children
6. Diarrhoea in children: Control strategies in the public health system (ORS, Zinc, WASH, rational antibiotic and drug use), identifying cost-effective strategies for supplementation of micronutrients and probiotics
7. Anaemia in women and children
8. Malnutrition (undernutrition, overnutrition, micronutrient deficiency) in women and children (including study of obesogenic environments)
9. Assessment of food environment for different sections of population and their impact

Water, Sanitation and Hygiene (WASH)

1. Impact and economic evaluation of current WASH practices in the community on the nutrition of women and children
2. Strategies to promote WASH practices in the community

3. Provisioning of safe drinking water at household level

Contemporary societal (behavioural and social) issues

1. Empowerment of women

- (i). Developing and validating a context specific gender equity and women's empowerment scale including nutritional indicators of women and under-five children
- (ii). Developing evidence-based strategies to accelerate the impact of current policies and programmes aimed at empowering women's status in the society
- (iii). Developing mother friendly work place policies and governance framework

2. Engagement of male partners in MNCHN

3. Engaging and empowering families and communities for MNCHN

4. Changing lifestyles

- (i). Impact of social, cultural, economic, demographic, lifestyle and environmental transition in different geographical locations on

population food and dietary behaviour and consequent (MNCHN situation)

(ii). Effect of multitasking and time constraint of women working outside home on their and their children's care and nutrition

5. Abuse (physical and sexual): Epidemiology; identify and evaluate behavioural and societal interventions

6. Neurodevelopmental disorders

(i). Stigma (profile and determinants) & coping strategies adopted at family and community levels

(ii). Identifying strategies for rehabilitation and mainstreaming of children in the socio-economic milieu of India

7. Identifying effective communication strategies (messages and channels) to improve community awareness and mobilization

8. Design, implement and evaluate strategies for delivering essential (MNCHN) services during humanitarian crises

Policy related research

1. Evaluation of impact of
 - (i). Current legal provisions on domestic violence and its health impacts
 - (ii). Health insurance schemes on quality of (MNCHN) services
 - (iii). Social security and gender empowerment programmes (*e.g.*, MNREGS, *etc.*) on MNCHN and care seeking behaviour in vulnerable sections of the society
 - (iv). Existing policies and legislations on child safety, child labour and child abuse
 - (v). Existing policies and programmes (process, impact and economic evaluation) for women's social and economic empowerment and their impact on women's nutrition
2. Food and nutrition-related policies
 - (i). Evaluation of current programmes to ensure food and nutrition security for poor and socially backward communities
 - (ii). Developing policies and programmes to mitigate obesogenic components of the environments around children
 - (iii). Food policy interventions and regulations to minimize the risk of malnutrition (under and over) and chronic diseases (*e.g.*, fortification of foods and oils; biofortification of crops; regulations for advertisements, sale, labelling; supply chain management strategies)

(iv). Under the newly established NITI *Aayog*, establish a Ministry/Department of Nutrition to address the policy and programme imperatives of nutrition in the country on a pilot basis and assess its impact

3. Process, impact and economic evaluation of ARSH initiatives in the context of gender equity and nutrition security

4. Undertake systematic MNCHN policy analysis for identifying strengths and gaps and developing policy guidance to meet sustainable development goals

Basic research

1. Impact of tobacco and alcohol consumption on foetomaternal blood circulation, foetal growth and long-term consequences in the child
2. Vaccine-related research
 - (i). Evidence generation/synthesis for introduction of new vaccines in the UIP including modelling for cost-effectiveness
 - (ii). Impact of food quantity and quality, nutritional state and infectious co-morbidities on immune response to oral and injectable vaccines amongst infants residing in low-income settings
3. Non-communicable diseases
 - (i). Foetal and early childhood origin of adult diseases
 - (ii). Valid markers of non-communicable diseases during pregnancy and early childhood
 - (iii). Non-alcoholic fatty liver disease (NAFLD)
 - (iv). Definition of metabolic syndrome in Indian children in the context of wide-spread micro and macronutrient undernutrition

Intersectoral coordination and convergence

1. Develop innovative roadmaps and interfaces for...convergence between health-nutrition and non-health sectors (including agriculture)... at policy and programme levels for boosting (MNCHN)
2. Develop and evaluate innovative models of engaging private, informal and non-government sectors in...(MNCHN components)... of National health programmes (*e.g.*, National AIDS Control Programme) and service provisioning (*e.g.*, conditional cash transfer, PPP business models)
3. Agriculture and food technology for MNCHN
 - (i). Epidemiology, risk and prognostic factors of inappropriate use of pesticides in agriculture in India and its impact on child health and nutrition; cost-effective strategies for pest control
 - (ii). Development of novel and innovative food items and supplements based on modern technologies for improving macro- and micronutrient content and their bioavailability
 - (iii). Promoting nutrition sensitive and ecofriendly agricultural practices and influence the value chains that bring value for all stakeholders including the marginal farmers and the consumers from poor communities: identifying strategies to leverage existing institutional frameworks in agriculture and other related sectors to achieve above objectives

Antibiotic resistance

1. Genetic epidemiology and dynamics of antibiotic resistance
2. Establishing nationwide multicentric antimicrobial surveillance and antibiotic stewardship programme for infectious morbidities
3. Promoting rational use of antibiotics: in prescriptions, self-medication; developing guidelines

Data for action

1. Improving administrative data quality and strengthening data-driven (MNCHN) services, action and accountability at community and different levels of health system
2. Establishing a nationwide surveillance system for MNCHN morbidities for epidemiological data and quality of management
3. Establishing an effective and sustainable vaccine preventable disease surveillance programme

AYUSH, Ayurveda Yoga and Naturopathy; ARSH, Adolescent reproductive and sexual health; EAG, Empowered Action Group; HR, Human resource; ICDS, Integrated Child Development Services; ICT, Information and communication technology; MNCHN, maternal, newborn, child health and nutrition; MNREGS, Mahatma Gandhi National Rural Employment Guarantee Scheme; NAFLD, Non-alcoholic fatty liver disease; NITI, National Institution for Transforming India; ORS, Oral rehydration salts; PPP, Public private partnership; PRIs,

Panchayati Raj institution; UIP, Universal Immunization Programme; VHNDs, Village health and nutrition days; VHSCs, Village health and sanitation committees;
WASH, Water, sanitation and hygiene