ANNUAL REPORT 2022-23

Indian Council of Medical Research
New Delhi

Annual Report
2022-23

icmr

INDIAN COUNCIL OF MEDICAL RESEARCH

Serving the nation since 1911

Compiled & Edited by: Dr. Chanchal Goyal, Scientist 'E',
Division of Extramural Descriptive Research

Scientific Inputs : Dr Anup Anvikar, Scientist 'G' & Director, ICMR-NIMR, Dwarka, & Ex Head, P& C Division

Published on behalf of the Secretary DHR & DG, ICMR, New Delhi

Designed & Printed at M/s Aravali Printers & Publishers (P) Ltd., W-30, Okhla Industrial Area, Phase-II, New Delhi-110020, Phone: 47173300, 26388830-32

DIRECTOR GENERAL MESSAGE

It gives me immense pleasure to present the Annual Report of the Indian Council of Medical Research (ICMR) for the year 2022-23. During this period, ICMR developed 38 new technologies like Real-time PCR for the Mpox virus, metagenomic based NextGen Sequencing; designed 9 guidelines /policies like Tobacco Control in India 2022, National Injury Prevention strategy document, guidelines for STI surveillance , published 25 reports/ database/manuals like biorepository of endometriosis, Childhood Cancer Care Services in India, NLEM, and started 19 academic Medical/paramedical courses like NPHE, one health, whereas 55 new products have been developed & applied for patenting. A total of 6 patents were granted, significant being, Von Willebrand Factor and Factor VIII detector and malaria severity predictor. A total of 1018 publications were done out of which approximately 50 were published in journals with impact factor more than 20. Several important projects were completed during this period; as an example, a large implementation Research project, strengthening state NCD programme for diagnosis and treatment of suspected cases of Breast Cancer at medical colleges/institutes has established self-breast examination as a tool for early diagnosis & treatment.

Several state of Art infrastructure facilities were provided to the country, significant being, ICETIME, BSL III lab, VRDL labs, etc. Interventions of Nationwide utility like intervention manuals in Mental health, IBD NutriCare App, PANIQ, IASQ, i-RegVeD,etc, were developed.

The inauguration of annex building of the centre and laying of foundation stone of School of Public Health and BSL III Laboratory at ICMR-RMRC, Bhubaneswar was done on 7th Jan, 2023 by Dr. Mansukh Mandaviya, Hon'ble Union Minister for Health and Family Welfare. He also laid the foundation stone on 25th Jun 2022, for "International Centre of Excellence for Training in Medical Entomology (ICETIME)" in the premises of ICMR-VCRC, Puducherry and released National List of Essential Medicines (NLEM), 2022 on 13th Sept, 2022. On World Sickle cell day, 19th Jun 2022, the Hon'ble Union Minister of Health and Family Welfare, Dr. Mansukh Mandaviya, Hon'ble Governor of Madhya Pradesh, Shri Mangubhai Patel, and Hon'ble Chief Minister of Madhya Pradesh, Shri Shivraj Singh Chouhan, inaugurated the workshop on "Holistic Management of Sickle Cell Disease (SCD)" at ICMR-NIRTH. The Hon'ble Governor of Madhya Pradesh, His Excellency, Shri Mangubhai Patel, graced the occasion of two-day symposium on "Sickle Cell Disease in India" on 22-23rd Feb 2023 at ICMR-NIRTH.

Dr. Bharati Pravin Pawar, Union Minister of State, Ministry of Health and Family Welfare, on 3rd Dec, 2022, released a book "ODI-SCI: The Odyssey of the women scientists of Odisha" which documents the life history of the great women scientists of the Odisha State. The FAQ hard copy consisting of 150 items and a report on "A Situational Analysis of Childhood Cancer Care Services in India -2022" were released on 27th Sep 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.

I congratulate all ICMR Scientists for their commitment and accomplishments in Health Research.

Rajiv Bahl

(Dr Rajiv Bahl)
Secretary to Govt of India, Department of Health Research &
Director General, Indian Council of Medical Research, New Delhi

ICMR has made outstanding contribution as a knowledge generating organization and contributed in understanding various diseases of national importance such as Malaria, Japanese Encephalitis, Tuberculosis, AIDS, Kala-azar, Filariasis, Leprosy and Poliomyelitis. Additionally, ICMR has made extensive contributions in the areas of Non-Communicable Diseases, Nutrition, Maternal & Child Health, Occupational & Environmental Health and research complimenting health systems. ICMR regional medical research institutes/ centres have been contributing in tackling regional health problems. Training and capacity building of young investigators, medical and allied health professionals and providing funding support for research projects to investigators all over the country are other very unique and significant contributions of ICMR.

Mandate of ICMR

- Apex body in India for formulation, coordination and promotion of biomedical research.
- Conduct, coordinate and implement medical research for the benefit of the Society.
- Translating medical innovations in to products/processes and introducing them in to the public health system.

Vision of ICMR

- Translating Research into Action for Improving the Health of the Population.

Mission of ICMR

- Generate, manage and disseminate new knowledge.
- Increase focus on research on the health problems of the vulnerable, the disadvantaged and marginalized sections of the society.
- Harness and encourage the use of modern biology tools in addressing health concerns of the country.
- Encourage innovations and translation related to diagnostics, treatment, methods/ vaccines for prevention.
- Inculcate a culture of research in academia especially medical colleges and other health research institutions by strengthening infrastructure and human resource.

OVERVIEW

The Indian Council of Medical Research (ICMR) is the apex and premier medical research organization in the country which spearheads planning, formulation, coordination, implementation and promotion of biomedical research.

The year 2022-23 saw immense contribution of ICMR to National biomedical and Public Health Research. Under new infrastructure, The Hon'ble Union Minister of Health and Family Welfare, Dr Mansukh Mandaviya laid the foundation stone on 25th June 2022, for "International Centre of Excellence for Training in Medical Entomology (ICETIME)" in the premises of ICMR-VCRC, Puducherry.

National List of Essential Medicines (NLEM), 2022 was released by Hon'ble Minister of Health, Dr. Mansukh Mandaviya on 13th September, 2022. It is expected to result in better quality of medical care, better management of medicines and cost-effective use of health care resources. The NLEM, 2022 contains 384 medicines in 27 therapeutic categories.

On World Sickle cell day, 19th June 2022, ICMR-NIRTH organized a workshop on "Holistic Management of Sickle Cell Disease (SCD)" in collaboration with the National Health Mission, Bhopal. The Hon'ble Union Minister of Health and Family Welfare, Dr. Mansukh Mandaviya, Hon'ble Governor of Madhya Pradesh, Shri Mangubhai Patel, and Hon'ble Chief Minister of Madhya Pradesh, Shri Shivraj Singh Chouhan, graced the occasion.

ICMR-NIRTH, Jabalpur had organized a two-day symposium on "Sickle Cell Disease in India" on 22-23rd Feb 2023. The Hon'ble Governor of Madhya Pradesh, His Excellency, Shri Mangubhai Patel, graced the occasion.

Dr. Bharati Pravin Pawar, Union Minister of State, Ministry of Health and Family Welfare, on 3rd Dec, 2022, released a book "ODI-SCI: The Odyssey of the women scientists of Odisha" which documents the life history of the great women scientists of the Odisha State.

A total of more than 150 Frequently Asked Questions (FAQs) have been framed by ICMR Bioethics Unit. This would serve as a source of information for young researchers and newly constituted ethics committees in various colleges/institutions across the country. The FAQ hard copy was released on 27th September 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.

Report on "A Situational Analysis of Childhood Cancer Care Services in India -2022" prepared by ICMR-NCDIR in collaboration with the Directorate General of Health Services, Ministry of Health &

Family Welfare and the World Health Organization (India office) was released on 27th September 2022 by the Hon'ble Union Minister of State for Health and Family Welfare, Dr. Bharati Pravin Pawar. The findings of the report emphasize the need to formulate a childhood cancer policy that would enable timely diagnosis, treatment, supportive care, and follow-up through well-defined care pathways.

The first fatal case of Mpox was imported from UAE to Kerala, India in July 2022 and was detected with the A.2 lineage of clade IIb. Genome characterization of Mpox cases detected in India led to the identification of three sub-clusters among the A. 2 lineage. The Mpox DNA was detected in clinical samples from the 5th to 24th post-onset days (POD) in samples from the cases in Delhi. These Mpox cases without international travel history suggest the underdiagnosed Mpox infection in the community.

The STREAM stage 2 clinical trial where ICMR-NIRT was the Nodal site in India contributed to the adoption of fully oral regimen of 9 Months in the National TB treatment guidelines. The ultra-short regimen of 6 months with two months injectable gave an efficacy above 80% even among rifampicin resistant study participants with pulmonary TB.

ICMR-NIRT Serves as the National Reference laboratory to National AIDS Control organization for HIV Viral load and HIV-TNA PCR testing. ICMR released the country's first 'Indian catalogue of Mycobacterium tuberculosis mutations and their association with drug resistance – 2022'

ICMR-NIMR established a Malaria Slide Bank at national level to impart trainings and assessments for malaria microscopist at regular intervals and quality assurance. NIMR has prepared around 25000 slides till date.

ICMR-NARI contributed to development of guidelines for STI surveillance. The institute also contributed to guidelines for elimination of vertical transmission of HIV and syphilis (EVTHS).

This first-of-kind intervention study by ICMR-NIRTH using modern techniques in field setting (hand-held X-ray, molecular diagnosis, *etc.*), was taken up in a highly endemic district of Madhya Pradesh, where Saharia tribal populations live, could successfully be replicated. Similar model is now being planned to be replicated in other Saharia-dominated districts of Madhya Pradesh, Uttar Pradesh and Rajasthan.

New treatment guidelines (combination therapy of AmBisome and Miltefosine) for VL-HIV co-infected cases was endorsed by WHO and implemented in program through NCVBDC, Govt. of India.

ICMR-RMRIMS is designated as WHO Collaborating Centre for Leishmaniasis. Apart from various service components viz. ICTC, ART plus, OST, MDR/XDR diagnostic facility, VRDL (Medical college level), ICMR-RMRIMS, Patna is the designated centre for viral load testing and treatment for Hepatitis B & C for different districts of Bihar.

Future road map for the national program on prevention and control of snakebite in India was provided to Niti Ayog by ICMR-NIRRCH.ICMR-NIN estimated the glycaemic index and glycaemic loads of more than 150 foods such as breakfast foods, lunch and dinner foods, fast foods, bakery foods, chat foods, junk foods etc.

ICMR multi-centric task force study on polycystic ovarian syndrome (PCOS) is one of the largest studies providing data on prevalence of PCOS and regional phenotypic variation in India. The study provides valuable information relevant for clinical management and policy on PCOS.A systematic

review and meta-analysis showed that cessation of areca nut usage (without tobacco) led to a 28.9% risk reversal of oral cancer and 48% reversal of pharyngeal cancer. For users of areca nut with smokeless tobacco, the risk for oral cancer was reduced in former users after 10 years of cessation. These results provide evidence for a policy for inclusion of areca nut cessation intervention in cancer control efforts.

ICMR-NIMS is the nodal institute for management and analysis of *HIV Sentinel Surveillance (HSS)* data and to provide HIV burden estimates for India, States and UTs in collaboration with National AIDS Control Organization (NACO), Ministry of Health and Family Welfare (MoHFW), Government of India (GOI). ICMR-NIIRRCH established National clinical database and biorepository of endometriosis.

ICMR participated in the G20 Expo held during the 1st Health Working Group meeting at Thiruvananthapuram. The stall was conceptualized to display the council's achievements in the area of pandemic preparedness and translational research. Two films, on 'Outbreak Investigation and Pandemic Preparedness' and 'Translating Research into Action for Disease Management and Elimination' were also developed.

The council's first conclave on health communications "Connect and Collaborate 2022" was held on July 15, 2022. Experts and leading voices in public health, communications and health journalism were brought together to exchange learnings on a range of issues.

A special collection of 75 stories celebrating the spirit of New India, titled 'Changing the Nation's Health Landscape' was published. ICMR prepared a report 'ICMR's Response to COVID-19', which documents the various interventions undertaken by ICMR and its institutes to strengthen India's fight against COVID-19. ICMR Bioethics Unit, under the aegis of ICMR, has published a reference book on 'Biomedical Ethics Perspectives in The Indian Context.'

ICMR developed about 38 new technologies, designed 9 guidelines /policies, published 25 reports/ database/manuals and started 19 academic Medical/paramedical courses. A total 5148 Adhoc proposals were submitted out of which 691 proposals were funded. A total of 42 Indian patent applications, 4 design applications, 3 copyright applications and 6 foreign patent applications were filed. 2 Indian patents and 4 foreign patents were granted. The total number of Research papers published in peer reviewed journals through the several intramural Research Programmes by 27 institutes of ICMR organization are 1018. A total of 10 issues (including 4 special issues) of IJMR were published, the special issues being on 'Tuberculosis', 'HIV & Co-Infections', 'India & COVID-19 Part VI' and 'Tribal Health'.

ICMR-DHR International Fellowships were awarded to 25 Senior and 27 Young Indian Scientists. Six meetings of Health Ministry's Screening Committee were held wherein 201 projects were considered out of which 149 projects were approved for international collaboration. 3 MoUs were signed viz. MoU between ICMR and Inserm, France, MoU between ICMR and Department of Medical Services of Ministry of Public Health, Thailand and LoI between ICMR and the Coalition for Epidemic Preparedness Innovations(CEPI), Norway for Cooperation on Vaccine Research, Development and Innovation.

Dr. Chanchal Goyal,
Scientist 'E',
Division of Extramural Descriptive Research

MOST IMPORTANT OUTCOMES (2022-23)

NEW HEALTH TECHNOLOGIES

A. NEW PRODUCTS DEVELOPED

- A novel colorimetric LAMP assay has been developed for the detection of the Nipah virus. This would be useful as a point-of-care assay for the detection of the Nipah virus.
- Real-time PCR for the Mpox virus was standardized and validated.
- A cost-effective colorimetric isothermal (LAMP) assay for rapid detection of Mpox virus was developed. The assay can be applied in the field setting.
- ICMR published a study on understanding TB disclosure patterns and have developed a new tool to measure TB disclosure.
- A measurement tool was validated for patient-perceived quality of care for TB (PPQCTB) which measured the patient's satisfaction with reference to healthcare providers and health care services. This tool could support quality of care evaluation frameworks for TB health services in India.
- A patient-centric interventions framework and module was developed which is being used to implement patient-centric interventions under the TB program for in-patients to build treatment and life resilience.
- ICMR developed a needs assessment form for the purpose of better implementation of Nikshay Mitra initiative.
- Innovative TB awareness material was developed which includes TB IEC tickets and TB Puzzle game for school students.
- Gold nanoparticle-aptamer complex has been created that will specifically bind with HCV core antigen to develop a cost-effective and rapid HCV detection in blood that will be suitable for use in resource-limited settings.
- There was development of a multivalent, highly immunogenic candidate glycoconjugate vaccine with protective efficacy against *S.* Typhi, S. Paratyphi and NTS (*S.* Typhimurium and S. Enetritidis)
- The ICMR team identified cyclic constrained peptides from different proteins of the *P. falciparum*, which can be developed as novel diagnostic tools for malaria.

- ICMR screened about 100 marine derived extracts/compounds for discovery of antimalarial drugs. Leads were generated with activities in micromolar concentrations. Further characterization of potential extracts is underway. Also developed novel single-step multiplex qPCR assay for detection of nonhuman malaria parasites *Plasmodium knowlesi* and *P. cynomolgi*.
- There was development and designing of improved lid of underground tanks where An. stephensi used to breed (20-40%). This action prevented An. stephensi from breeding in western Rajasthan.
- ICMR-NIMR team developed and validated discriminatory concentrations of nine insecticides with bottle bioassay and 2 insecticides with filter paper test against Aedes aegypti (first time) and An. stephensi mosquitoes, which are currently in use or under evaluation for various vector control applications (IRS, LLIN, space spray, household products, etc). This information is key to establish the baseline susceptibility of vector populations to the new insecticides and to detect any change in phenotypic resistance after their deployment. It will help the national programme in monitoring of insecticide susceptibility of mosquito vectors of public health importance. Results are included in report published by WHO in March 2022.
- ICMR-VCRC has synthesized 10 molecules, purified by column chromatography and characterized the chemical structures by FTIR, ^{1}HNMR and MS spectral analysis as part of drug design and synthesis and evaluation of select repurposed drugs against SARS-CoV-2.
- A molecular algorithm to diagnose vector borne diseases among acute undifferentiated febrile illness has been developed and is under in-house validation.
- A spatiotemporal model was developed for forecasting visceral leishmaniasis and has been validated for block-level predictions and long-term forecasts of VL incidence. This model can be used to monitor progress of VL elimination and identify the risk of resurgence in post-elimination settings.
- A metagenomic based NextGen Sequencing (Illumina) Technology to Identify aetiology of Acute Encephalitis Syndrome (AES) technology has been developed.
- Two artificial diets have been developed as a substitute for blood meal for mosquitoes.
- ICMR developed a microprocessor-based mosquito feeding device for rearing and maintaining mosquito colonies.
- A toolkit for VL surveillance was developed by ICMR-RMRIMS in collaboration with SPEAK India.
- ICMR-RMRCBB has developed audio content in local tribal language for creating awareness pertaining to the cause, sign, symptoms, transmission mode & treatment of Anthrax disease.
- A rapid detection kit for *Orientia tsutsugamushi* diagnosis has been developed by ICMR-RMRCGKP. This technology is based on isothermal recombinase polymerase amplification and lateral flow analysis.
- ICMR-NIRRCH has developed the first-ever online tool for polypharmacological target and drug prediction, which accurately identified popular repurposed drugs such as sildenafil (Viagra) for hypertension and erectile dysfunction (which was otherwise an accidental discovery) and metformin for PCOS and diabetes mellitus.

- ICMR has released the fourth online version of database for antimicrobial peptides-CAMP$_{R4}$ that is freely accessible at http://www.camp.bicnirrh.res.in/. It contains manually curated information on sequence, protein definition, accession numbers, activity, source organism, target organisms, protein family descriptions, N and C terminal modifications of antimicrobial peptides. It also has ML-based algorithms for prediction and rational design of natural and synthetic AMPs.
- Point of care sickle cell tests were rolled out in the national program at a cost estimated through HTA study conducted at the institute of ICMR-NIRRCH.
- An android app e-STAR is a digital Innovation by ICMR-NIN to implement 'screen and treat anaemia' at the population level.
- ICMR validated a novel point-of-care Hb measurement in pooled capillary blood by a portable autoanalyzer which has better Hb estimates than conventional point of care methods being used.
- A functional food formulation containing amla, turmeric, cinnamon, ginger, and black pepper has been developed and ICMR team has provided preclinical evidence that this formulation can prevent diabetic nephropathy in rats.
- A low-cost indigenous automated cervical cancer screening device was validated as a stand -alone screening device for low-resource settings. This can be used to augment cervical cancer screening in settings with paucity of trained cytotechnologists/ pathologists**.**
- ICMR-RMRCNE developed rapid (~1 hour), point-of-care, visual detection, one-pot-assay using isothermal methods and CRISPR technologies for *P. falciparum* K13, C580Y mutation (artemisinin resistance).
- An in-house incubator-cum-detector was developed by ICMR-RMRCNE which can be used for incubation of CRISPR reactions as well as visualization. The device is battery operated and thus suitable for field-use.
- A mobile application, Fever Tracker with dashboard has been developed for real time epidemiological surveillance. It has been successfully deployed in Tripura and being updated for the malaria endemic areas of other northeastern states.
- For malaria mapping with ecological data, land use and land cover (LULC) maps of study districts have been created.
- ICMR-NIIH has performed field validation for two indigenously developed kits for SCD.
- For the first time, indigenous red cell screening panel suitable for Indian population has been prepared and distributed to 78 blood banks all over the country for detection of antibodies.
- Based on study on mechanism of RhD negativity in Indians a population-specific data was generated and an Indian-specific diagnostic algorithm was developed which can provide the correct RHD status and simultaneously characterize the serologically-weak D samples. The strategy will be applied for non-invasive fetal RhD typing for management of pregnancy in Indian RhD negative antenatal women.
- "IBD NutriCare App" was released for Inflammatory Bowel Disease (IBD) patients on World Inflammatory Bowel Disease Day,19th May 2022. This is a mobile app which will help patients in

recording their real time diet data on a regular basis, track their nutrient intake, monitor their disease activity, and keep a tab on their medicine intake and lifestyle. This will also help physicians and dieticians in the assessment of nutritional status of patients and provide tele-nutrition counseling.

B. PRODUCTS ON THE WAY TO COMMERCIALIZATION

- A cost-effective multiplex Real time PCR assay was designed for detection of GARV, HAdV-F, NoV GI, NoV GII and RNaseP. In-house and third-party validation in two laboratories revealed >96% sensitivity and 100% specificity. The kit is in process of technology transfer.
- Diagnostic tests for non-invasive prenatal diagnosis, for foetal RhD typing from maternal plasma, for management Rh-HDN have been standardized at NIIH. This is now ready for transfer of technology and further commercialization.
- The technology for rapid, simple and cost-effective lateral flow immunoassay for the diagnosis of severe Haemophilia A and von Willebrand disease, developed by NIIH, has been transferred for commercialization to Bhatt Biotech and has been approved by CDSCO and is ready for marketing.
- ICMR-NITM validated the diabetic wound healing activity of essential oil obtained from flower buds of *Mammea suriga* and elucidated its molecular mechanism of action. It has public health relevance as a home remedy for management of diabetic wounds.

NEW GUIDELINES/POLICY PREPARED

- The study on Strengthening state NCD programme for diagnosis and treatment of suspected cases of Breast Cancer at medical colleges/institutes has established self-breast examination as a tool for early diagnosis & treatment.
- ICMR formulated guidelines for management of type 1 diabetes. The document spanning 12 chapters address epidemiology and diagnosis, lifestyle, drugs, monitoring, acute, microvascular and macro vascular complications, education and special group.
- ICMR contributed two policy documents.

  a) Tobacco Control in India 2022

  b) National Injury Prevention strategy document

- Future road map for the national program on prevention and control of snakebite in India was provided to Niti Ayog by ICMR-NIRRCH.
- ICMR multi-centric task force study on polycystic ovarian syndrome (PCOS) is one of the largest studies providing data on prevalence of PCOS and regional phenotypic variation in India. The study provides valuable information relevant for clinical management and policy on PCOS.
- ICMR-NARI contributed to development of guidelines for STI surveillance.
- ICMR also contributed to guidelines for elimination of vertical transmission of HIV and syphilis (EVTHS).

- Target Product Profiles for the rapid diagnosis of sepsis in adults and neonates were developed to detail the criteria for performance and operational specifications of a 'fit-for-use test' as per needs of healthcare in India.
- ICMR developed policy recommendations for managing human anthrax outbreaks.

REPORTS/DATABASE/MANUALS/BOOKS PUBLISHED

- National List of Essential Medicines, 2022: NLEM, 2022 was released by Hon'ble Minister of Health, Dr. Mansukh Mandaviya on 13th September, 2022. The NLEM, 2022 contains 384 medicines in 27 therapeutic categories.
- A total of more than 150 Frequently Asked Questions (FAQs) have been framed by Bioethics unit. The FAQs are available on the website and are arranged section-wise to ascertain easy access and navigation to these particular topics. The FAQ hard copy was released on 27th September 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.
- A report on "A Situational Analysis of Childhood Cancer Care Services in India -2022" were released on 27th Sep 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.
- Dr. Bharati Pravin Pawar, Union Minister of State, Ministry of Health and Family Welfare, on 3rd Dec, 2022, released a book "ODI-SCI: The Odyssey of the women scientists of Odisha" which documents the life history the great women scientists of the Odisha State.
- A Report on "The Environmental Burden of Tobacco Product Wastes in India," a joint study by ICMR-NICPR and AIIMS Jodhpur, was released. The evidence thus generated may serve to reinforce and amend the existing policies on regulation of tobacco product packaging through Plastic Waste Management Rules (2016) and the provisions of environmental compensation.
- ICMR Bioethics Unit has published a reference book on 'Biomedical Ethics Perspectives in The Indian Context.' This is the first-of-its-kind book in India with a comprehensive and unique compilation of topics addressing ethical aspects in various kinds of research in the Indian context by relevant experts.
- ICMR-NIIRRCH established National clinical database and biorepository of endometriosis.
- ICMR has created an online resource - GeDiPNet freely accessible at http://gedipnet.bicnirrh.res.in/. It currently has information on 7297 diseases associated with 12,280 genes with their relevant annotations. This resource can accelerate disease informatics and health research initiatives.
- 6 animated videos were prepared based on National ethical guidelines, Ethics preparedness in outbreak and emergencies and other relevant regulatory requirements. The videos are approximately 2-4 minutes each and are made freely available online in ICMR Bioethics Unit website. (https://ethics.ncdirindia.org/A_Videos.aspx)
- ICMR Bioethics unit aimed to develop the first of its kind- short educational movies in the country. These self-learning videos also serve as a tool for addressing complex scenarios that deviate from the norm and assisting the stakeholders in taking appropriate action in such cases. 13 videos of

approximately 2-5 minutes each were developed and released and are freely available online for easy accessibility.

- A Database on herb-drug interaction has been developed by ICMR-NITM with curated information available on interactions of commonly used drugs & herbs for the treatment/management of Diabetes mellitus (DM), Arthritis, and Gastrointestinal disorder (GI) (nausea, vomiting, diarrhoea, acidity).
- I-MANN- the first mental health database for research in India was launched.
- There was development and Validation of the Screening Version of the Indian Scale for Assessment of Autism, A screening version of ISAA. The simple, 10-minute, yes-no questionnaire, the Indian Autism Screening Questionnaire (IASQ), was developed which is an ideal instrument for screening of Autism in community settings and identifying autism early. The early identification can lead to early intervention benefitting the child. The IASQ has a sensitivity of 97-99% in different settings.
- ICMR developed Indian version of Anxiety and Panic Questionnaire (PANIQ) which is a culturally validated instrument to identify and measure anxiety and panic for Indian population
- Development of intervention manuals in Mental health.
  - ❖ For nurse-led intervention for perinatal depression (BIND-P)
  - ❖ For telephonic interventions in suicide attempts
  - ❖ For detecting physical illness in the seriously mentally ill in the community (Community Level Intervention for Physical Illness in Mentally Ill People-CLIPMI)
  - ❖ For ASHA to detect serious mental illnesses, common mental illnesses and substance use disorders in the community
- The mindfulness intervention module has been also standardized for use in patients with diabetes and depression.
- ICMR Monograph Publications were done.
  - ❖ Reviews on Indian Medicinal Plants. 2022. Vol 24 (Sa-Sc). Indian Council of Medical Research, New Delhi. pp. 1-1008.
  - ❖ Reviews on Indian Medicinal Plants. 2022. Vol 25 (Se-Sm). Indian Council of Medical Research, New Delhi. pp. 1-833.
  - ❖ Reviews on Indian Medicinal Plants. 2022. Vol 26 (So-Sp). Indian Council of Medical Research, New Delhi. pp. 1-716.
  - ❖ Reviews on Indian Medicinal Plants. 2022. Vol 27 (St-Sy). Indian Council of Medical Research, New Delhi. pp. 1-859.
- Technical Report of the study undertaken by ICMR-NIMS on “Validation study on assigning cause of death” was released. It is envisaged that the evidence generated would inform the researchers and decision-makers for strengthening cause specific mortality statistics in India.

- Prescription Research Software (PrescReSof©) for the RUMCs of National Virtual Centre of Clinical Pharmacology (NvCCP) was developed and hosted at ICMR-NIMS.
- ICMR-National Hospital Based Registry on Venous Thromboembolic Disorders (i-RegVeD) developed and hosted at ICMR-NIMS aims to establish a nationwide registry through selected hospitals and collect data for generating to generate evidence on *Venous thromboembolism (VTE)* prevalence for planning response, and strengthening healthcare facilities across different treatment settings.
- ICMR prepared a report 'ICMR's Response to COVID-19', which documents the various interventions undertaken by ICMR and its 27 institutes to strengthen India's fight against COVID-19.
- ICMR drafted standard operating procedures for laboratory diagnosis of human anthrax.
- ICMR Identified the hot spots and developed predictive risk map for human Anthrax in India.
- A special collection of 75 stories celebrating the spirit of New India, titled 'Changing the Nation's Health Landscape' was published. From the country's first test tube baby to tackling leprosy to battling COVID19, the photobook is a collection of interventions by ICMR that have helped improve the health and wellbeing of all Indians.
- ICMR redesigned and republished the autobiography of Dr. C.G. Pandit, Founder & the first Director General of ICMR. The book titled 'My World of Preventive Medicine' provides a first-hand account of the early history of the institution and the seminal contributions made by its scientists during 20th century.

NEW COURSES LAUNCHED

- ICMR rolled out an online health communications course. The curriculum of the program provided participants with an overview of critical topics like importance of strategic communication, health communication, media management and community engagement.
- ICMR-VCRC took a lead role in establishing a National Public Health Entomology (NPHE) Programme and facilitated in replicating the M.Sc. PHE course in other ICMR institutes, where vectors and vector borne disease research is undertaken. Accordingly, ICMR-RMRCGKP, Gorakhpur; ICMR-RMRIMS, Patna; ICMR-RMRCNE, Dibrugarh and ICMR- NIRTH, Jabalpur have been identified as Regional Campuses to conduct M.Sc., PHE course. Pondicherry Central University has provided Provisional Affiliation.
- Training module on VL, PKDL and VL-HIV co-infection was developed under DNDi sponsored Centre of Excellence program.
- The ICMR School of Public Health (ICMR-SPH) at ICMR-National Institute of Epidemiology has been conducting advanced (Master of Public Health and Epidemic Intelligence Services Program) and intermediate (FETP-NCD) field epidemiology training programs in India.
- ICMR designed and developed an online certificate course on 'One Health', first-of-its-kind in India which was launched on 23rd January 2023 through the NPTEL platform.
- ICMR- BMHRC is conducting the following courses

- DNB (Diplomate National Board) in Ophthalmology course.
- MD Anaesthesia course (Post Graduation).
- The Bhopal College of Nursing conducts the following courses:
  - M.Sc. Nursing
  - B.Sc. Nursing
  - Post Basic BSc Nursing.

- The Paramedical Institute at BMHRC conducts the following Diploma Courses
  - Diploma in Anaesthesia Technician
  - Diploma in Blood Transfusion Technician
  - Diploma in Dialysis Technician
  - Diploma in Cath Lab Technician
  - Diploma in Medical Lab Technician
  - Diploma in Optometry & Refraction Technician
  - PG. Diploma in Perfusion Technology
  - Diploma in X-Ray & Radiographer Technician

INFRASTRUCTURE AND CAPACITY BUILDING

- The inauguration of annex building of the centre and laying of foundation stone of School of Public Health and BSL III Laboratory at ICMR-RMRC, Bhubaneswar was done on 7th Jan, 2023 by Dr. Mansukh Mandaviya, Hon'ble Union Minister for Health and Family Welfare.
- Dr. Mansukh Mandaviya, Hon'ble Union Minister for Health and Family Welfare also laid the foundation stone on 25th Jun 2022, for "International Centre of Excellence for Training in Medical Entomology (ICETIME)" in the premises of ICMR-VCRC, Puducherry.
- On World Sickle cell day, 19th Jun 2022, the Hon'ble Union Minister of Health and Family Welfare, Dr. Mansukh Mandaviya, Hon'ble Governor of Madhya Pradesh, Shri Mangubhai Patel, and Hon'ble Chief Minister of Madhya Pradesh, Shri Shivraj Singh Chouhan, inaugurated the workshop on "Holistic Management of Sickle Cell Disease (SCD)" at ICMR-NIRTH.
- The Hon'ble Governor of Madhya Pradesh, His Excellency, Shri Mangubhai Patel, graced the occasion of two-day symposium on "Sickle Cell Disease in India" on 22-23rd Feb 2023 at ICMR-NIRTH.
- The mobile BSL-3 laboratory validation and four field trials were conducted in Maharashtra and Kerala by ICMR-NIV. This will be a very important tool for outbreak response in remote and underserved areas.
- Training on Mpox diagnosis was provided to 35 VRDLs by ICMR-NIV, of which 15 laboratories were supplied with reagents for testing. Seven SEAR countries were also provided reagents for laboratory diagnosis of Mpox.

- As an apex referral laboratory for dengue, ICMR-NIV provided diagnostic support to Maharashtra, Bihar and Goa. The results reveal the predominant circulation of DENV-2 in these states.
- ICMR-NIV and its field units provided diagnostic support for the confirmation of HFMD outbreaks in different parts of the country. The emergence of Coxsackievirus A6 (CVA6) was noted. The other viruses identified were Coxsackievirus A16 and Coxsackievirus A4. The phylogenetic analyses demonstrated that the strains CVA6 belong to group D.
- A country-wide serosurvey for Hepatitis A and E virus has been initiated by ICMR-NIV and 4500 samples have been collected from three states Gujarat, Rajasthan and Karnataka. This study will help guide policy decision-making on the need for routine vaccinations.
- Thirteen participants from seven institutes were trained by ICMR-NIV in a four-day workshop on Ixodidae tick surveillance.
- ICMR-NIV undertook the validation of the Mobile BSL-3 laboratory (MBSL3). Four field trials were conducted in Maharashtra (3) and Kerala (1). The field trials were found satisfactory, indicating that travel was not interrupting the functioning of laboratory/system equipment, and the diagnostic tests.
- A month-long extensive hands-on training for scientists and technologists of ICMR-RMRC Gorakhpur was conducted by the team of ICMR-NIV Pune for working in MBSL3.
- Eight mice and Golden Syrian hamster strains are currently bred, maintained and supplied for various studies by ICMR-NIV. During the year, transgenic mice -Tg (K18-hACE2) were procured from National Centre for Biological Science (NCBS), Bangalore for SARS CoV-2 studies.
- The VRDL External Quality Assurance (EQA) program by NIV for serological testing of Dengue, Japanese encephalitis, and Chikungunya by IgM ELISA was reassuring with an average concordance of 97.1% from 61 VRDLS. The WHO proficiency of 15 VRDLs for laboratory diagnosis of measles and rubella was also supported. Twenty-two VRDLs participated in quality control (QC) testing for serological diagnosis of a panel of viruses, with an average concordance of 95.2% indicating that the VRDLs were maintaining a high standard of testing. One hundred and twenty staff from the VRDL network were trained for NGS application and bioinformatics analysis of the SARS CoV2 virus.
- ICMR-NIV undertook core activities for the Regional research platform for Dengue laboratory capacity building in South East Asian Region (SEAR). A technical visit was conducted through ICMR and WHO for capacity building for dengue diagnosis by serology and PCR as well as establishing dengue Real Time RT PCR-based serotyping at National Health Laboratory, Dili, Timor Leste.
- 35 VRDLs were trained for Good Clinical Laboratory Practices (GCLP) and ISO:15189 by NIV.
- 18 laboratories were trained by NIV team for Kyasanur Forest Disease (KFD) and Crimean Congo Haemorrhagic Fever (CCHF) diagnosis.
- Third round of EQA for SARS-CoV-2 has been undertaken for 800 COVID-19 RT-PCR laboratories across the country by NIV. The results were submitted by 523 laboratories which tested the panel with different rRT-PCR kits, 403 (80.6%) laboratories qualified the EQAP.

- WHO certification has been awarded to ICMR NARI for *in house* assay for Integrase drug resistance genotyping using DBS specimens. HIV drug resistance genotyping support was provided to Sri Lanka for the clinical management of PLHIV on treatment.
- HIV Drug Resistance laboratory at NARI has been identified as the first national laboratory having WHO certification for DBS based in house assay for Integrase resistance testing.
- In order to deal emerging and remerging outbreaks/infectious diseases, state level VRDL lab were established at ICMR-RMRC Gorakhpur. A state-of-art facility for timely identification of viruses and other agents causing morbidity, cater the diagnostic/research services to 50 million populations of Uttar Pradesh and Western Bihar.
- Apart from diagnosing seven syndromes (29 viral etiologies), ICMR-RMRC, Gorakhpur, VRDL is also sentinel site for Zika surveillance.
- There was establishment of a Health and Demographic Surveillance System [HDSS] by RMRCGKP. The HDSS coupled with GIS mapping identified morbidity and mortality pattern, data on prevalent communicable and non-communicable diseases, socio-economic and nutritional status of 1 lac population from HDSS villages.
- National Tobacco Testing Laboratory at NICPR supported the National Tobacco Control Programme and tested samples of smoked and smokeless tobacco products from various government agencies, performing nearly 1950 tests and provided the results to the respective agencies.
- In the 'aspirational district', Nandurbar has been adopted by NIIH to establish facilities for genetic diagnosis and counselling of hemoglobinopathies and newborn screening for 6 common disorders.
- Next generation sequencing facility (NextSeq 2000) has been successfully installed in NIIH. This will help us analyse large number of unresolved cases referred to our institute for diagnosis by whole genome / whole exome analysis.
- ICMR-NIIH has established molecular immunohaematology reference laboratory to resolve problems in blood grouping and cross matching and identification of rare blood groups.
- ICMR-NIIH initiated two multicentric projects in the area of autoimmune diseases which has helped in establishing diagnostic facilities at 14 centres across India, including 4 centres in NE region. The data generated from all the centres will also help in planning future multicentric research activities in the area of autoimmune diseases.
- There was establishment of long-term gametocyte culture and mosquito infection facility by NIMR for screening of transmission blocking drugs/ vaccine for *P. falciparum.*
- The ICMR-NARFBR has excellent facility of genetically tested rodents and lagomorphs for biomedical research. Centre has established state-of-the-art facility for SPF-like Non-Human Primates for preclinical trials of biologicals, vaccines, etc. Centre has also created state-of-the-art infrastructure for testing and preclinical trial of medical devices and biopharmaceuticals in pigs and beagle dogs.

SELECTED HIGH IMPACT PUBLICATIONS

During the year 2022-23, the total number of Research papers published in peer reviewed journals through the several intramural Research Programmes by 27 institutes of ICMR organization are **1018**. The best 50 publications in Internationally acclaimed Scientific Journals with high impact factor are tabulated below.

1	GBD 2020 Cancer Collaborators. The global burden of cancer attributable to riskfactors, 2010–19: a systematic analysis for the Global Burden of Disease Study 2019. Lancet.2022; 400(10352):563–591. Available from: https://www.researchgate.net/publication/367053144_Canceroge	202.731
2	WHO Solidarity Trial Consortium Collaborators: Godbole S, etal. Remdesivir and three other drugs for hospitalised patients with COVID-19: results of the WHO Solidarity randomised trial and updated meta-analyses. *The Lancet.* 2022 May 21-27; 399(10339): 1941-53.	202.731
3	GBD 2020 Alcohol Collaborators. Population-level risks of alcohol consumption by amount, geography, age, sex, and year: a Systematic analysis for the Global Burden of Disease Study 2020. Lancet. 2022 Jul 16;400(10347):185-235. doi: 10.1016/S0140- 6736(22)00847-9. PMID: 35843246; PMCID: PMC9289789.	202.731
4	Christina Z, Dheepa J, Anna P, Kevin K, Vani S, Zivai M, SubbaRao M G, Kathryn B: World Children's Day 2022: power, policy, and children's rights to nutrition. Lancet. 18; doi: 10.1016/S0140-6736(22)02352-2.	202.731
5	Kanungo S, Azman AS, Ramamurthy T, Deen J, Dutta S. Cholera. Lancet. 2022 Apr 9;399(10333):1429-1440. doi: 10.1016/S0140-6736(22)00330-0. PMID: 35397865.	202.7
6	Saxena N, Saha KB, Das A. India at 75 years: improving tribal health for self-reliance. Lancet. 2022 Nov 5;400(10363):1581. doi: 10.1016/S0140-6736(22)01801-3.	202.7.
7	Saxena N., Singh S. Traditional healers in South Africa: a parallel health care system connecting tribal healers to primary health care: A dire need to alleviate health of indigenous and tribal populations (Letter to editor). BMJ. March 2022, https://www.bmj.com/content/310/6988/1182/rr-0	107.7
8	Grant R, Sacks JA, Abraham P, Chunsuttiwat S, Cohen C, Figueroa JP, Fleming T, Fine P, Goldblatt D, Hasegawa H, MacIntrye CR, Memish ZA, Miller E, Nishioka S, Sall AA, Sow S, Tomori O, Wang Y, Van Kerkhove MD, Wambo MA, Cohen HA, Mesfin S, Otieno JR, Subissi L, Briand S, Wentworth DE, Subbarao K. When to update COVID-19 vaccine composition. *Nat Med.* 2023 Feb 20. doi: 10.1038/s41591-023-02220-y.	87.241

9	GBD 2019 Adolescent Transport and Unintentional Injuries Collaborators. Adolescent transport and unintentional injuries: a systematic analysis using the Global Burden of Disease Study 2019. Lancet Public Health. 2022 Aug;7(8):e657-e669. doi: 10.1016/S2468-2667(22)00134-7. Epub 2022 Jun 30. Erratum in: Lancet Public Health. 2022 Dec;7(12):e992. PMID: 35779567; PMCID: PMC9329128.	72.427
10	Kanungo S, Chatterjee P, Bavdekar A, Murhekar M, Babji S, Garg R, Samanta S, Nandy RK, Kawade A, Boopathi K, Kanagasabai K, Kamal VK, Kumar VS, Gupta N, Dutta S. Safety and immunogenicity of the Rotavac and Rotasiil rotavirus vaccines administered in an interchangeable dosing schedule among healthy Indian infants: a multicentre, open-label, randomised, controlled, phase 4, non-inferiority trial. Lancet Infect Dis. 2022 Aug;22(8):1191-1199. doi: 10.1016/S1473-3099(22)00161-X. Epub 2022 May 16. PMID: 35588754; PMCID: PMC9464301.	71.421
11	A multinational Delphi Consensus to end the COVID-19 public health threat. Nature 2022; 611: 322-345. https://doi.org/10.1038/s41586-022-05398-2	69.504
12	NCD Risk Factor Collaboration (NCD-RisC), Chaturvedi, H.K… Menon, G.R (2023). Diminishing benefits of urban living for children and adolescents' growth and development. *Nature, 615*, 874–883. https://doi.org/10.1038/s41586-023-05772-8	69.504
13	Skou S.T, Mair F.S, Fortin, M. et al. Multimorbidity. Nature Reviews Disease Primer. 2022. Doi:https://doi.org/10.1038/s41572-022-00376-4	65.038
14	Alcantara LCJ, Amenga-Etego L, Andersson R, Bhaumik M, Choi YK, DecaluweH,Geoghegan J, Haagmans BL, López S, Mukhtar MM, Nelwan E, Rahal EA, Sato K, SklanEH, Fang YSC. Methods for fighting emerging pathogens. Nat Methods. 2022Apr;19(4):395-397. doi: 10.1038/s41592-022-01441-2.	47.99
15	Muniyandi M: Global, regional, and national burden of hepatitis B, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *The lancet Gastroenterology & Hepatology* 2022.	45.042
16	GBD 2019 Colorectal Cancer Collaborators. Global, regional, and national burden of colorectal cancer and its risk factors, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Gastroenterol Hepatol*. July, 2022, 7(7):627-647.	45.042
17	L Preethi, MS Alina, Lakshmi Chandran, S Asvin, M Jagadeesan, TM Vijayakumar, V Chitra, Ashok Kumar Pandey, Mahendra M Reddy, BR Misra, Rajni Kant, PL Bhukya, Gururaj Deshpande, Priya Abraham, Gajanan Sapkal and Kamran Zaman (2022). Duration of Seroprotection of the live attenuated SA-14-14-2 Japanese encephalitis vaccine in children in India. *Journal of Travel Medicine*, 2022, 1–8. https://doi.org/10.1093/jtm/taac147	39.194

18	Deshpande GR, Bhukya PL, Yadav PD, Salunke A, Patil C, Tilekar BN, Rakhe A, Srivastava R, Gurav YK, Potdar V, Abraham P, Sapkal GN. Comparison of neutralizing antibody response in first and second waves of SARS CoV-2 pandemic in India. *J Travel Med*. 2022 May 31;29(3):taab196. doi: 10.1093/jtm/taab196.	39.194
19	Deshpande GR, Yadav PD, Abraham P, Nyayanit DA, Sapkal GN, Shete AM, Gupta N, Vadrevu KM, Ella R, Panda S, Bhargava B. Booster dose of the inactivated COVID-19 vaccine BBV152 (Covaxin) enhances the neutralizing antibody response against alpha, Beta, Delta and omicron variants of concern. *J Travel Med*. 2022 May;29(3): taac039. doi: 10.1093/jtm/taac039.	39.194
20	Preethi L, Alina MS, Chandran L, Asvin S, Jagadeesan M, Vijayakumar TM, Chitra V, Pandey AK, Reddy MM, Misra BR, Kant R, Bhukya PL, Deshpande GR, Abraham P, Sapkal G, Zaman K. Duration of Seroprotection of the live attenuated SA-14-14-2 Japanese encephalitis vaccine in children in India. *J Travel Med.* 2022 Dec 10: taac147. doi: 10.1093/jtm/taac147.	39.194
21	Sapkal G, Deshpande GR, Tilekar B, Yadav P, Abraham P, Salunke A, Patil C, Deshpande K, Patil R, Pawar N, Joshi A, Vaidya A, Shivankar A. Antibody responses to Sputnik Vaccination in naïve and COVID 19-recovered vaccine recipients, India. *J Travel Med.* 2022 May 31;29(3): taac040. doi: 10.1093/jtm/taac040.	39.194
22	Sapkal G, Srivastava RK, Dwivedi G, Sahay RR, Yadav PD, Deshpande GR, Singh R, Nyayanit DA, Patil DY, Shete-Aich AM, Zaman K, Chaudhari AK, Gupta N, Panda S, Abraham P, Bhargava B. Immune responses against different variants of SARS-CoV-2 including omicron following six months of administration of heterologous prime-boost COVID-19 vaccine. *J Travel Med*. 2022 May 31;29(3): taac033. doi: 10.1093/jtm/taac033.	39.194
23	Kumar NP, Banurekha VV, Kumar CPG, Nancy A, Padmapriyadarsini C, Shankar S, Hanna LE, Murhekar M, Devi KRU, Babu S. Inactivated COVID-19 vaccines: durability of Covaxin/BBV152 induced immunity against variants of concern. J Travel Med. 2022 Sep 17;29(6):88.	1. 39.194
24	Muzembo BA, Kitahara K, Mitra D, Ohno A, Khatiwada J, Dutta S, Miyoshi SI. Burden of Shigella in South Asia: a systematic review and meta-analysis. J Travel Med. 2022 Nov 4: taac132. doi: 10.1093/jtm/taac132. Epub ahead of print.	39.194
25	Local Burden of Disease Household Air Pollution Collaborators. Mapping development and health effects of cooking with solid fuels in low-income and middle-income countries, 2000-18: a geospatial modelling study. Lancet Glob Health. 2022 Oct;10(10):e1395-e1411.	38.927
26	Murhekar MV, Kumar CG. Health-care-associated infection surveillance in India. Lancet Glob Health. 2022 Sep;10(9):e1222-e1223.	38.927

27	Rosu L, Madan JJ, Tomeny EM, Muniyandi M, Nidoi J, Girma M, Vilc V, Bindroo P, Dhandhukiya R, Bayissa AK *et al*: Economic evaluation of shortened, bedaquiline-containing treatment regimens for rifampicin-resistant tuberculosis (STREAM stage 2): a within-trial analysis of a randomised controlled trial. *Lancet Glob Health* 2022.	38.927
28	Pandit P, Bhatt P, Sahay RR, Joshi Y, Patil DY, Yadav PD. A case of breakthrough infection with SARS-CoV-2 Delta derivative and reinfection with Omicron variant in a fully vaccinated health care professional. *J Infect*. 2022 Jul;85(1):e15-e17. doi:10.1016/j.jinf.2022.04.023.	38.637
29	Sahay RR, Patil DY, Sapkal GN, Deshpande GR, Shete AM, Nyayanit DA, Kumar S, Yadav PD. SARS-CoV-2 Delta and delta derivatives impact on neutralization of Covishield recipient sera. *J Infect*. 2022 Apr;84(4):e36-e38 doi: 10.1016/j.jinf.2022.02.018.	38.637
30	Shete AM, Yadav PD, Kumar A, Patil S, Patil DY, Joshi Y, Majumdar T, Relhan V, Sahay RR, Vasu M, Gawande P, Verma A, Kumar A, Dhakad S, Krishnan AB, Chenayil S, Kumar S, Abraham P. Genome characterization of monkeypox cases detected in India: Identification of three sub clusters among A.2 lineage. *J Infect.* 2023 Jan;86(1):66-117. doi: 10.1016/j.jinf.2022.09.024.	38.637
31	Yadav PD, Reghukumar A, Sahay RR, K S, Shete AM, Raman A, Vk P, Abraham P, Benson R, Sm S, Mohandas S, Patil DY, Gupta N, George AE, Vijay N, U A, Suresh M, A RR, Sapkal GN, Ravindranath M, Sreenivasan S, James P, Mk S. First two cases of Monkeypox virus infection in a traveller returned from UAE to India, July 2022. *J Infect.* 2022 Nov;85(5):e145-e148. doi: 10.1016/j.jinf.2022.08.007.	38.637
32	Yadav PD, Sahay RR, Agrawal S, Shete A, Adsul B, Tripathy S, Nyayanit DA, Manrai M, Patil DY, Kumar S, Marwah V, Sapkal GN, Shastri J, Viswanathan R, Pandit P, Mishra Y, Chavan S, Joshi Y, Kumar TA, Majumdar T, Kumar A, Patil S, Munshi R, Desai U, Kaushal H, Suryawanshi A, Dudhmal M, Gawande P, Jain R, Waghmare A, Kalele K, Vedpathak P, Yemul J, Bodke P, Kore T, Kakrani AL, Athavale P, Suryawanshi P, Patsute S, Padbidri V, Awate P, Abraham P. Clinical, immunological and genomic analysis of the post vaccinated SARS-CoV-2 infected cases with Delta derivatives from Maharashtra, India, 2021. *J Infect.* 2022 Jul;85(1):e26-e29. doi: 10.1016/j.jinf.2022.04.014.	38.637
33	Yadav PD, Sapkal GN, Sahay RR, Patil DY, Deshpande GR, Jain R, Nyayanit DA, Shete AM, Suryawanshi A, Nandapurkar A, Gurav YK, Abraham P. Elevated neutralization of Omicron with sera of COVID-19 recovered and breakthrough cases vaccinated with Covaxin than two dose naïve vaccinees. *J Infect.* 2022 Jun;84(6):834-72.doi: 10.1016/j.jinf.2022.03.016.	38.637

34	Yadav PD, Sapkal GN, Sahay RR, Patil DY, Agrawal S, Adsul B, Tripathy S, Deshpande GR, Nyayanit DA, Shete AM, Shastri J, Abraham P. Reduced neutralizing antibody response in naïve Covishield vaccinees against Omicron emphasizes booster vaccination. *J Infect.* 2022 Jul;85(1):90-122. doi: 10.1016/j.jinf.2022.04.031.	38.637
35	Yadav PD, Sapkal GN, Sahay RR, Potdar VA, Deshpande GR, Patil DY, Nyayanit DA, Shete AM, Shastri J, Awate P, Malhotra B, Abraham P. Substantial immune response in Omicron infected breakthrough and unvaccinated individuals against SARS-CoV-2 variants of concerns. *J Infect*. 2022 May;84(5):e80-e81. doi: 10.1016/j.jinf.2022.02.005.	38.637
36	Murhekar MV, Gupta N, Hasan AZ, Kumar MS, Kumar VS, Prosperi C, Sapkal GN, Thangaraj JWV, Kaduskar O, Bhatt V, Deshpande GR, Thankappan UP, Bansal AK, Chauhan SL, Grover GS, Jain AK, Kulkarni RN, Sharma SK, Chaaithanya IK, Kharwal S, Mishra SK, Salvi NR, Sharma S, Sarmah NP, Sabarinathan R, Duraiswamy A, Rani DS, Kanagasabai K, Lachyan A, Gawali P, Kapoor M, Shrivastava AK, Chonker SK, Tilekar B, Tandale BV, Ahmad M, Sangal L, Winter A, Mehendale SM, Moss WJ, Hayford K. Evaluating the effect of measles and rubella mass vaccination campaigns on seroprevalence in India: a before-and-after cross-sectional household serosurvey in four districts, 2018-2020. *Lancet Glob Health.* 2022 Nov;10(11):e1655-64. doi: 10.1016/S2214-109X(22)00379-5.	38.927
37	Carvalho MJ, Sands K, Thomson K, Portal E, Mathias J, Milton R, Gillespie D, Dyer C, Akpulu C, Boostrom I, Hogan P, Saif H, Ferreira A, Nieto M, Hender T, Hood K, Andrews R, Watkins WJ, Hassan B, Chan G, Bekele D, Solomon S, Metaferia G, Basu S, Naha S, Sinha A, Chakravorty P, Mukherjee S, Iregbu K, Modibbo F, Uwaezuoke S, Audu L, Edwin CP, Yusuf AH, Adeleye A, Mukkadas AS, Zahra R, Shirazi H, Muhammad A, Ullah SN, Jan MH, Akif S, Mazarati JB, Rucogoza A, Gaju L, Mehtar S, Bulabula ANH, Whitelaw A, Roberts L; BARNARDS Group; Walsh TR. Antibiotic resistance genes in the gut microbiota of mothers and linked neonates with or without sepsis from low- and middle-income countries. Nat Microbiol. 2022 Sep;7(9):1337-1347. doi: 10.1038/s41564-022-01184-y. Epub 2022 Aug 4.	30.96
38	Hoffman SA, LeBoa C, Date K, Haldar P, Harvey P, Shimpi R, An Q, Zhang C, Jayaprasad N, Horng L, Fagerli K, Borhade P, Chakraborty D, Bahl S, Katkar A, Kunwar A, Yewale V, Andrews JR, Bhatnagar P, Dutta S, Luby SP. Programmatic Effectiveness of a Pediatric Typhoid Conjugate Vaccine Campaign in Navi Mumbai, India. Clin Infect Dis. 2023 Mar 22: ciad132. doi: 10.1093/cid/ciad132. Epub ahead of print. PMID: 36947143.	20.999
39	Padmapriyadarsini C, Vohra V, Bhatnagar A, Solanki R, Sridhar R, Anande L, Muthuvijaylakshmi M, Bhatia M, Jeyadeepa B, Taneja G *et al*: Bedaquiline, Delamanid, Linezolid and Clofazimine for Treatment of Pre-extensively Drug-Resistant Tuberculosis. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America* 2022.	20.999

40	Padmapriydarsini C, Mamulwar M, Mohan A, Shanmugam P, Gomathy NS, Mane A, Singh UB, Pavankumar N, Kadam A, Kumar H, Suresh C, Reddy D, Devi P, Ramesh PM, Sekar L, Jawahar S, Shandil RK, Singh M, Menon J, Guleria R. Randomized Trial of Metformin with Anti-Tuberculosis Drugs for Early Sputum Conversion in Adults With Pulmonary Tuberculosis. *Clin Infect Dis*. 2022 Aug 31;75(3):425-434.	20.999
41	Wilkin T, Chen H, Sahasrabuddhe V, Matining R, Mngqibisa R, Chinula L, Mbilizi Y, Magure T, Omoz-Oarhe AE, Rassool M, Riviere C, Bhosale R, Godbole S, Naranjo R, Coombs R, Michelow P, Godfrey C, Firnhaber C. A Randomized Clinical Trial of Human Papillomavirus Test-and-Treat as Compared to Cytology-Based Screening for Prevention of Cervical Cancer Among Women With Human Immunodeficiency Virus: AIDS Clinical Trials Group Protocol A5282. *Clin Infect Dis*. 2022 Oct 12;75(8):1280-1288.	20.999
42	Chavan VR, Ahir S, Kerkar S, Ansari Z, Samant-Mawani P, Nanavati R, Mehta P, Mania-Pramanik J. Th1 cytokine gene polymorphism and the corresponding plasma cytokine levels: A comparative study in HIV-1 positive and exposed uninfected infants. *J Med Virol* 94(2): 625-633, 2022	20.693
43	Gupta SM, Warke H, Chaudhari H, Mavani P, Katke RD, Kerkar SC, Mania-Pramanik J. Human Papillomavirus E6/E7 oncogene transcripts as biomarkers for the early detection of cervical cancer. *J Med Virol* 94(7): 3368-3375, 2022	20.693
44	Banerjee A, Mazumder A, Roy J, Das J, Majumdar A, Chatterjee A, Biswas NK, Chawla Sarkar M, Das S, Dutta S, Maitra A. Emergence of a unique SARS-CoV-2 Delta sub-cluster harboring a constellation of co-appearing non-Spike mutations. J Med Virol. 2023 Jan;95(1): e28413. doi: 10.1002/jmv.28413. PMID: 36541745; PMCID: PMC9878222.	20.693
45	Kumar N, Misra BR, Reddy MM, Deval H, Zaman K, Rajni Kant (2022). COVID-19 transmission among vaccinated laboratory workers during the second wave in eastern Uttar Pradesh, India. *J Med Virol*. 2022;94(8):3512-3514. doi:10.1002/jmv.27788	20.693
46	Nandi SS, Sawant S, Gohil T, Lambe U, Sangal L, Patel D, Krishnasamy K, Ghoshal U, Harvey P, Deshpande J. Poliovirus nonpermissive CD155 knockout cells derived from RD cell line for handling poliovirus potentially infectious materials in virology laboratories. *J Med Virol.* 2022 Oct;94(10):4901-9. doi: 10.1002/jmv.27897.	20.693
47	Patil DY, George S, Sahay RR, Chenayil S, Shete AM, Bhaskaramenon SC, Anish TS, Jain R, Nazeer FA, John R, Joshi Y, Sivaprasad R, Waghmare P, Ray S, Balakrishnan S, Kumari V, Sathe S, Yadav PD. A case of human buffalopox in Malappuram, India: The role of mpox surveillance in 2022. *J Med Virol.* 2023 Feb;95(2):e28580. doi: 10.1002/jmv.28580.	20.693

48	Ranshing S, Ganorkar N, Ramji S, Gopalkrishna V. Complete genomic analysis of uncommon G12P[11] rotavirus causing a nosocomial outbreak of acute diarrhea in the newborns in New Delhi, India. *J Med Virol.* 2022 Jun;94(6):2613-23. doi: 10.1002/jmv.27468.	20.693
49	Relhan V, Sahay RR, Shete AM, Yadav PD, Sahoo B, Patil DY, Kumar S, Premachandran Syamaladevi KS, Dar L, Mohandas S, Abraham P. Clinical presentation, viral kinetics, and management of human monkeypox cases from New Delhi, India 2022. *J Med Virol.* 2023 Jan;95(1):e28249. doi: 10.1002/jmv.28249.	20.693
50	Tandale BV, Khude PM, Deshmukh PS, Narang R, Qazi MS, Padmaja GV, Jain M, Jain D, Guduru VK, Deshmukh PR, Raut AV, Narlawar UW, Jha PK, Rajderkar SS; Japanese Encephalitis Epidemiology Study Group. Effectiveness of Japanese encephalitis vaccination among children in central India. *J Med Virol.* 2023 Jan;95(1):e28399. doi: 10.1002/jmv.28399.	20.693

PATENTS

The IP protection of innovations generated either through intramural or ICMR supported extramural innovation research project had been considered. After carrying out proper due diligence such as identification of IP component, establishment of novelty, non-obviousness and industrial applicability, the protection of IP need to be made through patents, copyright, designs and trademark. Converting the innovative and technical information into techno-legal information involves activities viz. due diligence of new invention reports, patentability examination, patent filing and prosecution (India & abroad), patent grant & monitoring, weeding out unproductive patents. A total of 42 Indian patent applications, 4 design applications, 3 copyright applications and 6 foreign patent applications were filed. 2 Indian patent and 4 foreign patents were granted.

Table 1: Indian Patent Application, Design and Copyright Applications.

S. N.	Tile of invention	Patent Application No
1.	Quantum dot antibody conjugate and method of preparation thereof	202211021649
2.	A biomarker panel for early prediction or detection of liver metastasis in lung cancer	202211021943
3.	A composition for isolating exosomes and method thereof;	202211022537
4.	Loop mediated isothermal amplification primers for simultaneous detection of multiple human Plasmodium species	202211022727
5.	Photoacoustic spectroscopy and machine learning-based method to detect human breast tumor in xenografts	202211023646

6.	A System and Method for Phase Imaging and Absolute Refractive Index Measurement	202211026976
7.	Customized 3D Printed Hollow Capsular Device, Uses And Method Of Fabricating Thereof	202211027762
8.	Novel aptamers against bacterial vaginosis associated bacteria (BVAB)	202211029191
9.	A biodegradable implant for Deep wound healing and process for preparation thereof	202211031167
10.	A method for identification and classification of proteins based on auto fluorescence.	202211031669
11.	A bivalent typhoidal bacterial ghost (BTBG) immunogenic formulation and method for preparation thereof A bivalent typhoidal bacterial ghost (BTBG) immunogenic formulation and method for preparation thereof	202211034380
12.	Device And Method For Design And Development Of A Medical Glove For Hand Tremor Management Caused By Parkinson's Disease	202211035303
13.	An Innovative Artificial Diet for Adult Female Aedes Aegypti Mosquitoes	202211038493
14.	A fusion construct containing Salmonella Typhi outer membrane protein as a candidate vaccine	202211039222
15.	Transdermal delivery of cyclosporine A using ionic liquids mediated pluronic gel.	20221103907
16.	Natanite- A soft, self-dispensable, and sustained release ocular insert formulation of natamycin using 3D-printing and its composition thereof	202211041047
17.	Novel method on Diagnosis of SARS Cov-2 using Nucleic acid extraction free real time PCR system	202211041619
18.	A new biomedical device for improving shape of nose after septo-rhinoplasty	202211044156
19.	Development and Evaluation of Novel Multifunctional Nanocarriers loaded with Rivastigmine and siRNA for the management of Alzheimers Disease	202211046214
20.	A Device For Measuring Dynamic Changes In Optical Properties Under Different Conditions For Photothermal Theranostics	202211046195

21.	Designing of patient specific Total Elbow Replacement prosthesis for Indian Population"	202211047926
22.	Low Volume device for glycated hemoglobin detection in capillary or venous blood.	202211048056
23.	Avian Embryo Chorioallantoic Membrane as a Biological Testing Membrane	202211050928
24.	A Culture Media Formulation for inducing angiogenic differentiation	202211051584
25.	NIV's multiplex single tube Influenza and SARS- CoV-2 RTPCR detection kit	202211052927
26.	Novel bone graft to be used as scaffold in bone tissue engineering in critical sized defects	202211055922
27.	LAMP assay for rapid detection of Monkeypox virus	202211057074.
28.	Microwave assisted screw conveyor for rice fortification	202231057966
29.	Visual and simple detection system for BK Virus	202211058621
30.	A Gastro-Floating Sustained Release Tablet Of Penicillin	202211062012
31.	Nano-biosensor SANS for breast cancer risk-assessment in rural women exposed to biomass fumes.	202211064249
32.	Development of a colorimetric isothermal (RT-LAMP) assay for rapid detection of Nipah virus.	202211066352.
33.	Method for cardiovascular risk assessment in diabetic patients by performing oxidative stress test and uses thereof	202211071150
34.	Versatile and cost-effective microspheres to prepare radiolabeled formulations with trivalent cationic radionuclides of variable energies and properties	202211072667
35.	Fiber optic nano-antenna based excitation of whisper gallery made resonator and various sensing applications,	20221100468
36.	A self-gelling and self-setting bioactive cement formulation for dental tissue regeneration	202311005516
37.	compositions for metabolic reprogramming of cells by modulating the expression of tumor suppressor candidate 1 (TUSC1) and methods thereof	20221100397
38.	A Rapid and Sensitive Colorimetric Assay For Detection Of Ergosterol In Candida albicans.	202211077099

39.	Development of genetically tailored 3-D organotypic model of human intestine for study of enteroviruses	202311003845
40.	"Dendrimer Stabilized Albumin Nanoparticles Loaded with Asiatic Acid for the Management of Alcohol Addiction"	202311009523
41.	Injectable pH and thermo-responsive hydrogel incorporated with photothermal agent and method of preparation thereof for controlled on-demand drug release	202311008786
42.	Process technology for whole-grain rice fortification	202311010189

Table 2: Foreign Application Numbers.

1.	Korea Application Number awaited
2.	Uganda Application Number awaited
3.	US 17/904,201
4.	BR 11 2022 018935-4
5.	South African patent App. No. 2022/08022
7.	South African patent No. 2022/11453

Table 3: Indian and Foreign Patents granted during the period.

S. No	Tile of invention	Patent No.
1.	A process for engineering nucleotide specificity.	410956
2.	A process for the preparation of a fibrinolytic enzyme.	391961
3	'Fly ash based mosquito larvicidal formulations of Bacillus thuringiensis var. israelensis'	Bhutan Patent No. BT/PT/15/05
4	Biomarkers for Predicting Malaria Severity and Methods Thereof	Nigerian Patent No. F/P/2021/493
5	A novel molecular diagnostic technique for detecting the different species of plasmodium	Patent No. IDP000082545
6	Apparatus, Method and Kit for Detection of Von Willebrand Factor and Factor VIII	South Africa - National Phase Patent No.2021/07051

Table 4: Copyright Applications.		
S. No.	**Tile of invention**	**Copyright Application No.**
1	A Matlab based framework for automated sorting and consolidation of multivariate, multistep blood investigation data - Data Clearing Tool	15687/2022-CO/SW
2	A Python based framework for automated extraction of blood investigation data from patient reports in Portable document format - Data Extraction Tool	15688/2022-CO/SW
3	Computer Software titled: Stroke Mobilization Assessment & Rapid Treatment -TAEI-SMART	17655/2022-CO/SW

Table 5: Design Applications.		
S. N.	**Tile of invention**	**Design Application No.**
1	Humerus1_Ulna1-	362853-001
2	Humerus2_Ulna2-	362854-001
3	Humerus 3_Ulna 3-	362855-001
4	Device for Printing Lateral Flow Assay Strip	366562-001

CONTENTS

COMMUNICABLE DISEASES

Communicable and infectious diseases pose serious public health problems. ICMR research efforts in the area of communicable diseases were made by 15 institutes/ centres including Regional Medical Research Centres (RMRCs) and their field stations located in different parts of the country as well as by granting adhoc projects in extramural mode in universities/ medical colleges and other organizations. The research activities carried out by different ICMR Institutes affiliated with Communicable Diseases Division for the year 2022-23 are detailed in this chapter. Other work carried out by these institutes is also included here.

INTRAMURAL RESEARCH

ICMR-NATIONAL INSTITUTE OF VIROLOGY (ICMR-NIV), PUNE

- **MPOX INFECTION:**

❖ Development of sample collection and shipment guidelines was done and circulated to WHO SEAR countries.

❖ Training on Mpox diagnosis was provided to 35 VRDLs of which 15 laboratories were supplied with reagents for testing. Seven SEAR countries were also provided reagents for laboratory diagnosis of Mpox.

❖ Real-time PCR for the Mpox virus was standardized and validated.

❖ Testing of specimens from 341 referred cases was undertaken. Among them, 25 cases were found to be positive for Mpox - Kerala (n=10) and New Delhi (n=15).

❖ The first fatal case of Mpox was imported from UAE to Kerala, India in July 2022 and was detected with the A.2 lineage of clade IIb. Genome characterization of Mpox cases detected in India led to the identification of three sub-clusters among the A. 2 lineage.

❖ The Mpox DNA was detected in clinical samples from the 5th to 24th post-onset days (POD) in samples from the cases in Delhi. These Mpox cases without international travel history suggest the underdiagnosed Mpox infection in the community.

❖ A cost-effective colorimetric isothermal (LAMP) assay for rapid detection of Mpox virus. was developed. The assay can be applied in the field setting.

- **COVID-19 INFECTION:**

❖ Omicron sub-lineages BA.2.12, BA.2.75, BA.4, BA.5.2, BF.7, BQ.1.1 and recombinants of XBB.1 were successfully isolated, propagated and characterized using cell culture and animal model.

- Genomic analysis of 3091 SARS-CoV-2 sequences showed the predominance of the Omicron variant and its sub-lineages. The current surge showed the circulation of XBB lineage and its sub-lineage since January 2023.
- Immunogenicity and protective efficacy of inactivated SARS CoV-2 vaccine candidate in animal models showed that administration of COVAXIN® booster dose enhances the vaccine effectiveness against the Delta variant infection and gives protection against the BA.1.1 and BA.2 variants.
- Immune response after the precautionary third dose of COVISHIELD/COVAXIN was tested for S1RBD IgG by chemiluminescent microparticle immunoassay among healthy adults. The antibodies were detected in more than 96% of the samples.
- The anti-SARS-CoV-2 antibody avidity assay was optimized. The avidity responses were found similar in individuals with natural infection or vaccinated individuals with two doses of Covaxin or Covishield. The responses were high among individuals with a breakthrough infection as compared to the vaccinees.
- In-vitro studies showed that exposure to SARS CoV 2 spike glycoprotein alters the mitochondrial oxidation stress of endothelial cells. SARS CoV2 glycoprotein exposure of cultured vascular endothelial cells significantly reduced the cellular ACE levels.

- **NIPAH VIRUS:**

- A novel colorimetric LAMP assay has been developed for the detection of the Nipah virus. This would be useful as a point-of-care assay for the detection of the Nipah virus.

- **INFLUENZA AND OTHER RESPIRATORY VIRUSES:**

- ICMR-NIV screened 11405 referred clinical samples for SARS-CoV-2 and influenza, with positivity rates of 5.7% and 7.8%, respectively.
- Influenza was the most common cause (18%) of severe acute respiratory illness (SARI) cases (n=4921), followed by RSV (6.1%).
- Whole genome sequencing of circulating influenza strains was established and showed a similarity with the Southern Hemisphere vaccine component.
- A cohort study among 1082 elderly (age >=60 years), with a median follow-up of 49 weeks, in 2022, showed an incidence rate of 21.3 episodes of acute respiratory infections per 1000 elderly per week. Among 680 samples tested, 29 were positive for Influenza, 3 for RSV, 27 for SARS-CoV-2/ORV, and 14 for HMPV.
- A cohort study was conducted to understand the effectiveness of the Influenza vaccine (INFLUVAC TETRA 2022), in which 1397 pregnant women were enrolled including 667 in the vaccinated arm and 730 in the non-vaccinated arm. The inactivated vaccine was 85% effective in preventing influenza among vaccinated pregnant women as compared to non-vaccinated (relative risk = 0.15).

- **POLIO AND NON-POLIO ENTEROVIRUSES:**

- The phase II study on poliovirus infection in the immunodeficient patient has identified 2 immunodeficiencies related to vaccine-derived poliovirus (iVDPVs) cases, in patients of X-linked Hyper IgM syndrome and SCID respectively.

- ❖ Genetically diverse non-polio enteroviruses such as Rhinoviruses (RV-A, RVB-B, RV-C) and Echoviruses were detected in cases of both acute and severe acute respiratory infection during the COVID-19 pandemic period.
- ❖ All polioviruses isolated during AFP and environmental surveillance were Sabin-like poliovirus type 1 and type 3 and non-polio enteroviruses. Wild, vaccine-derived and type 2 polioviruses were not detected during this period in India.

- **MEASLES AND RUBELLA VIRUS:**

- ❖ A quarter of the 12598 serum samples tested were positive for measles and nearly 3% were positive for rubella. Only the D8 genotype of measles was detected.
- ❖ The cost-effectiveness of rubella vaccination among women in Maharashtra revealed that with rubella vaccination of women of age group 20-39 years, INR 39,01,601.00 can be saved per CRS case averted. The total QALY gained by the vaccination will be 1,44,374 and Incremental Cost-Effectiveness Ratio is -15,213.18 cost per QALY gained.

- **ZIKA:**

- ❖ ICMR-NIV confirmed the first human case of Zika virus infection in Karnataka detected at Raichur by VRDL, VIMS, Bellary; as well as a new case in Pune, Maharashtra. The subsequent testing of close contacts and pregnant women was negative.

- **DENGUE AND CHIKUNGUNYA:**

- ❖ As an apex referral laboratory for dengue, ICMR-NIV provided diagnostic support to Maharashtra, Bihar and Goa. The results reveal the predominant circulation of DENV-2 in these states.
- ❖ The in-vitro antiviral activity of different extracts/compounds/formulations against dengue virus type 2 and chikungunya virus was evaluated and it was found that five compounds (resveratrol, doxorubicin, lomibuvir, elvitegravir, and enalaprilat) had significant anti-DENV activity. In-silico assays revealed that these drugs can interact with a variety of protein targets of DENV. Lipophilic extracts of Ocimum basilicum (Tulsi) were also observed to exert anti-DENV activity.
- ❖ Carbonated zeolitic imidazolate frameworks (ZIF-C), a metalorganic framework biocomposite was utilized to deliver siRNAs targeted against chikungunya virus and it was shown to enhance the antiviral activity of CHIKV E2 and nsP1 genes directed siRNAs.
- ❖ Drug identification and repositioning for chikungunya (CHIK) acute patients using a computational multiple omics strategy revealed 65 repurposed drug compounds including drugs baicalin, enoxaparin, amlexanox, fluoropyrimidine, pemetrexed and balsalazide. Some of these are reported as showing in vitro anti-CHIKV activity and others need to be evaluated in-vitro.

- **RABIES:**

- ❖ ICMR-National Institute of Epidemiology coordinated a national survey to estimate the burden of human rabies and animal bites. Forty randomly selected clusters were surveyed in four districts - Nagpur, Nashik, Raigad, and Satara. Among 21455 people, 561 (2.6%) animal bite cases were reported, 302 of them in the last five years. Almost 88.7% were dog bites, followed by cat bites (9.6%).

- **IDENTIFICATION OF INSECT-SPECIFIC VIRUSES FROM AEDES MOSQUITOES:**

❖ Next-generation sequencing-based metagenomic analysis in field-collected Aedes aegypti mosquitoes from seven sites across India identified the most common viral species as Phasi-Charoen Like Virus [PCLV] and Cell Fusing Agent Virus [CFAV]. Other viruses belonging to Baculoviridae, Rhabdoviridae, Genomoviridae and Bunyaviridae families were identified. Insect-specific Phasi Charoen-like virus (PCLV) was isolated in the mosquito-derived cell line.

❖ A conventional polymerase chain reaction (PCR) for the detection of PCLV in mosquito samples was standardized.

- **ROTAVIRUSES AND ENTERIC VIRUSES:**

❖ A hospital-based study conducted in Pune City confirmed the predominance of rotavirus A (RVA) followed by norovirus, adenovirus and astrovirus among acute gastroenteritis patients.

❖ Asymptomatic infection with rotavirus C (RVC) was observed in pigs at two sites in India, with a detection rate of 20% suggesting continuous circulation in pigs.

- **HAND FOOT AND MOUTH DISEASE (HFMD):**

❖ ICMR-NIV and its field units provided diagnostic support for the confirmation of HFMD outbreaks in different parts of the country. The emergence of Coxsackievirus A6 (CVA6) was noted. The other viruses identified were Coxsackievirus A16 and Coxsackievirus A4. The phylogenetic analyses demonstrated that the strains CVA6 belong to group D.

- **HUMAN PAPILLOMAVIRUS:**

❖ The study confirmed high-risk HPV genotypes (16 and 18) in nearly 15% of 84 participants by Xpert® HPV system.

- **NON-VIRAL AGENTS:**

❖ **Pertussis:**

➢ Evaluation of 655 mother-newborn pairs from three sites in India for pertussis serology demonstrated maternal seropositivity for anti-pertussis toxin IgG in 6.3% (95% CI 4.7-8.4) and newborn seropositivity in 8.2% (95% CL 6.3-10.5) of the study participants. The data indicated poor maternal immunity resulting in high susceptibility of newborns to pertussis.

➢ Pertussis was confirmed in nearly 10% of suspected cases (33/354) among infants with a severe respiratory infection, across the four study sites. *Bordetella parapertussis* was confirmed in 3.3% of suspected cases.

❖ **Lyme disease:**

➢ Among 72 suspected cases of Lyme disease from Wayanad district, Kerala and Karnataka, 17 (22%) tested positive for Borrelia IgM or IgG antibodies.

- **VRDL NETWORK:**

❖ The VRDL External Quality Assurance (EQA) program for serological testing of Dengue, Japanese encephalitis, and Chikungunya by IgM ELISA was reassuring with an average concordance of 97.1% from 61 VRDLS. The WHO proficiency of 15 VRDLs for laboratory diagnosis of measles and rubella was also supported.

❖ Twenty-two VRDLs participated in quality control (QC) testing for serological diagnosis

of a panel of viruses, with an average concordance of 95.2% indicating that the VRDLs were maintaining a high standard of testing.

❖ One hundred and twenty staff from the VRDL network were trained for NGS application and bioinformatics analysis of the SARS CoV2 virus.

- **TRAINING ON MANAGEMENT OF INFECTIOUS DISEASE EMERGENCIES:**

Training on 'Management of Infectious Disease Emergencies' provided to NDRF, SDRF and Officers of the Tri-services (Army, Navy & Airforce) under the CBRN disaster management courses.

ICMR-NATIONAL INSTITUTE FOR RESEARCH IN TUBERCULOSIS (ICMR-NIRT), CHENNAI

- **TUBERCULOSIS TREATMENT:**

❖ The STREAM stage 2 clinical trial where ICMR-NIRT was the Nodal site in India contributed to the adoption of fully oral regimen of 9 Months in the National TB treatment guidelines. The ultra-short regimen of 6 months with two months injectable gave an efficacy above 80% even among rifampicin resistant study participants with pulmonary TB.

❖ Analysis of treatment outcomes in Isoniazid resistant pulmonary TB patients across India revealed that levofloxacin-based regimen offers a treatment success rate of 82%.

❖ Assessment of cost-effectiveness of Latent TB Infection Tests (LTBI) in India concluded that screening the household contacts of TB patients with the new C-Tb skin test can be cost saving for the TB Programme.

- **TUBERCULOSIS DIAGNOSIS:**

❖ A novel protocol that involves stringent decontamination and sedimentation process of stool was developed. This protocol improves the yield of *M. tuberculosis* in both phenotypic (smear and culture) and genotypic methods (Xpert ultra and LPA)

- **TUBERCULOSIS PREVENTION & CARE:**

❖ Retrospective data analysis revealed that BCG revaccination in a community offered modest protection (36%) against the development of TB disease at the end of 15 years.

❖ The team published a study on understanding TB disclosure patterns and have developed a new tool to measure TB disclosure.

❖ The institute alidated a measurement tool for patient-perceived quality of care for TB (PPQCTB) which measured the patient's satisfaction with reference to healthcare providers and health care services. This tool could support quality of care evaluation frameworks for TB health services in India.

❖ The study team developed a patient-centric interventions framework and module which is being used to implement patient-centric interventions under the TB program for in-patients to build treatment and life resilience.

❖ The institute developed a needs assessment form for the purpose of better implementation of Nikshay Mitra initiative.

❖ District wise prevalence of microbiologically confirmed pulmonary tuberculosis in Tamil Nadu among persons aged ≥15 years in Tamil Nadu was completed. The findings would help

the state of Tamil Nadu to plan and strategize interventions based on the prevalence estimates in different districts and would serve as a base line for assessing the progress towards ending TB in Tamil Nadu.

❖ An innovative approach by engaging students and women organizations to improve TB case detection and treatment adherence – a step towards TB elimination in Senaptai, District Manipur, was initiated.

❖ The institute developed innovative TB awareness material which includes TB IEC tickets and TB Puzzle game for school students.

- **SUPPORT TO NATIONAL PROGRAMMES :**

❖ NIRT Serves as the National Reference laboratory to National AIDS Control organization for HIV Viral load and HIV-TNA PCR testing.

❖ NIRT is successfully administering the only in-country PBMC EQAS programme.

❖ The institute provides technical support for the TB laboratory activities to five states and five Union territories in India for TB program activities. As part of Supranational National Reference Laboratory (SNRL), NIRT conducts External Quality Assurance (EQA) for culture and DST (Drug susceptibility testing) under the TB program. This is also extended to SEARO member countries namely Myanmar and Timor Leste.

❖ The team released the country's first 'Indian catalogue of Mycobacterium tuberculosis mutations and their association with drug resistance – 2022'

❖ The institute provided technical support for Maldives TB Elimination project

- **BIOREPOSITORY:**

❖ Biorepository of well characterised biological specimens including blood, sputum etc is being hosted by the institute.

- **MISCELLANEOUS:**

❖ A LAMP assay has been validated in cervical tissue samples that showed a sensitivity of 70% and specificity of 90% for detection of high-risk HPV infection in cervical cancer. This method is ready for commercialization.

ICMR-NATIONAL JALMA INSTITUTE FOR LEPROSY & OTHER MYCOBACTERIAL DISEASES (ICMR-NJIL & OMD), AGRA

- **Study of profile of deformity in new leprosy cases to analyze predictive risk factors in the development and progression of the disability:**

In new leprosy cases, neuropathy was diagnosed according to alterations in the neurological examination based on pain and neural thickening, sensory and/or motor deficit assessment and nerve conduction studies. These patients were followed up three monthly, serum antibodies to the *Mycobacterium leprae* phenolic glycolipid (PGL) & lipoarabinomannan (LAM) and against nerve components S-100 & ceramide were measured. Impaired amplitude in sensory and motor nerve conduction was seen in 48% cases before presence of nerve function impairment (NFI) and restored with clinical improvement. Among the nerves which were not found to be enlarged clinically but having impaired vibration, warm and cold impaired sensation as well as impaired sensory nerve conduction velocity (SNVC) and motor nerve conduction velocity (MNVC) parameters,

23% develop NFI during course of treatment in Ulnar (35%), Median (20%) and Radial (14%) nerves. Higher mean level of ND-O-HSA and S-100 antibodies (Fig.1) was observed in sera of leprosy cases with Grade1 deformity as compared to those with no nerve function impairment. Thus, impaired nerve conduction parameters in leprosy cases along with higher mean level of ND-O-HSA and S-100 antibodies may aid to predict cases with high risk for developing deformities.

- **An investigational study on mycobacteriophages and their enzymes as new drugs (IND) for treating tuberculosis:**

The emergence of antibiotic resistance in *Mycobacterium tuberculosis* has been the culprit behind the inefficient treatment of tuberculosis. Mycobacteriophages being rapid and specific in their activity against mycobacteria including *M.tuberculosis* are an emerging alternative solution to the antibiotic resistance problem. The data shows that D29 LysB targets both drug sensitive and drug resistant *M.tuberculosis* isolates, irrespective of its drug resistance status, and, importantly, is able to inhibit the growth of intracellular mycobacteria.

- **Investigation of T regulatory cell markers for their role in treatment monitoring of extrapulmonary tuberculosis:**

Although current treatment regimens are effective in eradicating the TB bacilli, proper treatment monitoring will prevent relapses and treatment failures. The markers CD4+CD25+ as well as CD4+CD25+FoxP3 were found to be promising for predicting early treatment response i.e. till intensive phase of TB therapy (2 months). The CD4+CD25+ subset showed an increase in levels after IP while CD4+CD25+FoxP3 showed a decline in levels after IP. The number of CD4+CD25+ cells may be useful for predicting treatment success as they showed significant increase at the end of CP (in eCP) when compared to BT group. Thus, the results from this study showed that CD4+CD25+, CD4+CD25+FoxP3 are useful for early extrapulmonary TB monitoring and treatment success.

ICMR-NATIONAL INSTITUTE OF CHOLERA AND ENTERIC DISEASES (ICMR-NICED), KOLKATA

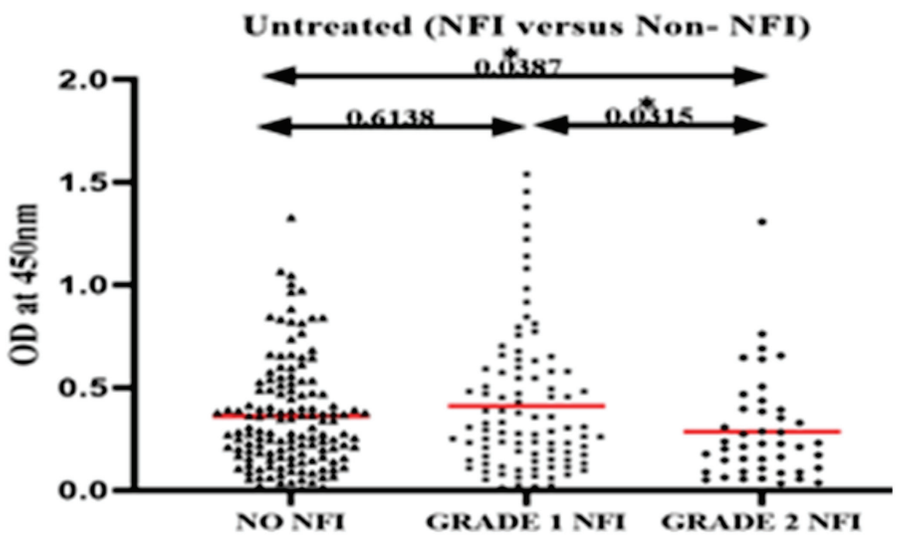


Fig. 1: Antibodies against S-100 in leprosy patients along with nerve function impairment.

- **Anti-rotaviral potential of Ivermectin and Importin:** Viruses rely on host cellular machinery for nearly every step of the replication cycle. Therefore, targeting host factors that are indispensable for virus replication could be a promising strategy to discover new drugs. The study found that Importazole and Ivermectin hinder replication of various rotavirus strains both *in vitro* and *in vivo* by inhibiting cellular nuclear import system, suggesting strong therapeutic potential for treating Rotaviral diarrhea.
- **Identification of novel Anti-Parasitic Compound from Natural Medicinal source and their effect on *Giardia lamblia***: It was found that the plant Andrographis paniculate extract may cause a change in *Giardia* morphology through multiple mechanisms including the effect on *Giardia* motility, oxidative stress, and altering the gene expression.
- The study team found that Arabinose, a non-toxic sugar, when supplemented in the growth medium caused complete growth inhibition in vitro of *V. cholerae* O1 and O139 strains under certain cultural conditions.
- Subtilisin, which was used in detergent industry for a long time, was shown to have cancer-killing properties.
- The institute published State of the Art Report and Policy Brief on Environmental Dimension of AMR in India
- HCV drug resistance-associated amino acid substitutions within the local circulating HCV isolates have been identified that will help in better therapeutic management of HCV to achieve the HCV elimination goal by 2030
- An array of apolipoproteins, cytokines and endothelial proteins differentially expressed in dengue disease progression have been identified using the proteomics approach
- Demonstration of in vivo pathogenicity of L-form S. Typhi suggests that their generation following the initiation of treatment with antibiotics could lead to drug escape of *S.* Typhi and cell to cell (macrophages) spread of the bacteria, which sustain the infection
- A cost-effective multiplex Real time PCR assay was designed for detection of GARV, HAdV-F, NoV GI, NoV GII and RNaseP. In-house and third-party validation in two laboratories revealed >96% sensitivity and 100% specificity. The kit is in process of technology transfer.
- Gold nanoparticle-aptamer complex has been developed that will specifically bind with HCV core antigen to develop a cost-effective and rapid HCV detection in blood that will be suitable for use in resource-limited settings
- There was development of a multivalent, highly immunogenic candidate glycoconjugate vaccine with protective efficacy against *S.* Typhi, S. Paratyphi and NTS (*S.* Typhimurium and S. Enetritidis)
- Crucial information on the incidence rate of *Paragonimus* spp. was provided in crab-eating communities in West Bengal to aid in better diagnosis and management of the disease in the region
- The potential effect of glycyrrhizin in reducing infection and associated gastric damages has been validated in both *in vitro* and *in vivo* models

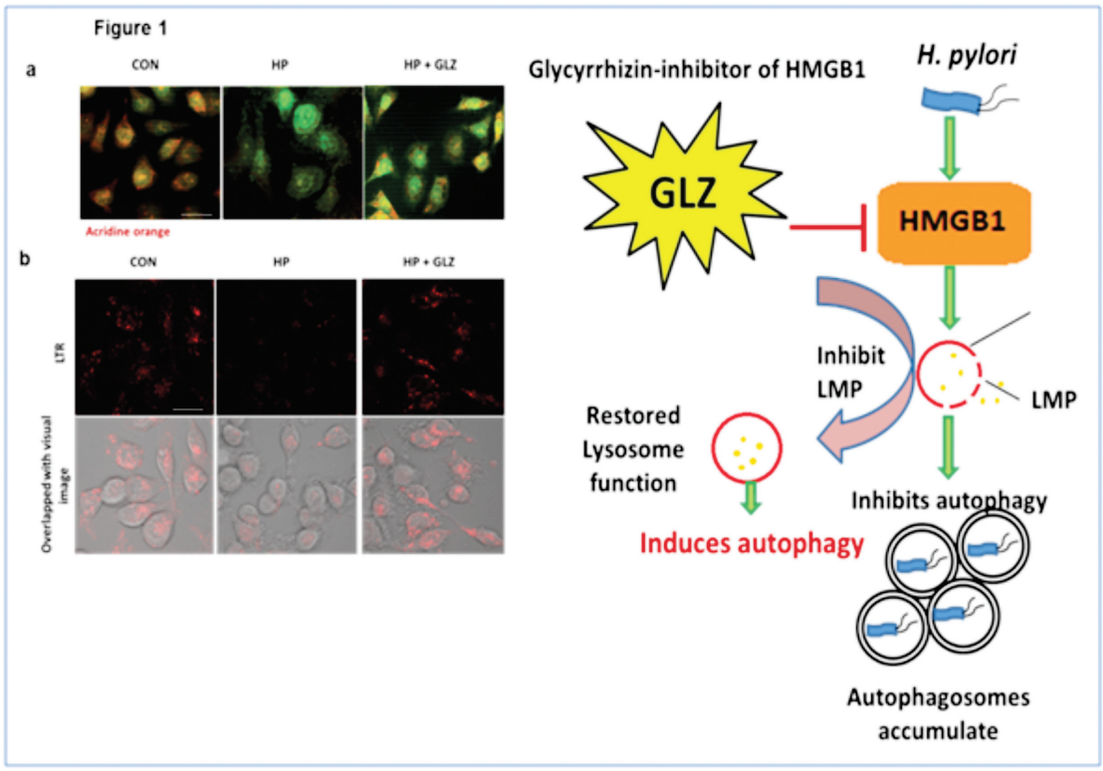


Fig. 2: Lysosomal function is restored by glycyrrhizin by inhibiting HMGB1.

ICMR-NATIONAL INSTITUTE OF MALARIA RESEARCH (ICMR-NIMR), NEW DELHI

- **National Malaria Slide Bank**: The study team aims to establish a Malaria Slide Bank at national level to impart trainings and assessments for malaria microscopist at regular intervals and quality assurance. (Fig. 3). NIMR has prepared around 25000 slides till date, supported training of malaria microscopists for detection and identification and counting of parasites and shared slide panels to state hospitals and Bhutan Government.

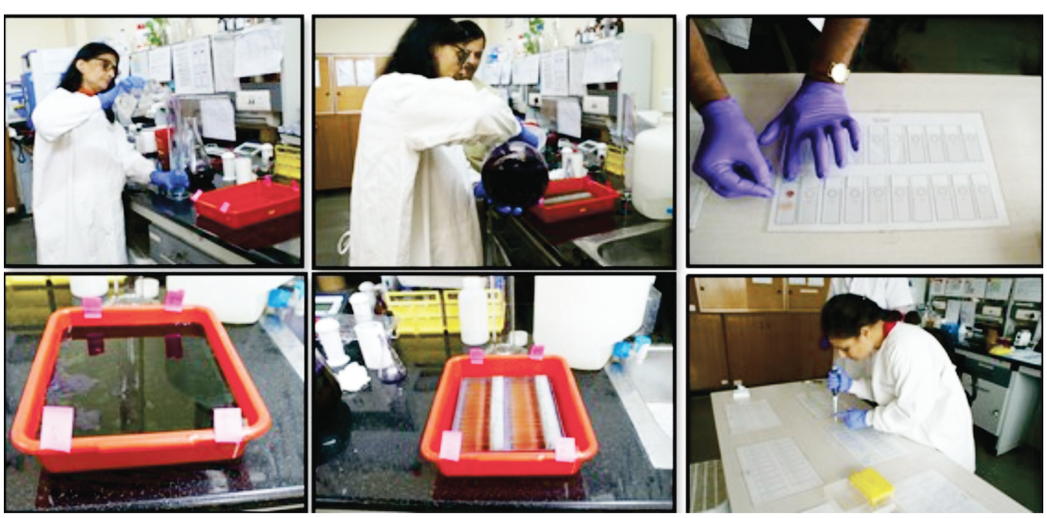


Fig. 3: Blood smear preparations and mass staining of smears at NIMR, Delhi.

- **Quality Assurance of Malaria Rapid Diagnostic Tests:** This laboratory is recognized by WHO to assess the quality of malaria RDTs procured and supplied by NVBDCP in India. *P. vivax* and *P. falciparum* panels were prepared from the samples collected from malaria endemic regions of India. Panels were validated by at least two reference kits, before testing the RDTs every time. The post-dispatch RDTs received from the field were also tested for their quality. This is the only lab of its kind in South East Asia, that performs RDTs lot testing to ensure distribution of quality diagnostics under programme.
- **Establishing a pan-India landscape of human Plasmodium infections from dried blood spots collected under National Family Health Survey, NFHS-5:** DNA was isolated from 22751 samples (29% of the total). To date, total 5578 samples (7% of total) have been diagnosed by qPCR and out of them 1650 (30%) were found to be positive for *Plasmodium* genus.
- **Insecticide susceptibility status of malaria vector *Anopheles fluviatilis*:** On request of State NCVBDC (National Centre for Vector Borne Disease Control), insecticide susceptibility status was tested for DDT (4%), Deltacypermthrin (0.08%), Cyfluthrin (0.15%) and Malathion (5%) on wild-caught malaria vector Anopheles *fluviatilis*. The result suggests the vector showed insecticide resistance against DDT (4%) with a 35% mortality rate.
- The study team identified cyclic constrained peptides from different proteins of the *P. falciparum*, which can be developed as novel diagnostic tools for malaria.
- There was establishment of long-term gametocyte culture and mosquito infection facility for screening of transmission blocking drugs/ vaccine for *P. falciparum*.
- The team screened about 100 marine derived extracts/compounds for discovery of antimalarial drugs. Leads were generated with activities in micromolar concentrations. Further characterization of potential extracts is underway. Also developed novel single-step multiplex qPCR assay for detection of nonhuman malaria parasites *Plasmodium knowlesi* and *P. cynomolgi*.
- Phase-III Trials showed GR and DT formulation is potent larvicide for the control of *Anopheles* and *Aedes* vectors.
- NIMR, Field Unit Raipur is working with Chhattisgarh Health department in various aspects like awareness programme and trainings toward malaria elimination goal.
- At the request of NDMC (New Delhi Municipal Corporation), NIMR conducted an extensive survey in months of June and July for finding key mosquitogenic spots for effective long-term control. After a survey of 29 localities surveyed, including Rashtrpati Bhawan, PMO, Parliament, Hospitals like AIIMS, Safdarjung, and residential areas, a report was submitted with suggestions for long-term control of the mosquito problem in the region.
- There was development and designing of improved lid of underground tanks where An. stephensi used to breed (20-40%). This action prevented An. stephensi from breeding in western Rajasthan.
- NIMR team developed and validated discriminatory concentrations of nine insecticides with bottle bioassay and 2 insecticides with filter paper test against Aedes aegypti (first time) and An. stephensi mosquitoes, which are currently in use or

under evaluation for various vector control applications (IRS, LLIN, space spray, household products, etc). This information is key to establish the baseline susceptibility of vector populations to the new insecticides and to detect any change in phenotypic resistance after their deployment. It will help the national programme in monitoring of insecticide susceptibility of mosquito vectors of public health importance. Results included in report published by WHO in March 2022.

ICMR-VECTOR CONTROL RESEARCH CENTRE (ICMR-VCRC), PUDUCHERRY

- The Hon'ble Union Minister of Health and Family Welfare, Dr Mansukh Mandaviya laid the foundation stone (25th June 2022) for **"International Centre of Excellence for Training in Medical Entomology (ICETIME)"** in the premises of ICMR-VCRC, Puducherry. Her Excellency, the Lt. Governor and the Hon'ble Chief Minister, Members of Parliament and Legislative Assembly, Puducherry also participated in the function.

- **Genetic structure of *Aedes aegypti* in India:** As many as 625 *Ae. aegypti* mosquitoes, collected from 22 locations from northern, southern, eastern, western and central parts of India (Fig. 4), were genotyped using microsatellite markers. The mosquito populations across India are largely genetically closer to each other irrespective of geographical distance between them which indicates high gene flow among the populations. However, signs of genetic structure were also observed owing to the factors associated with geographical locations. Particularly, temperature and latitude showed significant impact on the genetic patterns.

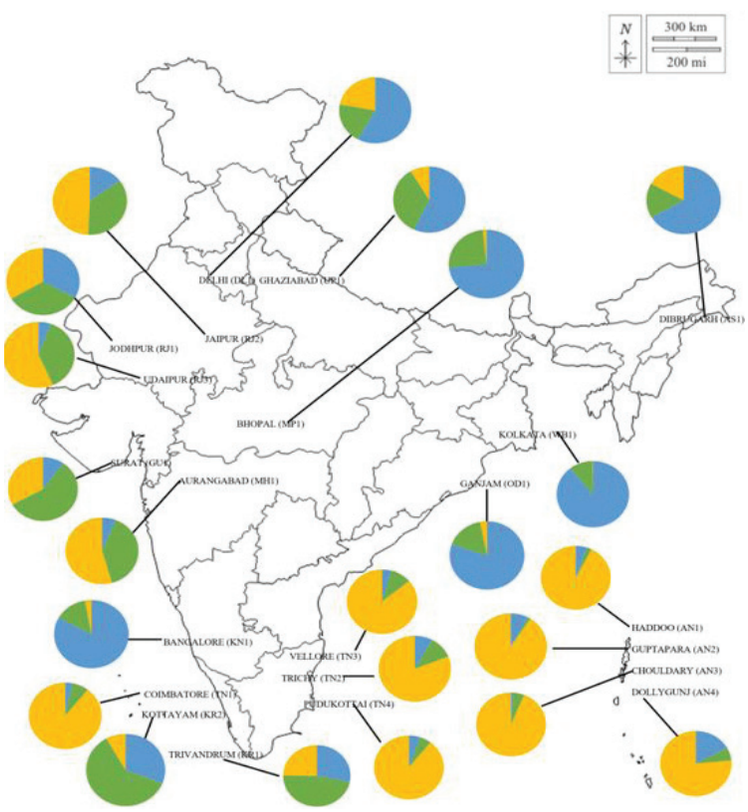


Fig. 4: Genetic structure of Aedes aegypti in India across different climatic zones; Map of sampling sites where Aedes aegypti mosquitoes were collected in India. Pie charts showing the proportion of genetic ancestry assigned to individuals of each population.

- ICMR-VCRC took a lead role in establishing a National Public Health Entomology (NPHE) Programme and facilitated in replicating the M.Sc. PHE course in other ICMR institutes, where vectors and vector borne disease research is undertaken. Accordingly, ICMR-RMRCGKP, Gorakhpur; ICMR-RMRIMS, Patna; ICMR-RMRCNE, Dibrugarh and ICMR- NIRTH, Jabalpur have been identified as Regional Campuses to conduct M.Sc., PHE course. Pondicherry Central University has provided Provisional Affiliation.
- The study team got certification of GLP compliance by the National GLP Compliance Monitoring Authority (NGCMA) for Phase II evaluation of LLINs in experimental huts.
- The institute has synthesized 10 molecules, purified by column chromatography and characterized the chemical structures by FTIR, ^{1}HNMR and MS spectral analysis as part of drug design and synthesis and evaluation of select repurposed drugs against SARS-CoV-2.
- A molecular algorithm to diagnose vector borne diseases among acute undifferentiated febrile illness has been developed and is under in-house validation.
- Epidemiological and entomological evaluation of three rounds of mass drug administration (MDA) with triple drugs showed continuing transmission and with given uncertainty in coverage estimates and spatial heterogeneity, more rounds of MDA are required to achieve elimination target of lymphatic filariasis.
- Long term follow-up of cohort of individuals, with or without filarial infection showed clearance of about 80% of patent infection, but recruitment of new infection in the area under MDA indicates continued transmission.
- New format of Brugia rapid kits has been evaluated to be inferior compared to the old format and hence, not suitable to evaluate the impact of MDA in Brugia endemic areas in India.
- *Staphylococci*, *Pseudomonas* and *Proteus* are common microbial organisms detected from the skin of filarial lymphoedema patients, causing acute episodes of lymphangitis and many cases were detected with polymicrobial infections.
- Entomological assessment of malaria elimination programme in Odisha State showed interruption of transmission. However, both the malaria vectors viz., *An. fluviatilis* and *An. culicifacies* exhibited shift in their resting and biting activities due to control pressure and has implications on the vector management strategies.
- Zymodeme MON-37 of *L. donovani* is found involved in both cutaneous (CL) and visceral leishmaniasis (VL) manifestations in the Western Ghats region of India, while MON-2 zymodeme is established to be causing VL in the Eastern endemic zone of India. Two sibling species of *P. argentipes,* belonging to *morphospecies A & B* were detected.
- A spatiotemporal model was developed for forecasting visceral leishmaniasis and has been validated for block-level predictions and long-term forecasts of VL incidence. This model can be used to monitor progress of VL elimination and identify the risk of resurgence in post-elimination settings.
- Plant lectins which specifically bind to mannose showed high specificity towards the dengue NS1 antigen.
- One natural compound VCRC-NP-1 has been identified as a promising dengue virus

inhibitor that blocks the functioning of NS2B/NS3 protease through molecular docking and dynamics simulation studies.

- Four unique nonsynonymous mutations viz., "I22T" & "I160M" (pre-Membrane) and "D348N" & "V473L" (Envelope) have been detected from ZIKV isolates from Thiruvananthapuram, Kerala.
- Through a hospital based study, metagenomic based NextGen Sequencing (Illumina) Technology to Identify aetiology of Acute Encephalitis Syndrome (AES) technology has been developed.
- IPD-Mol-21 is demonstrated to be an effective drug for control of blood-feeding JE vector mosquitoes if applied to livestock population as endectocide. This drug is also found to be effective in killing *P. argentipes* adults when fed on treated sucrose solution.
- Two artificial diets have been developed as a substitute for blood meal for mosquitoes.
- The institute developed a microprocessor-based mosquito feeding device for rearing and maintaining mosquito colonies.
- Circulation of multiple antigenic types of *Orientia tsutsugamushi* in human cases of scrub typhus in Theni District Tamil Nadu has been detected.
- Wastewater (environmental) sampling surveillance strategy has been developed for STH (soil transmitted helminths) and demonstrated to be a potential evaluation tool for National Deworming Day programme. Control of *Trichuris*, the less susceptible parasite to MDA with albendazole, detected in more samples, is a challenge to NDD programme.

Fig. 5: The Hon'ble Union Minister of Health and Family Welfare, Dr Mansukh Mandaviya has laid the foundation stone (25th June 2022) for **"**International Centre of Excellence for Training in Medical Entomology (ICETIME)" in the premises of ICMR-VCRC, Puducherry. Her Excellency, the Lt. Governor and the Hon'ble Chief Minister, Members of Parliament and Legislative Assembly, Puducherry also participated in the function.

Fig. 6: Interactive session of Hon'ble Union Minister of Health and Family Welfare with the Scientists of ICMR-VCRC.

Fig.7: Inauguration of the second international Conference of Society of Vector Ecology by the Hon'ble Lt. Governor, Puducherry -13-16 March 2023.

ICMR-NATIONAL AIDS RESEARCH INSTITUTE (ICMR-NARI), PUNE

- HIV Drug Resistance laboratory has been identified as the first national laboratory having WHO certification for DBS based in house assay for Integrase resistance testing.
- There was redesignation of the institute as WHO Collaborating Centre for HIV Diagnosis and Monitoring of Antiretroviral (WHO CC IND 92)
- There was identification of new molecules for inhibiting HIV infection in the preclinical studies: (a) natural compounds- the combination of 3 marine natural compounds: Phycocyanin (C-PC), B-Phycoerythrin (B-PE), Allophycocyanin (APC); and (b) formulations of different ayurvedic phytomolecules as drug combinations in metal-based nano-compositions of *Tinospora cordifolia, Asparagus racemosus, and Withania somnifera*, as potential agents/ candidates against HIV-1 infection.
- Genetic studies revealed individuals with various genotypes such as ApoB 12669 GA, MTP -493TT and down-regulated APOM and APOA5 genes had an increased the risk for development of dyslipidemia.
- There was identification of genetic variants- Individuals with *ABCA*1051 AA genotype and those with *CYP2C*82AT genotype were associated with increased risk for development of TDF- related renal dysfunction.
- The study team identified the role of miRNA-155 in the impaired innate immune responses during progressive HIV disease. Exogenous stimulation of TLR signaling improved the overall anti-viral innate response in the progressors.
- Identification of anti HSV-2 candidate: Combination of 5 cellular miRNAs have been identified to attenuate the Herpes Simplex virus (HSV)-2 infection.
- Based on Air borne infection control (AIC) study findings, recommendations have been given to National AIDS Control Programme (NACP) for initiation of TB screening among health care workers (HCWs) at HIV care settings. These recommendations will support the NACP for improvement of AIC measures at HIV care settings in India.
- India Hypertension Control Initiative programme was initiated in 2018 in 4 districts. However, after witnessing the success of this hypertension intervention within the existing primary healthcare system under the National Health Mission (NHM), Maharashtra State expanded its implementation to 13 districts and 12 Corporations. The state also streamlined the drug supply so that the drugs were supplied for at least 30 days. Maharashtra has shown great progress in decentralising the program from 72% at hospital to 45.2% at PHC/HWC. BP control rate at HWC is around 60%.
- The institute contributed to development of guidelines for STI surveillance
- The institute contributed to guidelines for elimination of vertical transmission of HIV and syphilis (EVTHS)

ICMR-NATIONAL INSTITUTE OF RESEARCH IN TRIBAL HEALTH (ICMR- NIRTH), JABALPUR

- **A Pilot Demonstration Project for Reduction of Tuberculosis in Saharia Tribe:**In order to

demonstrate reduction in tuberculosis (TB) in Saharia dominated district (Sheopur) of Madhya Pradesh using innovative operational strategies, and to establish mechanisms and processes for enhanced testing and treatment of tuberculosis cases, this research project was undertaken. Panchayats sarpanch and secretaries, health and wellness centres, ASHA and ANMs were involved for finding the presumptive TB cases. Screening camps were organized daily in each block. Screening was performed through hand held X-Ray device in symptomatic individuals. Confirmation of tuberculosis was performed by Truenat. All identified patients were referred to DTC for initiation of treatment. All the patients' contacts were also screened for tuberculosis. TB preventive therapies (TPT) were given to all negative contacts as per standard NTEP guidelines. Further, several camps for awareness generation on drug adherence and preventive aspects of TB were conducted. In total, 826 camps were organized in all the three blocks covering 625 villages of Sheopur during the reported period. During the camp, total 14,760 presumptive TB cases were screened, in which total 11,054 X-ray and 6,461 sputum (on spot and morning sample) were taken for diagnosis. Of this, 663 patients were microbiologically confirmed MTB. X-Ray for TB was positive in 163 cases and 26 were extra-pulmonary. Treatment was started for all the 663 patients and contact screening activities were organized for 1955 contacts. TPT was started for 1189 contacts. A total of 826 TB positive individuals were detected. Ready-to-eat therapeutic food pouches (RUTF) were given to 800 patients who were under BMI 18.5 kg/m^2. This first-of-kind intervention study using modern techniques in field setting (hand-held X-ray, molecular diagnosis, *etc.*), was taken up in a highly endemic district of Madhya Pradesh, where Saharia tribal populations live, could successfully be replicated. Similar model is now being planned to be replicated in other Saharia-dominated districts of Madhya Pradesh, Uttar Pradesh and Rajasthan.

- **Molecular Characterization of *Orientia tsutsugamushi* in Central India:** This study was conducted to unearth sero-epidemiological Information of scrub typhus and molecular characterization of the causative organism (*Orientia tsutsugamushi*) by genomic investigations in central India. Over 3,000 samples were serologically tested and about 13% positivity rate was observed. For molecular detection as well as for identification of genotype/strain of *O. tsutsugamushi,* DNA isolated from patient blood samples were subjected to PCR, followed by Sanger sequencing. Sequencing data were analyzed using Codoncode Aligner computer program. Molecular genotyping analysis showed that the 'Karp' genotype of *O. tsutsugamushi* is the major circulating genotype in the Central Indian region. In addition to this, study team had performed comparative genomics of *O. tsutsugamushi* strains using DNA sequences available in public domain and found certain genomic regions in the presently analyzed samples to be present in multiple copies (ranging in 20-150 copies).
- **Metabolic Syndrome among three PVTGs of Central India:** This cross-sectional study was a community-based survey of adults of Baiga, Bharia and Saharia PVTGs from rural areas of seven districts (selected districts were: Dindori, GPM district and Anuppur for Baiga population, Shivpuri, Morena and Gwalior districts for Saharia and Chhindwara

for Bharia PVTG population) of Central India. A total of 5,670 samples were collected; data analyses from Dndori district revealed substantial number of participants with hypertension (31.6%), diabetic (8.3) and with metabolic syndrome (7.8) in the Baiga tribe.

- On the occasion of World Sickle cell day, 19 June 2022, ICMR-NIRTH organized a workshop on "Holistic Management of Sickle Cell Disease (SCD)" in collaboration with the National Health Mission, Bhopal. On this occasion, the Honorable Union Minister of Health and Family Welfare, Dr. Mansukh Mandaviya, Honorable Governor of Madhya Pradesh, Shri Mangubhai Patel, Honorable Chief Minister of Madhya Pradesh, Shri Shivraj Singh Chouhan, Minister of Public Health and Family Welfare, Madhya Pradesh, Dr Prabhuram Choudhary graced the audience. On this occasion, a MOU was singed between NHM, Bhopal and ICMR-NIRTH for the establishment of a centre of excellence in SCD at ICMR-NIRTH. Around 800 delegates participated in the event.
- ICMR-NIRTH, Jabalpur had organized two-day symposium on "Sickle Cell Disease in India" in the campus of ICMR-NIREH, Bhopal on 22 and 23 February 2023. The Honorable Governor of Madhya Pradesh, His Excellency, Shri Mangubhai Patel, Honorable Union Minister of Tribal Affairs, Shri Arjun Munda, Minister of Public Health and Family Welfare, Government of Madhya Pradesh, Dr Prabhuram Choudhary graced the occasion. The Principal Secretary to the Governor, Madhya Pradesh, Additional Secretary, Ministry of Tribal Affair, New Delhi, Health Advisor, Ministry of Tribal Affair, New Delhi, Additional Chief Secretary, Ministry of Health and Family Welfare, Madhya Pradesh, Mission Director, NHM, Bhopal, and other state dignitaries of Madhya Pradesh were also present. Dr Graham Roger Serjeant, a world-renowned scientist on SCD from Jamaica was the guest of honour.

Fig. 8: The Honorable Union Minister of Health and Family Welfare, Dr. Mansukh Mandaviya, Honorable Governor of Madhya Pradesh, Shri Mangubhai Patel, Honorable Chief Minister of Madhya Pradesh, Shri Shivraj Singh Chouhan, Minister of Public Health and Family Welfare, Madhya Pradesh, Dr Prabhuram Choudhary graced the occasion of World Sickle cell day, 19 June 2022.

Fig. 9: The Honorable Governor of Madhya Pradesh, His Excellency, Shri Mangubhai Patel, Honorable Union Minister of Tribal Affairs, Shri Arjun Munda, Minister of Public Health and Family Welfare, Government of Madhya Pradesh, Dr Prabhuram Choudhary graced the occasion of two-day symposium on "Sickle Cell Disease in India".

- ICMR-NIRTH is involved in formulation of national guidelines for the elimination of SCD.

ICMR- RAJENDRA MEMORIAL RESEARCH INSTITUTE OF MEDICAL SCIENCES (RMRIMS), PATNA

- **Assessment of epidemiological, clinical, social and quality of life among VL-HIV co-morbid cases in highest kala-azar endemic state of India - A descriptive cross-sectional study:**

Under this descriptive cross-sectional study, 222 VL-HIV co-infected cases of Bihar were visited.

These cases were from 216 villages across 136 PHCs of 20 districts. Out of 222, 128 patients/ their legal representatives (in case of child or death case) were interviewed at their door level. Out of 128 VL-HIV cases, 47 (21%) were found dead. The median age of death individuals was 43 years with 95% CI as (28-55) years, hence deaths occurred significantly (63%) in the young working population. A highly statistically significant difference ($P<0.0001$; 95% CI) was observed between death individual stopping their ART and taking regular ART.

The other major findings observed were: heterosexual behaviour (88%) as the most common predisposing factor, most of them were from low socio-economic group, fever duration 4-365 days (mean ± SD; 62 ± 60.62 days), treatment for VL with AmBisome (79%) with 99% cure rate. Treatment outcome of HIV was also found very promising as 94% survived with ART.

Effect of the disease and post-treatment improvement in quality life, assessed using WHOQOL-BREF score, revealed mean score ≥60% for physical, psychological and social health, whereas <60% score for environmental health. About 57.8% responded as good for general quality of life.

- **Combining cyclodextrin nanoparticle with IL-10 antagonist peptide and Amphotericin B to enhance chemotherapeutic efficacy and antileishmanial immunity:**

Conventional antileishmanial drugs have many limitations and the emergence of drug-resistant *Leishmania donovani* has posed a major therapeutic challenge against the parasite.

In the present study, a nano-formulation of CD-AmB-Anti IL-10 peptide has already been synthesized, characterized and evaluated for its leishmanicidal efficacy through *in*-vitro experiments. During the period, *in-vivo* experiments on female Balb/c mice were carried out to confirm the leishmanicidal effect of this nano-formulation (Fig.10). It was found that the synthesized nano-formulation clears the intracellular amastigote more efficiently than Amphotericin B. Histopathology analysis also indicated more effective parasite clearance and reduced toxicity as compared to AmB treated group (Fig. 11). It was observed that the synthesized nano-formulation complex promotes the M1 phenotype to clear leishmania infection. This immunotherapeutic option (immune-modulatory anti-IL-10 peptide along with Amphotericin B) may be potentially effective in treatment of visceral leishmaniasis with reduced dose and side effects of Amphotericin B.

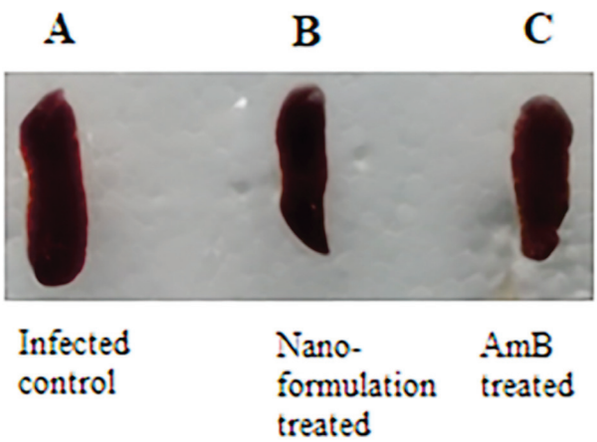


Fig. 10: Spleen image of BALB/c mice of different sub-groups: (A) L. donovani infected group, (B) CD-AmB-Peptide or Nanofromulation treated group, and (C) AmB treated.

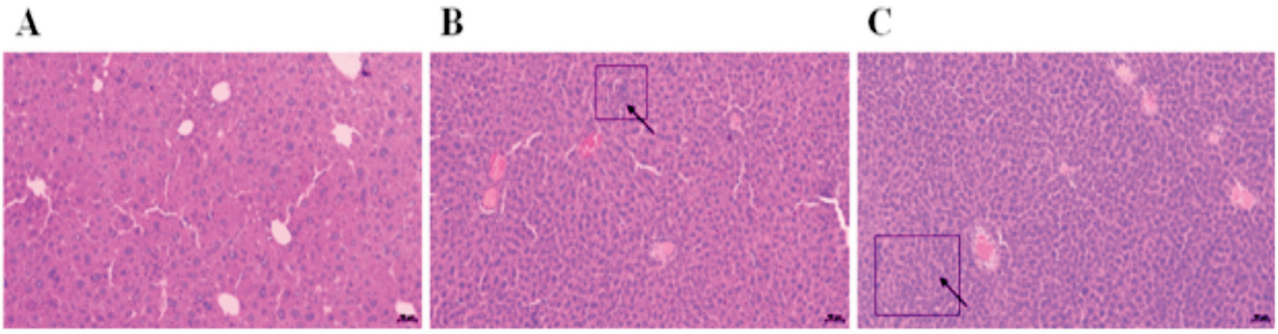


Fig. 11: Liver section of BALB/c mice of different sub-groups: (A) L. donovani infected group, (B) CD-AmB-Peptide or Nanofromulation treated group, and (C) AmB treated.

- **Virus Research and Diagnostic Laboratory (VRDL):** During the period, more than 18,000 blood, serum, throat swab, CSF and stool samples were collected from various Govt./ private hospitals including RMRI OPD for diagnosis of various. A total of 2353 samples (13.21%) were found positive for one or other types of viruses. None of the samples was found positive for Zika virus during this year.

  About 1.57% of throat samples received from different parts of Bihar were found positive for Influenza A through RT-PCR; of which H1N1 was one of the major etiological agents. Testing for Hepatitis revealed that positivity of Hepatitis B virus (HBV), Hepatitis C virus (HCV), Hepatitis E virus (HEV) and Hepatitis A virus (HAV) were 29.64%, 6.14%, 9.74% and 9.77% respectively.

  VRDL continued its diagnostic support to the State Health Dept., Bihar for diagnosis of dengue and other viral diseases. DEN2 was observed as predominant serotype in Bihar region. With regards to AES, about 17.95% were found positive for scrub typhus (*Orientia tsutsugamushi*) whereas only 3.09% were positive for JEV. Further, under rotavirus study total 316 stool samples were collected from children (<5 years of age) suffering from diarrhea of Patna, of which highest positivity was found for astrovirus (6.32%), followed by rotavirus (5.69%), adenovirus (4.11%), and enterovirus (1.89%).

- Insufficient confirmatory diagnostic facility observed at grass root level for PKDL; only 5% of the cases were diagnosed at district hospital level.
- New treatment guidelines (combination therapy of AmBisome and Miltefosine) for VL-HIV co-infected cases was endorsed by WHO and implemented in program through NCVBDC, Govt. of India.
- Discriminating concentrations of insecticides was determined through a multi-centric lab. based study in collaboration of WHO for monitoring resistance in sandlfies.
- A toolkit for VL surveillance was developed in collaboration with SPEAK India.
- The institute is designated as WHO Collaborating Centre for Leishmaniasis.
- Training module on VL, PKDL and VL-HIV co-infection was developed under DNDi sponsored Centre of Excellence program.
- Apart from various service components viz. ICTC, ART plus, OST, MDR/XDR diagnostic facility, VRDL (Medical college level), ICMR-

RMRIMS, Patna is the designated centre for viral load testing and treatment for Hepatitis B & C for different districts of Bihar.

ICMR - NATIONAL INSTITUTE OF EPIDEMIOLOGY(ICMR-NIE), CHENNAI

- **ICMR third dose COVID-19 vaccine cohort study:**

In India, more than 95 million people have received at least one dose and 75 million have received two doses of either *Covishield* and *Covaxin* vaccines. In addition to these two doses, the Government of India recommended an additional third dose called 'precautionary dose'. Limited studies from India have documented the dynamics of immune response to the third dose of *Covishield* / *Covaxin* vaccines among homologous/heterologous regimen recipients. Therefore, ICMR established a cohort of people receiving additional third dose to characterize the humoral and cellular immune response in 23 ICMR institutes. The results up to sixth-month follow-up showed that *IgG* antibodies against *S1-RBD* were persistently elevated six months after the precautionary dose of the COVID-19 vaccine (Fig, 12). It has been planned to extend the follow-up of the cohort up to 2 years from the receipt of precationary dose.

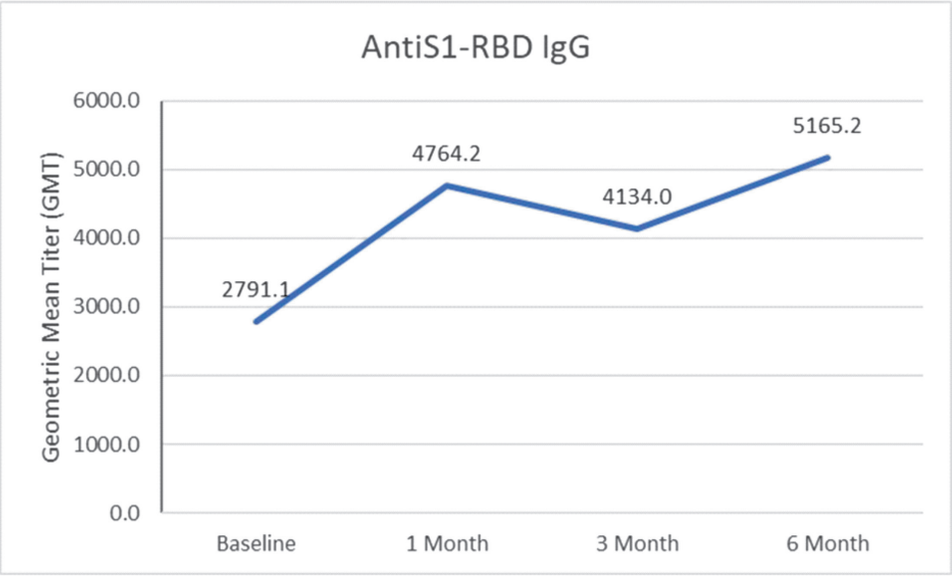


Fig. 12: *IgG* antibodies against *S1-RBD* six months after the precautionary dose of the COVID-19 vaccines.

- **India's first statewide differentiated TB care model aimed at reducing TB deaths:** In 2020-21, due to COVID-19 pandemic, there was an increase in estimated TB deaths in India. Starting April 2022, Tamil Nadu (all NTEP districts except Chennai) prioritized all patients with very severe undernutrition, respiratory insufficiency or poor performance status for referral, comprehensive assessment, and inpatient care immediately after TB diagnosis (Fig,13). ICMR-National Institute of Epidemiology (ICMR-NIE) and Tamil Nadu State TB cell jointly led this health system initiative called as Tamil Nadu *Kasanoi Erappila Thittam* (TN-KET – means TB death-free project in Tamil). This is supported by National Health Mission Tamil Nadu, three key Directorates under Health & FW Department (Govt of Tamil Nadu), ICMR-National Institute for Research in Tuberculosis and WHO India.

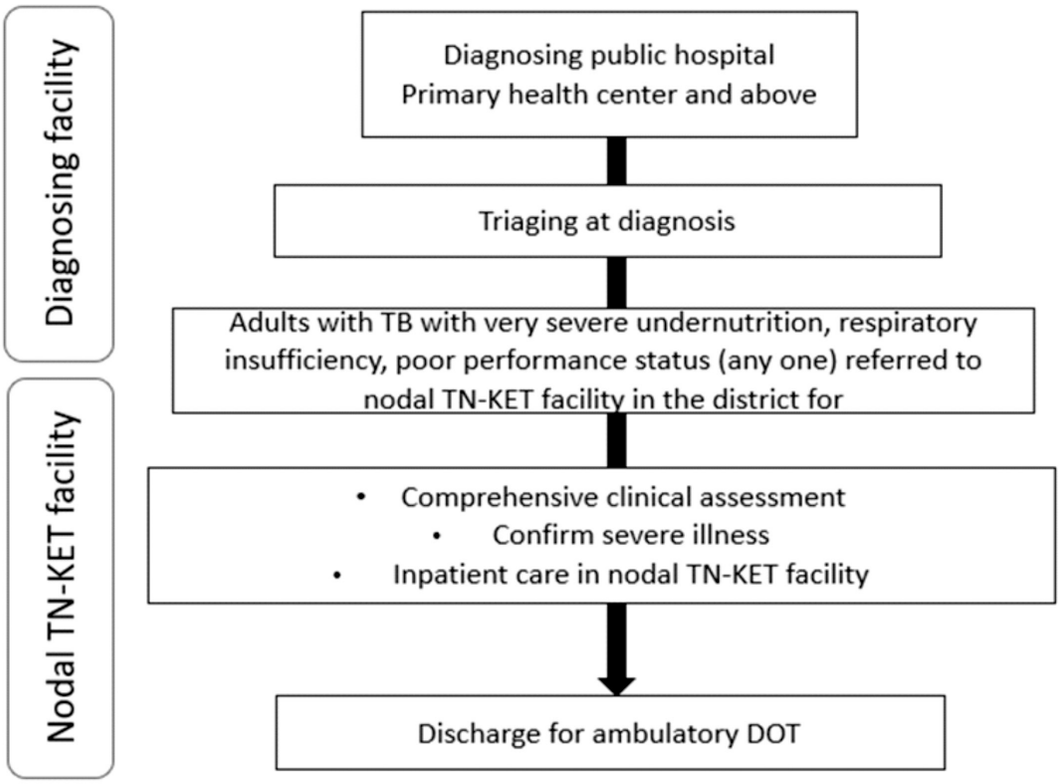


Fig.13: TN-KET care cascade.

Between April and December 2022, of 42 616 adults with TB diagnosed from public facilities, 39 708 (93%) were triaged and 4664 (11%) were eligible for referral. Of 4664 eligible, 3291 (71%) were referred, comprehensively assessed and confirmed as severely ill at nodal inpatient facilities (improved to 88% in December 2022). Of 3291 confirmed, 3102 (94%) were admitted for inpatient care. The median time from diagnosis to admission was one day and from admission to discharge was five days (increased to six days in December 2022). The absolute number of quarterly TB deaths, early TB deaths and home TB deaths showed a declining trend. It is proposed to further improve the quality and duration of inpatient care, especially therapeutic management of very severe undernutrition - applicable to half of admitted patients. The impact on TB deaths is being confirmed through cohort wise data analysis.

- **Antimicrobial resistance (AMR) in a community and hospitals [ARCH Study - Phase I]:**

Intestinal colonization with AMR bacteria is an important precursor for AMR infection and can contribute to unrecognized transmission in hospitals and communities. Measurement of AMR colonization, along with an evaluation of relevant epidemiologic data, can enable a better understanding of the landscape of AMR in community and healthcare settings. Additionally, colonizing AMR isolates could serve as indicator for the early identification of novel or emerging resistance phenotypes to inform public health prevention and containment strategies and policies.

From the 757 and 556 adults enrolled in the community and hospitals, respectively, a total of 3285 Enterobacterales were identified. ESCrE and CRE colonization in hospital participants were significantly higher compared with community

participants (p<0.001 for both). Overall, the prevalence of ARO colonization i.e. ESCrE or CRE or ColRE, in community and hospital participants was 78% and 90%, respectively.

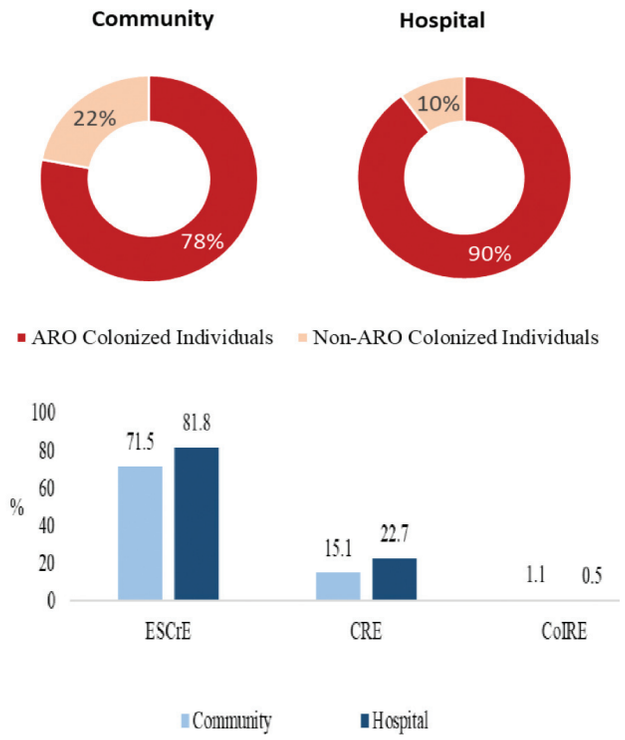


Fig. 14: ARO colonization and resistance phenotypes.

For the first time in India, the study documented comparable and high colonization levels with antibiotic-resistant Enterobacterales among the community and hospitalized individuals. Study findings highlight the importance of surveillance of colonization for understanding the burden of antimicrobial resistance. The findings add to the literature on AMR in India and emphasize the need to link hospital IPC measures with community-level antibiotic stewardship programs.

- **Added value of the measles-rubella supplementary immunization activity in reaching unvaccinated and under-vaccinated children in India:**

As part of India's commitment to measles and rubella elimination, the government launched a measles-rubella (MR) Supplementary immunization activity (SIA) in 2017, targeting all children aged 9 months to less than 15 years regardless of prior vaccination status, to reduce measles transmission and introduce rubella vaccine in the national immunization program.

A total of 1,675 children aged 9 months to younger than 5 years were enrolled in cross-sectional household serosurveys conducted in five districts (Dibrugarh District, Assam; Hoshiarpur District, Punjab; Palghar District, Maharashtra; Kanpur Nagar District, Uttar Pradesh; and Thiruvananthapuram District, Kerala) in India following the 2017–2019 measles-rubella (MR) SIA. Receipt of a 1st or 2nd MCV dose during the SIA was categorized as "added value" of the SIA in reaching un- and under-vaccinated children. The percentage of children receiving the 1st or 2nd dose through the SIA ranged from 12.8% in Thiruvananthapuram District to 48.6% in Dibrugarh District (Fig. 15). Although the number of zero-dose children before the SIA was small in most sites, the proportion reached by the SIA ranged from 45.8% in Thiruvananthapuram District to 94.9% in Dibrugarh District. Fewer than 7% of children remained measles zero-dose after the MR SIA (range: 1.1–6.4%) compared to up to 28% before the SIA (range: 7.3–28.1%).

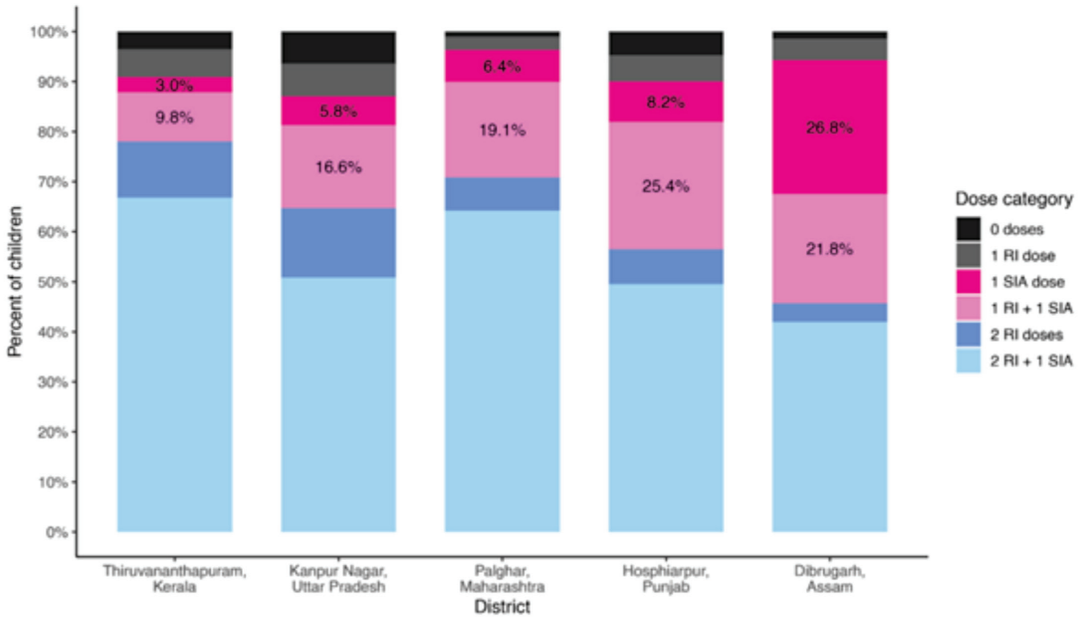


Fig.15: Receipt of measles-containing vaccine among children 9 months to younger than 5 years of age post-SIA by site and strategy, including documented or recall evidence of vaccination.

The study demonstrated that the MR SIA provided considerable added value regarding measles vaccination coverage. However, there was variability across districts due to differences in routine and SIA coverage, and which children were reached by the SIA. Metrics evaluating added value of SIAs can inform the design of vaccination strategies to better reach zero-dose or under-vaccinated children.

- **Serial sero-surveillance for SARS-CoV-2, Dengue and Chikungunya in a rural population cohort (CoDenChik):**

The primary objective was to estimate the cumulative annual incidence of SARS-CoV-2 infection based on four-monthly serial serosurveys. Additionally, baseline seroprevalence and seroincidence of SARS-CoV-2, Dengue and Chikungunya was also estimated among the cohort participants.

Four rounds of surveys were conducted between Feb 2021 and July 2022 in a cohort of 5019 individuals. The overall seropositivity for SARS-CoV-2 was 40.5% in round 1, which increased to 93.4% in round 4. Females had a higher level of antibodies across all the rounds. (Fig.16) The seropositivity was higher among fully vaccinated participants, compared to partial or non-vaccinated across round 2, 3 and 4. Seroconversion was higher among females and lowest in children.

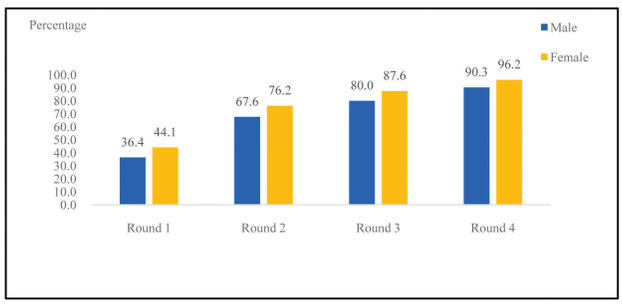


Fig.16: SARS-Cov-2 seropositivity across rounds by gender.

Around half of the participants in the younger age group were seropositive for dengue, whereas 99% of adults were seropositive. The proportion of seropositivity increased across the age groups in round 4. The seroincidence was lower among the younger individuals. Similarly, one-fifth of the

younger and two-third of adult participants were seropositive for chikungunya.

This study found a substantial increase in seropositivity over a year, reflecting the high transmission of SARS-CoV-2 across a wider age range and expanding vaccination coverage. Wide variation in the seroprevalence and incidence of dengue and chikungunya infections across age groups is an important baseline information for developing prevention and control strategies.

- **Prevalence of Chronic Kidney Disease of Unknown Origin, Prakasam District, Andhra Pradesh:**

There were reports of CKDu from the Prakasam district in Andhra Pradesh, which needed more systematic documentation. Hence, the team conducted a study in the Machavaram block of the Prakasam district to estimate the prevalence of CKDu and its associated factors. The team interviewed 1427 individuals, of which 1048 provided samples. Among the 1048 individuals, 50 (4.8%) had eGFR <60 ml/min/1.73m^2. The prevalence of eGFR <60 ml/min/1.73m^2 was 13-14% in two geographically contiguous villages. Males (6.7%) and the 51-60 years age group (13.0%) had the highest prevalence of eGFR <60 ml/min/1.73 m2. The prevalence of eGFR <60 was higher (p-value <0.001) among those with diabetes mellitus (9.9%) and hypertension (7.9%) when compared with those who did not have these co-morbid conditions.

- **ICMR School of Public Health:**

The ICMR School of Public Health (ICMR-SPH) at ICMR-National Institute of Epidemiology has been conducting advanced (Master of Public Health and Epidemic Intelligence Services Program) and intermediate (FETP-NCD) field epidemiology training programs in India. These courses are aimed at middle level health managers working with different state health departments. The NIE's SPH has trained more than 345 healthcare managers and medical officers from 26 Indian states in the last 23 years and thereby contributed to strengthening the health workforce in India (Fig.17).

Fig. 17: Statewise Data of ICMR School of Public Health.

ICMR-NATIONAL INSTITUTE OF MEDICAL STATISTICS (ICMR-NIMS), NEW DELHI

- **Estimation of HIV (Human Immunodeficiency Virus) burden in India:**

ICMR-NIMS is the nodal institute for management and analysis of *HIV Sentinel Surveillance (HSS)* data and to provide HIV burden estimates for India, States and UTs in collaboration with National AIDS Control Organization (NACO), Ministry of Health and Family Welfare (MoHFW), Government of India (GOI). Technical report of HIV Estimation 2021 published jointly with NACO in 2022 that

provides estimates on five key indicators such as adult (15-49 years) HIV prevalence, people living with HIV, annual new infection, annual AIDS related deaths and Prevention of Mother to Child Transmission (PMTCT), needs. The HIV estimation report is being used by all stakeholders including policy makers, program managers and academicians to formulate suitable actions for fast tracking the national AIDS and Sexually transmitted infections (STI) response to achieve the Sustainable Development Goals (SDG)

- **CLINICAL REGISTRIES AT ICMR-NIMS:**

❖ Clinical Trials Registry- India (CTRI) established in 2007 is an online public record system and one of the 17 primary registries of WHO's International Clinical Trials Registry Portal. Registration of clinical trials are mandatory by DCGI, Institutional ethics committees and Editors of Journal for publications. Out of 51000 trials registered, 9675 trials were registered during 2022-23.

❖ The National Clinical Registry for COVID-19 (NCRC) is an ongoing registry to understand the clinical profile, treatment patterns and outcomes of hospitalized COVID-19 patients. The registry data is periodically analyzed to inform COVID-19 response and management.

❖ Prescription Research Software (PrescReSof©) for the RUMCs of National Virtual Centre of Clinical Pharmacology (NvCCP) was developed and hosted at ICMR-NIMS.

❖ ICMR Advanced Mycology Diagnostic Research Centre Network (MycoNet) is a comprehensive national-level mycology clinical registry on epidemiology of invasive fungal infections, evidence-based decision making in clinical practice and public health policy and eventually, improve patient management.

❖ ICMR-National Hospital Based Registry on Venous Thromboembolic Disorders (i-RegVeD) developed and hosted at ICMR-NIMS aims to establish a nationwide registry through selected hospitals and collect data for generating to generate evidence on *Venous thromboembolism (VTE)* prevalence for planning response, and strengthening healthcare facilities across different treatment settings.

❖ Under the initiative of ***National Data Quality Forum (NDQF)***, in 2022-23, a total of five training of trainers (ToT) workshops were conducted in different regions of India to disseminate 'National Guidelines for improving the data quality in surveys. Three webinars on various topics related to Data quality were also conducted.

❖ ICMR-NIMS contributed significantly in the development of Ethical guidelines for application of Artificial Intelligence in Biomedical Research and Healthcare 2023, which was released by Secretary DHR & Director General (DG), ICMR, New Delhi.

❖ Technical Report of the study undertaken by ICMR-NIMS on "Validation study on assigning cause of death" was released. It is envisaged that the evidence generated would inform the researchers and decision-makers for strengthening cause specific mortality statistics in India.

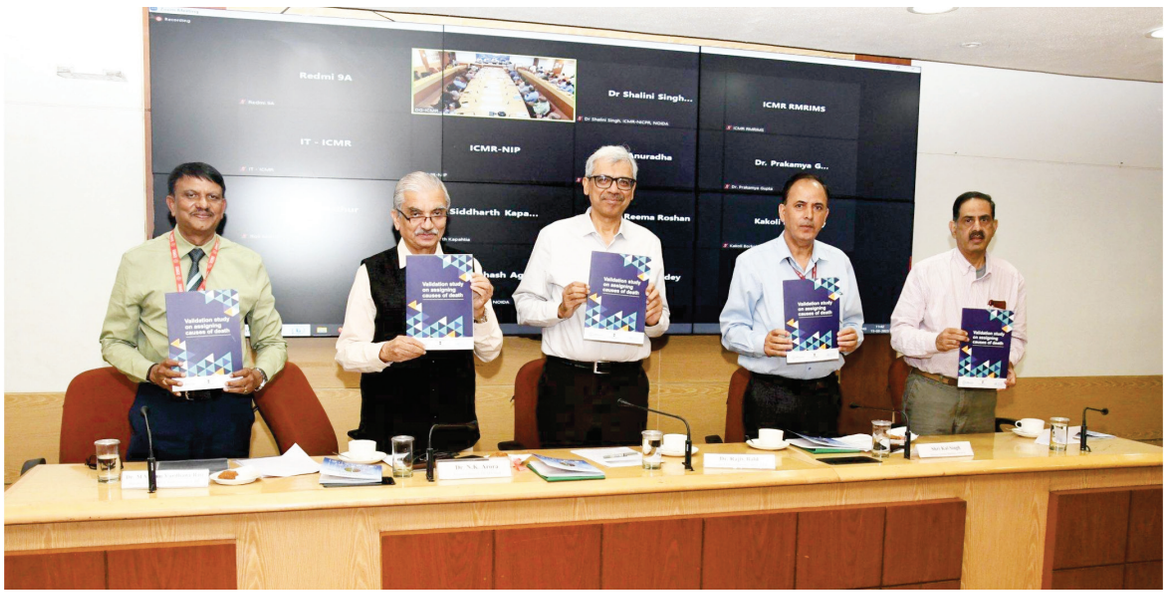


Fig.18: Release of technical report of study, "Validation study on assigning cause of death" by Dr Dr Rajiv Bahl, Secretary DHR & DG ICMR, Dr M Vishnu Vardhana Rao, Director, Dr N K Arora, Dr Kal Singh, DG Statistics, MoHFW and Dr B. Bhargava, Former DG ICMR.

Fig.19: Dr Rajiv Bahl, Secretary DHR & DG ICMR, Dr M Vishnu Vardhana Rao, Director, scientists from ICMR institutes and faculty from ICMR-NIMS during the third 'Induction Training on Research Methods and Biostatistics.

ICMR-REGIONAL MEDICAL RESEARCH CENTRE (ICMR-RMRCBB), BHUBANESWAR

- The regional VRDL is one of the laboratories contributing to genomic epidemiology of the SARS CoV2 through the INSACOG consortium in India and one of the only 2 laboratories from the state of Odisha providing information regarding SARS CoV2 variants and sub-variants at the state and national level. The genomic surveillance for tracking SARS CoV2 variants has also been initiated.
- **Odisha Tribal Family Health Survey (OTFHS)**: It is a first of its kind comprehensive and multidimensional survey, exclusively

among tribal population of Odisha. The survey has been designed to provide comparable estimates on over 140 social and health indicators for each of the 62 tribes and 13 primitive vulnerable tribal groups in the state. Data is being collected digitally from over 10000 households with an estimated 42000 participants in total. OTFHS would form the baseline for future need-based surveillance and for the Tribal Health Observatory for real-time decision-making support to the health system of the state.

- **Sickle cell Disease**: An intervention research project was undertaken with the aim to develop effective intervention model for the SCD patients in tribal areas for accessing government health care system and capacity building in terms of knowledge, skill and training of the health care workers at different levels of health system for prevention and management of SCD. The task force study on Neonatal Screening for Sickle Cell Disease was undertaken in Kandhamal district of Odisha. During the reporting period, a total 4324 newborn babies were screened using HPLC, out of which, 77(1.8%) babies were identified as Sickle Cell Disease (SCD), which added to the sickle cell cohort of ICMR. They are being followed up in specific time intervals with early initiation of interventions like prophylactic antibiotics, Hydroxy urea and Folic Acid. Besides, a total 592 (13.7%) Sickle cell traits were identified. The identified babies have been registered at district sickle cell unit. The parents were provided genetic counseling.
- The team has developed audio content in local tribal language for creating awareness pertaining to the cause, sign, symptoms, transmission mode & treatment of Anthrax disease.
- There was inauguration of annex building and laying of foundation stone of **School of Public Health and BSL III Laboratory** at ICMR-RMRC, Bhubaneswar on 7th January, 2023 by Hon'ble Union Minister for Health and Family Welfare, Dr. Mansukh Mandaviya, in the august presence of Shri Dharmendra Pradhan, Hon'ble Union Minister for Education and Skill Development & Entrepreneurship, Dr. Bharati Pravin Pawar, Hon'ble Minister of State, Ministry of Health and Family Welfare, Govt. of India, Smt. Aparajita Sarangi, Hon'ble Member of Parliament, Bhubaneswar and Dr. Rajiv Bahl, Secretary to Government of India, Department of Health Research and Director General, Indian Council of Medical Research.
- The institute compiled a book **"ODI-SCI: The Odyssey of the women scientists of Odisha"** which documents the life history, phenomenal scientific journey and enlightening views of the great women scientists of the Odisha State. This book was released by Dr. Bharati Pravin Pawar, Union Minister of State, Ministry of Health and Family Welfare, Government of India on 3rd December, 2022.
- ICMR-RMRC stall at "Make In Odisha Conclave 2022" during 30th November to 4th December, 2022 was awarded with the "**Best Departmental Pavillion Trophy**".
- The institute designed and developed an **online certificate course on 'One Health'**, first-of-its-kind in India which was launched on 23rd January 2023 through the NPTEL platform.
- Established a population cohort at its MRHRU, Tigiria. The cohort comprising 16,500 households would be of critical importance in understanding the disease transmission

dynamics and form a conducive platform for future clinical trials.

- The team published the magazine on Tuberculosis in India **"Science Horizon"** in collaboration with Odisha Bigyan Academy.

Fig. 20: Dr. Bharati Pravin Pawar, Union Minister of State, Ministry of Health and Family Welfare, Government of India released the book "ODI-SCI: The Odyssey of the women scientists of Odisha".

Fig. 21: Inauguration of annex building of the centre and laying of foundation stone of School of Public Health and BSL III Laboratory at ICMR-RMRC, Bhubaneswar on 7th January, 2023 by Hon'ble Union Minister for Health and Family Welfare, Dr. Mansukh Mandaviya.

Fig. 22: Published the magazine on Tuberculosis in India **"Science Horizon"** in collaboration with Odisha Bigyan Academy.

ICMR-REGIONAL MEDICAL RESEARCH CENTRE (ICMR-RMRCPB), PORT BLAIR

- Implementation of a novel strategy - Mass consumption of DEC fortified salt, supplementing to ongoing MDA in the four endemic islands of Nancowry with diurnally sub-periodic form of *filariasis (LF)* resulted in elimination of LF. A first transmission assessment survey by NCVBDC had passed the first assessment task.
- State Level Viral Research and Diagnostic Laboratory extended the support to Directorate of Health Services and Indian Navel Hospital. Samples received from Referral hospital , District hospitals , CHCs and PHCs were tested and results were shared within 4- 6 hours after receipt of the sample for initiation of specific therapy.
- The Model Rural Health Research Unit (MRHRU) functioning at CHC and working in close collaboration with Community Health Centres and PHCs, provide diagnostic support for endemic diseases such as leptospirosis, Dengue , chikungunya and Influenza.
- A demonstration project on malaria elimination has been implemented at Nancowry group of Islands towards malaria elimination.
- A community based cross-sectional study was carried out to find the prevalence of uterine cervical High risk Human Papillomavirus (HR-HPV) infection among married women of reproductive age group and identified common genotype.
- A full-fledged Covid-19 testing facility has continued functioning to provide to the needs of A & N Islands.
- A leptospiral protein that conserved a virulent variant of Leptospira has been identified and has implication in control of leptospirosis.
- Nine health and awareness camps were conducted in rural areas of south Andaman, identified the health problems and referred the patients to Health care facility.

ICMR-REGIONAL MEDICAL RESEARCH CENTRE (ICMR-RMRCGKP), GORAKHPUR

- **Japanese encephalitis virus / Acute Encephalitis Syndrome**: A total of 238 cases were admitted in BRD medical college, Gorakhpur (a tertiary care centre for AES treatment in eastern part of Uttar Pradesh) . All these AES cases were investigated for detection of anti-Japanese encephalitis (JE) virus-specific IgM (anti-JE IgM), anti- Orientia tsutsugamushi IgM (anti-OTs IgM), Dengue NS-1 antigen (DEN NS-1 Ag) and Anti-Lepto IgM by ELISA assays as per the ICMR recommendations. Anti-JE IgM positive was documented in 24 cases (10.08%) and anti-OTs IgM was detected in 127 cases (53.3%). Furthermore, anti-Dengue NS-1 and/or IgM was found in 4.6% of cases (n=11), Anti-Lepto IgM positivity in 4.2% cases (n=10) and anti-Chikungunya IgM in 5.04% cases (n=12).
- **Long term disability in children with AES:** Neurological impairments was observed in 43/73 (58.9%) JE positive patients, 58/148 (39.2%) ST positive patients and 67/164 (40.8%) patients of other known/unknown aetiology (OE) with mild to severe level of severity.
- **JE vector study:** In this study abundance of JE vectors were investigated and found that *Culex tritaeniorhynchus* was most prevalent

vector during the rainy season where as *Cx. quinquefasciatus* was most prevalent mosquito species in summer and winter season.

- A **rapid detection kit for *Orientia tsutsugamushi*** diagnosis has been developed by the study team. This technology is based on isothermal recombinase polymerase amplification and lateral flow analysis.
- **Vaccine interchangeability study:** The vaccine interchangeability (after heterologous vaccination by Covishield followed by Covaxin) study was conducted to determine the vaccine effectiveness, immunogenicity and reactogenicity. This study also characterizes the immune response to precautionary third dose of COVISHIELD/COVAXIN among healthy adult population. The findings suggest that immunization with a combination of Covishield and Covaxin was not only safe but also elicited better immunogenicity.
- **State Level Viral Diagnostics Laboratory (VRDL):** A state-of-art facility for timely identification of viruses and other agents causing morbidity in eastern areas cater the diagnostic/ research services to 50 million populations of Uttar Pradesh and Western Bihar.
- Apart from diagnosing seven syndromes (29 viral etiologies), ICMR-RMRC, Gorakhpur, VRDL is also sentinel site for Zika surveillance,
- **Next generation sequencing laboratory** has been fully functional and ready to perform deep sequencing related genomic studies.
- **MSc in Public Health Entomology course** has been initiated in the institute.

ICMR-NATIONAL ANIMAL RESOURCE FACILITY FOR BIOMEDICAL RESEARCH (ICMR-NARFBR), HYDERABAD

- The institute established state-of-the-art facility for SPF-like Non-Human Primates for preclinical trials of biologicals, vaccines, etc.
- The study team established state-of-the-art infrastructure for testing and preclinical trial of medical devices and biopharmaceuticals in pigs and beagle dogs.
- The ICMR-NARFBR also has excellent facility of genetically tested rodents and lagomorphs for biomedical research.

EXTRAMURAL RESEARCH

- **Organization of One Health Camp:**The camp aimed to observe the prevalence of zoonotic diseases of significance to the Kumhar and Qalandar communities involved in animal husbandry activities for their livelihood. The integrated one health camp was organized at Gualar Bhoj and Mahtosh, Udham Singh Nagar, Uttarakhand on 21st & 22nd March, 2023. The following pathogens were identified in the communities: Brucella abortus (prevalence 27%), Scrub typhus (prevalence 17.6%), Leptospira (prevalence 14.9%). The one health camp highlighted the synergistic partnership between ICMR and DAHD for promoting animal and human health. This initiative for integrated health received appreciation from the Commissioner of Animal health.
- The ICMR One Health team coordinated with the One Health Unit at the Principle Scientific Advisor to Government of India Office and led the deliberations for finalizing Priority Diseases for India from the One Health domain. This was achieved in the in the 4th meeting of Cross Ministerial One Health Action Group (OAG) held on 21st February 2023 under the chairmanship of Dr. Parvinder

Maini, Scientific Secretary, Office of the Principal Scientific Adviser. The meeting was attended by all the stakeholders in one health mission of India. The participants were from Department of Health Research, ICMR, ICAR, DBT, NCDC, DST and Central Zoo Authority.

- **Identified the hot spots and developed predictive risk map for human Anthrax in India:** Several human anthrax outbreaks have been reported in India. However, there was no data available regarding distribution and burden of anthrax in India. The study team conducted a systematic review and risk mapping to identify the hot spots of human anthrax and spatio-temporal distribution during the past two decades. The study revealed that human anthrax outbreaks in India were clustered around the Eastern Coastal regions. The states of Odisha, West Bengal, Andhra Pradesh and Jharkhand reported maximum number of outbreaks. Odisha reported a maximum number of 439 human anthrax cases since 2009, of which Koraput district contributed to 200 cases (46%).
- **Identified the risk factors & gaps and developed policy recommendations for managing human anthrax outbreaks:** The study team identified the risk factors involved in human anthrax outbreaks in India under the broad domains; behavioural and cultural factors, socio-economic factors and environmental factors. While handling or consumption of infected animal product were proximal drivers of these events, poverty, lack of awareness, traditional beliefs and local practices served as facilitatory factors. Other structural determinants were wild life-livestock interface, historical forest loss, soil pH, soil-water balance, organic carbon content, temperature, rainfall and humidity.
- The study also identified the programmatic issues and provided policy recommendations. Lack of active surveillance, unavailability of diagnostic facility at the periphery, delayed reporting, absence of routine livestock vaccination and lack of adequate veterinary services were identified as major issues. Targeted active surveillance in high risk areas, strengthening diagnostic facilities and point of care diagnostics at periphery, routine vaccination policy of livestock in outbreak prone areas/ animal ring vaccination during outbreaks, enhancing veterinary services, adequate veterinary inspectors and forest officers in endemic districts were key policy recommendations.

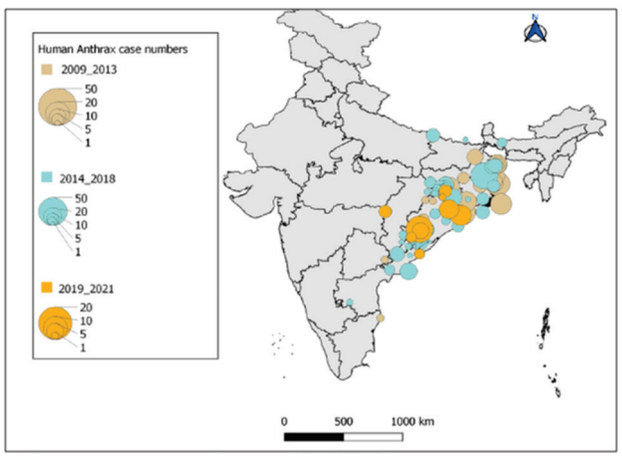


Fig. 23: Spatio-temporal distribution map of human anthrax showing the hot spots of anthrax outbreaks (IDSP data 2009-2021).

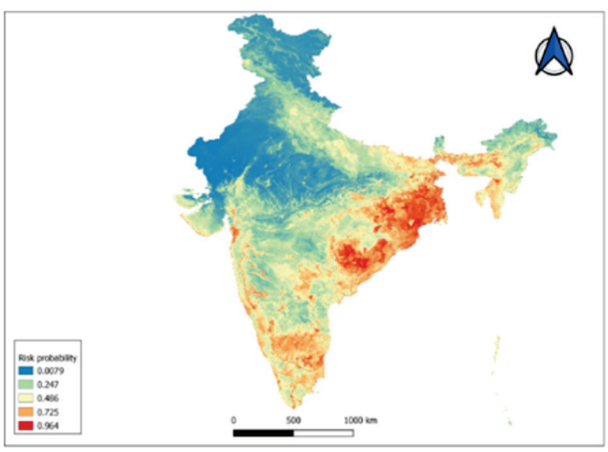


Fig. 24: Predictive risk map of human anthrax in India depicting anthrax suitability.

- **Drafted standard operating procedures for laboratory diagnosis of human anthrax:** The microbiological methods of diagnosis of human anthrax including culture, antibiotic susceptibility testing, biochemical, serological methods and molecular tests are described in this document. The SOP describes the special safety measures in handling anthrax specimens, disinfection methods, decontamination, disposal, storage instructions and spillage management. Additionally, it also includes handling animal samples and environmental sampling.

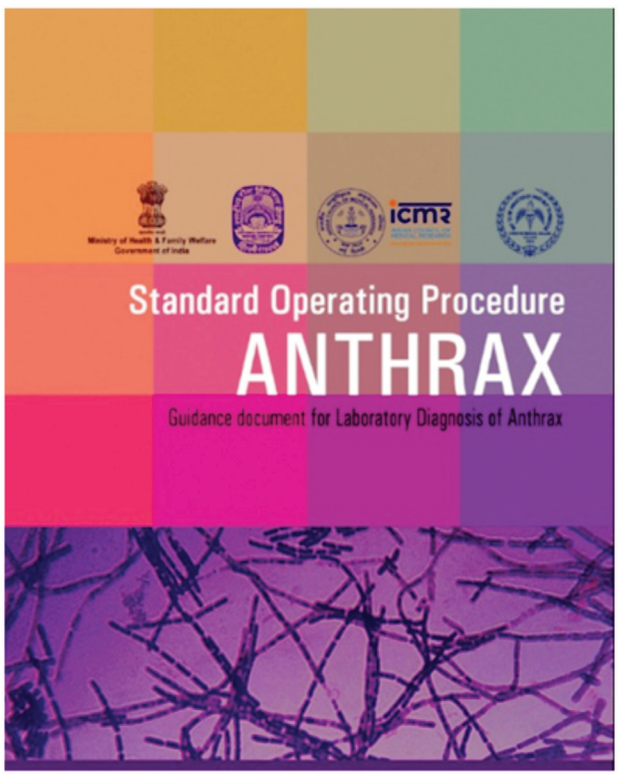


Fig. 25: Standard Operating Procedure for laboratory diagnosis of human anthrax.

- **Enhancing surveillance for emerging/re-emerging viral infections:** Pan India ILI-SARI surveillance network has been expanded from 21 to 31 sites across 26 states and Union Territories. This surveillance is the only integrated surveillance system for respiratory viruses in the country. The expanded network of ILI-SARI surveillance generates country-wide trends on circulation and seasonality of important respiratory pathogens, and severity of disease caused by influenza and SARS-CoV-2 viruses, which may have a bearing on the timing of influenza vaccination. The surveillance also generates data on high-risk groups for influenza and COVID-19 infections, as well as data on the match/mismatch of circulating influenza strains with recommended seasonal influenza vaccine. The data is routinely presented to empowered group such as the NITI Aayog and the NTAGI, and the MoHFW uses this data for decision making and implementation of appropriate public health measures.
- A network of 20 laboratories including ICMR-NIV Pune has been strengthened for the diagnosis of Monkeypox (MPoX) disease to combat MPoX outbreak, 2022. On July 23, 2022, the WHO declared Monkeypox (MPoX) outbreak as a Public Health Emergency of International Concern (PHEIC). Prior to the report of first case of MPoX in India on July 14, 2022, in Kerala, a network of 15 VRDLs were strengthened with a virtual training for the Monkeypox Clinical features and laboratory diagnosis on June 29, 2022 by ICMR-NIV Pune. Later on, 3 more laboratories of Kerala state including state public health lab and NCDC lab New Delhi were trained to expand the MPoX testing labs. The outcome was that the outbreak was contained effectively with a total case counts of 23 only.
- **Vector Borne Diseases:** Under the Collaboration of National Centre for Vector Borne Diseases Control (NCVBDC), Ministry of Health, a Task Force study on "Determination of resistance frequency and intensity among field populations of malaria vectors" has been

initiated at 11 malaria-endemic districts across the country.

- 18 laboratories were trained for Kyasanur Forest Disease (KFD) and Crimean Congo Haemorrhagic Fever (CCHF) diagnosis. A total of 22 participants from 11 laboratories were trained for KFD diagnosis while 14 participants from 7 laboratories were trained for CCHF diagnosis.
- Third round of EQA for SARS-CoV-2 has been undertaken for 800 COVID-19 RT-PCR laboratories across the country. The results were submitted by 523 laboratories which tested the panel with different rRT-PCR kits, 403 (80.6%) laboratories qualified the EQAP.
- From February 14 to 16, 2023, ICMR HQ conducted a workshop titled "Capacity Building for TB Research in a Programmatic Setting" at National Institute for Research in Tuberculosis (NIRT) in Chennai. This workshop was conducted in collaboration with the UNION as a part of the SEAR RRP PM ABHIM capacity building program. Participants from Bangladesh, Bhutan, India, Indonesia, Sri Lanka, Timor Leste, Maldives, and Nepal attended the meeting resulting in the development of research protocols.
- A comprehensive hands-on training session, focusing on enhancing capacities in Dengue Point-of-Care (POC) research, took place at the National Institute of Virology (NIV) in Pune from February 20 to 24, 2023 which was organized by ICMR HQ under the SEAR RRP PM ABHIM project. This event was attended by experts from India, Nepal, and Bangladesh resulting in the development of a multi-country research protocol and also provided hands on training on Dengue diagnostics.
- **International Collaboration:** ICMR and The Coalition for Epidemic Preparedness Innovations (CEPI) signed a Letter of Intent (LOI) on February 23, 2023. This formal agreement underscores a shared commitment to epidemic preparedness and innovation among the participating entities, marking a significant step forward in collaborative efforts to address global health challenges.
- Under **AntiMicrobial Resistance Programme**, the following achievements were done:

❖ Target Product Profiles for the rapid diagnosis of sepsis in adults and neonates were developed to detail the criteria for performance and operational specifications of a 'fit-for-use test' as per needs of healthcare in India.

❖ Initiated a prospective study on implementation of antimicrobial stewardship in tertiary care hospitals

❖ Initiated study to assess availability of essential diagnostics in five Indian states at PHC, CHC and district hospitals with support from National Health System Resource Centre(NHSRC).

❖ In collaboration with Global Antibiotic Research and Partnership Development, initiated study to understand the challenges in diagnosis and management of five tertiary care hospitals in India.

❖ ICMR and FIND project on AMR Diagnostics Use Accelerator (the "Project") at four sites ie NICED Kolkata, RD Gardi Medical College Ujjain, PGIMER, Chandigarh and JSS Chattisgarh under taken as part of ICMR-FIND MoU was successfully concluded. The results indicated significant reduction in antibiotic usage in patients with a respiratory diagnosis. This is of critical importance as this area

accounts for the greatest burden of unindicated outpatient antibiotic use and this group comprised over 50% of the study population. These results indicate that adding the influenza diagnostic panel can significantly cut down antibiotic prescriptions in febrile patients with respiratory symptoms.

- Field feasibility evaluation of one kit based rapid diagnostic test (Rapidogram) for UTI detection provided evidence on its usefulness in peripheral healthcare settings with 99.6% specificity, 90.6% sensitivity, 96.7% PPV, 98.9% NPV and 98.7% test accuracy. Diagnostic test was recommended to National Health Systems Resource Centre (NHSRC) under NHM for pilot study.
- Cost effectiveness assessments of two indigenously developed rapid diagnostics for diagnosis and management of uncomplicated symptomatic UTI among women provided evidence on the test associated cost-efficient clinical decision-making. Net Monetary Benefit of ₹ 37,715 (RightBiotic) and ₹ 37,281 (Rapidogram) were obtained for using these diagnostics based on GDP per capita income of ₹1, 45,679 in 2022.

NON-COMMUNICABLE DISEASES

In the area of non-communicable diseases, ICMR continues to carry out research studies for prevention and early detection of cancer, development of the National Cancer Registry and related activities like software module for cancer registration, patterns of cancer patient care and survival studies. ICMR has been working in the following major research areas during the reported period viz. Hypertension, Stroke, Diabetes, Sickle cell anemia, IDD, silicosis, snake bite, etc.

Major highlights of various programmes undertaken by ICMR in the area of non-communicable diseases during the year 2022- 23 are given below.

INTRAMURAL RESEARCH

ICMR-NATIONAL INSTITUTE OF CANCER PREVENTION AND RESEARCH (ICMR-NICPR), NOIDA

- A significantly higher prevalence of high-risk HPV in the cervical and anal samples and high grade cervical cytologic abnormalities in WLHIV in comparison to HIV-negative women. These results mandate the inclusion of cervical cancer screening in the routine management of WLHIV.
- A low-cost indigenous automated cervical cancer screening device was validated as a stand -alone screening device for low-resource settings. This can be used to augment cervical cancer screening in settings with paucity of trained cytotechnologists/ pathologists.
- The oral microbiome of smokeless tobacco users having oral potentially malignant disorders showed a distinct microbiome profile (both bacterial and fungal) compared to non-users and this was found to be similar to the microbiome of patients with oral cancer. The current findings warrant further research for the development of microbial biomarkers and prevention strategies against oral cancer induced due to the use of smokeless tobacco products.
- Bacterial and Fungal population were identified in various Indian smokeless tobacco products (both commercial and loosely packed). The levels of a fungal toxin (ochratoxins A) was very high in the *Mainpuri kapoori* product.
- A systematic review and meta-analysis showed that cessation of areca nut usage (without tobacco) led to a 28.9% risk reversal of oral cancer and 48% reversal of pharyngeal cancer. For users of areca nut with smokeless tobacco, the risk for oral cancer was reduced in former users after 10 years of cessation. These results provide evidence for a policy for inclusion of areca nut cessation intervention in cancer control efforts.

- It was found that alteration in the levels of three plasma microRNAs (miR-190b-5p, miR-215-5p, miR-527) is consistently linked with Prostate cancer and can be used as a potential diagnostic and prognostic biomarker.
- Using computational tools and algorithms, eight most deleterious nonsynonymous single nucleotide polymorphisms (SNPs) P139H, R257C, C265Y, L283P, G514D, L544Q, H566Y, and W670R identified in the human TLR9 gene as potentially damaging SNPs in various infectious diseases. Additionally, two SNPs G514D and W670R were found to be crucially involved in occurrence of endometrial cancer.
- MBD proteins bind to the BRCA1 gene promoter and regulate its expression, which can be modulated by resveratrol. MBD was found as a key molecule in breast cancer that might have target potential for new drug discovery for breast cancer.
- A combination of both organic and inorganic components that can deliver two or more drugs simultaneously based on specific stimuli to release at the proper site was developed, which is known as Nano-MOF as a hybrid nanocarrier to overcome the drawbacks of pure organic and inorganic carriers.
- It was found that in all low-grade cervical smears, the sensitivity of the two tests was comparable. However, dual staining with p16/Ki67 had a higher specificity and accuracy than HPV 16/18 genotyping.
- The study team revealed that a panel of 18 proteins identified in the proteome profile was associated with different signalling pathways that might have characteristics of a molecular signature and can be new drug targets for overcoming Abemaciclib and Palbociclib drug resistance in breast cancer.
- Comprehensive meta-analysis of SNPs in Cervical Cancer demonstrated that SNPs targeting genes related to immune, inflammation and DNA damage repair genes are responsible for increased cervical cancer risk.
- A study was carried out to quantify the environmental waste due to consumption of smoked and smokeless tobacco products in low- income and middle-income countries (LMICs). A total waste of 1,70,331 (± 29,332) tonnes was estimated to be generated annually, out of which 43.2% was plastic, 3.6% was foil and 0.8% was filter. Two-thirds of overall waste was contributed by smokeless products alone. The evidence thus generated may serve to reinforce and amend the existing policies on regulation of tobacco product packaging through Plastic Waste Management Rules (2016) and the provisions of environmental compensation. A Report was released – The Environmental Burden of Tobacco Product Wastes in India, a joint study by ICMR-NICPR and AIIMS Jodhpur. http://nicpr.org/wp-content/uploads/2023/02/tobacco_waste_report.pdf

ICMR-NATIONAL CENTRE FOR DISEASE INFORMATICS AND RESEARCH (ICMR-NCDIR), BENGALURU

- The project of monitoring survey of cancer risk factors and health system response in the Northeast Region of India was undertaken by institute. It aimed at collecting data on cancer risk factors and health system preparedness in the 12 regions covered by the existing Population based cancer registries in 8 States of North East Region. A total of 21321 respondents spread across a total of 480

Primary Sampling Units (PSUs) participated in the survey. The state wise reports were prepared for each of the eight north eastern states and were released during. The reports are available on ICMR-NCDIR website https://ncdirindia.org/All_Reports/ner2022/Default.aspx

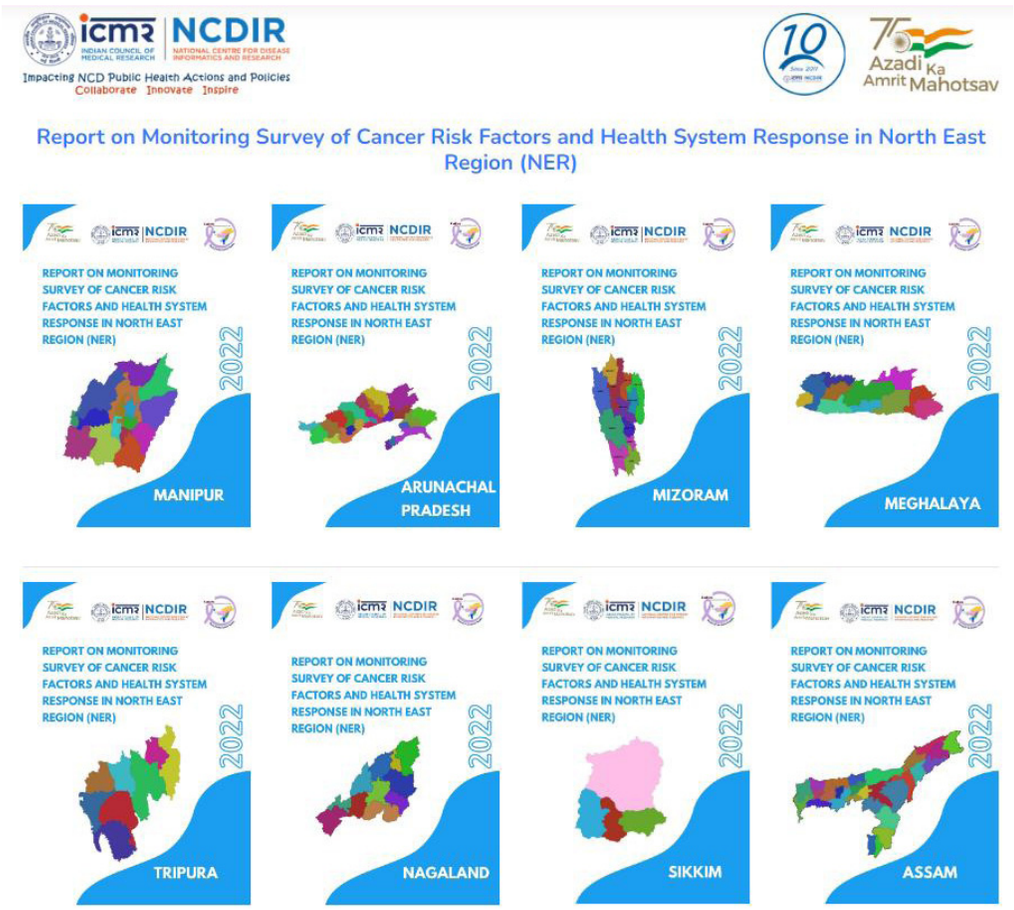


Fig. 1: State wise report of Monitoring survey of cancer risk factors and health system response in the Northeast Region of India.

Fig. 2: Release of State wise report of Monitoring survey of cancer risk factors and health system response in the Northeast Region of India.

This survey was an approach to implement a baseline monitoring system to drive in understanding the linkage between exposures to risk factors, other NCDs and cancer incidence derived from the PBCRs in the North eastern Region and would aid in analysing the trends over time. These survey reports would enable the policymakers and stakeholders at making best decisions to address cancer prevention and control in the respective state.

- The multi-centre, prospective study on the **Magnitude and Pattern of Causes of Heart Failure** was conducted in hospitals in small to medium sized cities in five different regions of India between 2018 to 2022 with the objectives to understand the pattern of causes of heart failure, pattern of care and outcomes of heart failure and to assess the feasibility of establishing the heart failure registry in different geographies of India. A total of 10,059 cases were registered across 5 centres, and most of the patients were from rural areas (60.5%). About 60% were in-patients, and 40% were treated in OPDs, majority (67.5%) were male patients. Ischemic heart disease (73.4%) was the most common cause of heart failure followed by Cardiomyopathies (30%) and Rheumatic Heart Disease (7%). Diabetes, hypertension & anaemia were the leading co-morbidities associated with HF cases. Beta blockers (OP vs IP) (76% vs 60.5%) were the most common drug administered followed by loop diuretics (59.1% vs 38.3%), Angiotensin Receptor Blockers (ACEIs) (37.3% and 38.3%) and Mineralocorticoid Receptor Antagonists (MRAs) (36.1 vs 43.8%). The reported mortality among diagnosed heart failure cases at the end of 180 days was 14.1%.
- There was Implementation of NCDIR electronic Mortality software (NCDIR e-Mor) in hospitals of the National Cancer Registry Programme (NCRP) network in North East India. The objective was to implement the NCDIR e-Mortality software to record deaths and capture cause of death information of all deaths occurring in the hospitals under the NCRP network in North East India and to aid the hospitals by facilitating outputs (MCCD-Form 4 and Death report-Form 2) for the purpose of death registration.

Table 1. Top five leading causes of death reported were as follows.

Sl. No	Major cause group	Frequency, N (%)		
		Male	Female	Total
	Diseases of the circulatory system (I00-I99)	2955 (16.6)	1739 (17.6)	4694 (17.0)
	Neoplasms (C00-D48)	1826 (10.3)	1186 (12.0)	3012 (10.9)
	Diseases of the digestive system (K00-K93)	2336 (13.2)	655 (6.6)	2991 (10.8)
	Diseases of the respiratory system (J00-J99)	1453 (8.2)	875 (8.8)	2328 (8.4)
	Codes for special purposes (U00-U85)	1553 (8.7)	767 (7.7)	2320 (8.4)
	Other groups	7637 (43.0)	4682 (47.3)	12319 (44.5)
Total		**17760 (100.0)**	**9904 (100.0)**	**27664 (100.0)**

- ICMR Bioethics Unit, under the aegis of ICMR, has published a reference book on 'Biomedical Ethics Perspectives in The Indian Context.' This is the first-of-its-kind book in India with a comprehensive and unique compilation of topics addressing ethical aspects in various kinds of research in the Indian context by relevant experts. It was released on the occasion of World Health Day on 7th April 2022. The book is expected to serve as a tool for teaching and act as a guidance document for students, researchers and ethics committee members. Reference: **https://ethics.ncdirindia.org/Reference_books.aspx**

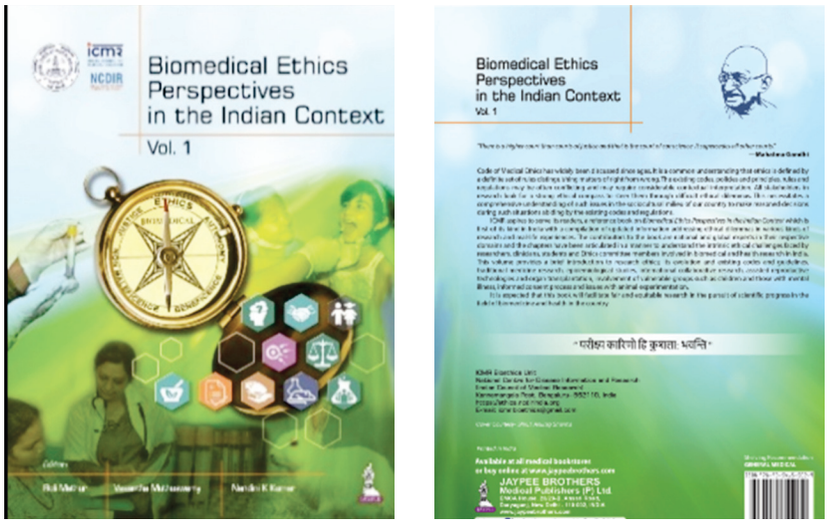


Fig. 3: Release of ICMR Reference book on "Biomedical Ethics Perspectives in the Indian Context" on 7th April 2022.

Fig. 4: Release of FAQs for Ethics Committees & Researchers.

- **Finalization and Release of FAQs for Ethics Committees & Researchers:** ICMR Bioethics Unit received emails with a wide range of queries concerning ethical aspects of research studies, functions of ethics committees, regulatory requirements, etc. A total of more than 150 Frequently Asked Questions (FAQs) have been framed. The FAQs are available on the website and are arranged section-wise to ascertain easy access and navigation to these particular topics. This would serve as a mine of information for young researchers and newly constituted ethics committees in various colleges/institutions across the country.The FAQ hard copy / book form was released on 27th September 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.

- **Release of Animated videos and infographic posters based on ICMR National Ethical Guidelines 2017:** ICMR Bioethics Unit had led initiatives to develop short animated videos based on current biomedical and health research topics in the country. In collaboration with the Global Health Strategies (GHS), Delhi, 6 animated videos were prepared based on National ethical guidelines, Ethics preparedness in outbreak and emergencies and other relevant regulatory requirements. It is believed that the animated videos are useful in ethics training programs for researchers and Ethics Committee members for a better understanding of the ICMR national ethical guidelines. The videos are approximately 2-4 minutes each and are made freely available online in ICMR Bioethics Unit website. (https://ethics.ncdirindia.org/A_Videos.aspx)

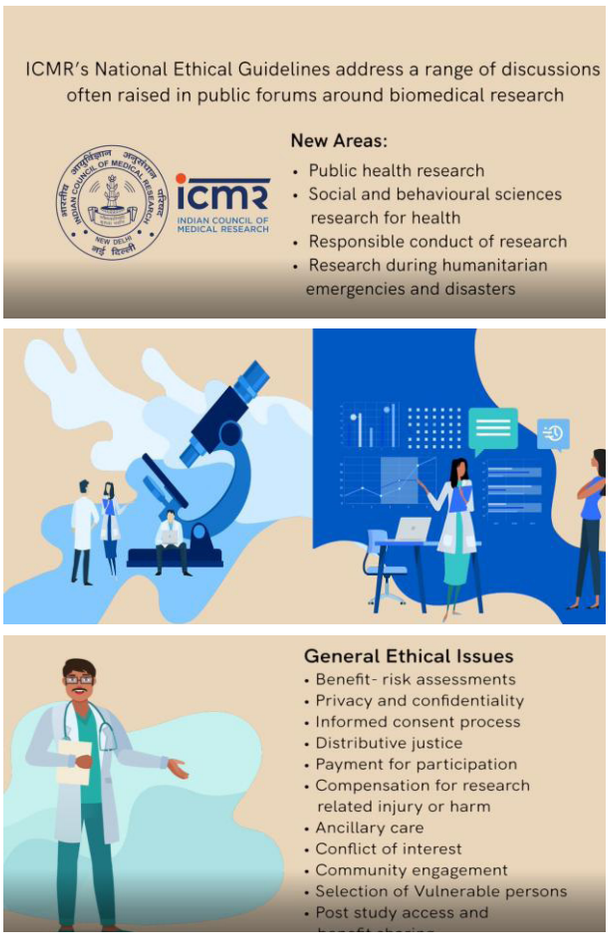


Fig. 5: Release of Animated videos and infographic posters.

- Short Movies as an ethics teaching tool/ resource material (Phase-1): ICMR Bioethics unit aimed to develop the first of its kind- short educational movies in the country. The videos are based on case scenarios and are intended to aid young researchers, scientists, clinicians, EC members, and the community at large for a better understanding of the ethical issues they frequently face while conducting research. These self-learning videos also serve as a tool for addressing complex scenarios that deviate from the norm and assisting the stakeholders in taking appropriate action in such cases. 13 videos of approximately 2-5 minutes each were developed and released and are freely available online for easy accessibility.

Fig. 6: Release of Short Movies as an ethics teaching tool/ resource material.

- Report on **"A Situational Analysis of Childhood Cancer Care Services in India -2022"** prepared by ICMR-NCDIR in collaboration with the Directorate General of Health Services, Ministry of Health & Family Welfare and the World Health Organization (India office) was released on 27th September 2022 by the Hon'ble Union Minister of State for Health and Family Welfare, Dr. Bharati Pravin Pawar. The findings of the report emphasize the need to formulate a childhood cancer policy that would enable timely diagnosis, treatment, supportive care, and follow-up through well-defined care pathways.

Fig.7 : Release of Report on "A Situational Analysis of Childhood Cancer Care Services in India -2022".

- Working paper titled 'Patterns of Stroke Care in ABPM-JAY beneficiaries in empaneled hospitals of PM-JAY Scheme', was published (https://pmjay.gov.in/node/3622) on 20th June 2022.
- ICMR – NCDIR and International Agency of Research on Cancer (IARC), have signed an MOU on 2 September 2022 for mutual goal to promote and conduct high-quality research to strengthen the cancer registry program and build evidence-base towards cancer prevention and control.
- ICMR – NCDIR has signed MOU with the State of Andhra Pradesh in December 2022 to set up of cancer registry in the state. It will strengthen evidence base for cancer prevention and control.

ICMR-NATIONAL INSTITUTE FOR IMPLEMENTATION RESEARCH ON NON-COMMUNICABLE DISEASES (ICMR-NIIRNCD), JODHPUR

- **Feasibility of carrying out CAB Intervention: House-to-house approach:** The village head, including the Sarpanch and Ward panch, played a crucial role in disseminating information about COVID-19 and other diseases to the entire village. They were instrumental in announcing the interventions and encouraging women to participate in the activities. Their support helped to ensure a wider outreach of messages and increased participation from the community. This personalized approach helps to ensure that the participants receive the information in a clear and concise manner.
- **Feasibility of carrying out CAB Intervention: Nukkad-natak approach:** The presence of local volunteers was beneficial for team's interventions, as it allowed the team to conveniently reach the sites within the same village. These volunteers played a critical role in promoting street plays by encouraging COVID survivors' family members and acquaintances to attend the performances. Their support and involvement helped to

expand study team's reach and impact within the community. By sharing their stories, COVID survivors were able to serve as role models and inspire others to take action to protect themselves and their communities.

- **A feasibility study for the implementation of innovative RBSK-NTEP collaboration module for active case finding of tuberculosis among school students:** This study explored the feasibility of TB case screening among school children through the existing Rastriye Bal Swasthya Karyakram (RBSK) system. Few diseases were covered under the RBSK program, but highly prevalent tuberculosis was not among them. A total of 3335 students were screened for TB-suggestive symptoms from 28 schools, including government, private and residential schools/hostels. The team found 47 presumptive cases of TB, which were referred to NTEP for further diagnostic workup and follow-up. Total 25 presumptive cases reported the history of exposure to TB in close contacts—however, all of the presumptive cases were found to be TB-negative.
- **To study the effectiveness of a tailored implementation strategy to improve adherence to a Tuberculosis Preventive Treatment:** Retrospective data collection covered 309 household child contacts of microbiologically confirmed index TB patients. Retrospective data found that 141 (45.6%) contacts were initiated on TPT. A total of 109 (35%) contacts completed the course of TPT. Perceived barriers and challenges were noted through the qualitative phase of the study. A tailored implementation strategy is being initiated to improve the TPT initiation and adherence.
- **Development and Validation of Artificial Intelligence tool for Screening/Detection of Pulmonary Tb and other lung diseases using Chest X-rays:** The institute has uploaded 2128 TB and 1147 non-TB annotated X-rays to train the software tool to diagnose TB through Artificial Intelligence. There were 1801 TB, 389 Non-TB, and 117 normal cases from the site in Phase-I of the study to train the AI tool. The AI tool was validated in phase II mode, and the study team have uploaded 786 cases.
- **Early Diagnosis and Development of Referral System for Sandstone Miners:** Silicosis is the most common and oldest occupational lung disease. However, despite its ubiquitous presence among various mine and quarry workers, there is no uniformly available referral system for workers having occupational dust exposure. The current study involved clinical assessment of those working in mines and quarries in Jodhpur, Rajasthan, Western India and explored the possibility of a referral system for symptomatic mine workers. A total of 435 mine/quarries workers (M:F=332:3) working in the sandstone belt of Jodhpur, Rajasthan, Western India were assessed clinically. Demographic information was as followed by mean ± SD age=36.44±11.23 years, mean duration of dust exposure=13.4±9.6 years. A total of 96/435 workers were symptomatic (22%), and silent hypoxia was present in 113/435 (26%). Both groups of these subjects were referred to nearby community health centres for further evaluation. Awareness level among the workers was poor as only 119/435 (27%) workers had some idea about the prevention. Regular mask usage was present in 8% (35/435). A referral system for those needing further evaluation was demonstrated.
- **Assessment of Iodine Status among Pregnant & Lactating Women And 6-11**

Years Children in Selected Districts of Rajasthan: The aim of this study was to assess the urinary iodine level among pregnant & lactating women and 6-11 years children in Rajasthan & to estimate the iodine content in edible salt samples collected from the households along with Nutritional counselling of the population for Iodine Deficiency Disorders (IDD) program of Government of India. A median urinary iodine value was 110 µg/l in pregnant women, 87.5 µg/l in lactating women, and180 µg/l in NPNL women. Nutrition Counseling was provided to all the 3840 household subjects regarding the IDD program of Govt. of India. A high proportion of households (55.2%) consumed salt, which was inadequately iodized and needed corrective measures. In this study, 7.2% of school children, 73.9% of pregnant women, 60.6% of lactating women, and 22.9% of NPNL women median urinary iodine excretion (UIE) was found to be below the optimal values of median UIE as per WHO cut offs. This study revealed that there is a strong need to create awareness regarding iodine deficiency disorders in this area, which in turn will facilitate the National Iodine Deficiency Disorder Control Program in reduction of Iodine deficiency disorders in Rajasthan.

- **Comparative Cognitive and Behavioural Well-Being of Adolescent Children who Lived in COVID and Non-COVID Homes:** Anxiety, depression, and cognitive complaints have been noted in adolescent children who have either been in COVID-19 homes or have suffered from COVID-19 symptoms. The aim of this study was to compare the frequency of cognitive, neuropsychological, and behavioural impairments among adolescent children who lived in homes with COVID-19-positive families and compare them with adolescents living in COVID-free homes. Adolescents, aged 12-17 years, were recruited from schools of Jodhpur area. There were a total of 77 children (M:F=34:43 mean age±SD=15.81±1.4 years). Mild anxiety and depression were noted in 8 (10.3%) and 2 (2.6%) children, respectively. Montreal cognitive assessment (MoCA) scores of children who lived in COVID-19 homes (n=36) was 24.56±2.56 compared to those who lived in COVID-19-free homes (n=41; 27.40±2.10). The difference between the two groups was statistically significant (95% CI=1.79 to 3.88; p-value=0.0001). Postgraduate institute memory scale (PGI-MS) scores were low in most children with lower MoCA scores, while they were normal in the non-COVID group. The results indicate that the cognitive scale scores using MoCA are lower in children who lived in COVID-19+homes than those who lived in non-COVID-19 homes.

- **Assessment of Neonatal Screening Approaches for Sickle Cell Disease and the Effect of Early Intervention In Management of the Disease in Tribal Population:** The objective of undertaking a newborn screening program for Sickle cell anaemia (disease) in tribal populations of TSP areas of the state were for (a) early detection (b) to understand the magnitude of the problem, and (c) to understand the barriers. Neonates were screened at Gogunda, Kotda and Jhadol blocks of Udaipur District of Rajasthan. During the reporting period, 3542 newborns were screened for various hemoglobinopathies in five blocks of Udaipur. Among the newborns screened for sickle cell disorder, 343 were found positive for sickle cell anaemia. Among the sickle cell positives, 327 were found to

be sickle cell trait and 16 were found to be sickle cell disease. When the team compared the prevalence of sickle cell disorder among the whole population, the highest prevalence was reported from the Garasiya community (11.02%) followed by Bhil (10.59%). All 33 newborns were followed up, and a total of 107 follow-ups were done. The fetal Hb level was found to be decreased with age in the case of sickle homozygous newborns. The level of Hb-F in babies aged 0-3 months was 55% and reduced to 20% in 22-31 month-old babies. However, the reverse of the above condition was recorded in the case of sickle haemoglobin. The highest sickle Hb concentration (75%) was recorded in babies of 19-21 months, and the lowest concentration (40%) in 0-3 months old babies. The level of Hb was recorded between 8.1 to 9.4gm/dl. Acute febrile illness (AFI), acute respiratory infection (ARI) and anaemia were recorded in 1059, 1461 and 949 cases, respectively, per 1000 population/year.

- **Sickle Cell Anemia – Screening and Counseling (Phase-III):** Rajasthan has approximately 13.5% tribal population which has a high prevalence of sickle cell anaemia. The Tribal Area Development Department, Govt. of Rajasthan had asked the Institute to screen the tribal population of TSP areas for sickle cell disorders for another five blocks of Rajasthan. 78000 tribal population (6-21 age group) has been screened. The overall prevalence was 6%. The training was imparted to 135 Medical & Para Medical Staff in screening for Sickle cell disease at the peripheral level. 50000 Sickle status cards were distributed, out of which Yellow coloured cards were for Sickle Cell Disease, Half-yellow cards for Sickle Cell trait and White cards for normal individuals. Also, counselling was given to the diseased individuals (homozygous and heterozygous) and parents regarding marriage, family planning, etc.

Fig.8: Screening of tribal students for sickle cell disorder.

ICMR-REGIONAL MEDICAL RESEARCH CENTRE (ICMR-RMRCNE), DIBRUGARH

- Entomological assessment of Larval and Pupal indices of Dengue vectors was conducted in Tripura. Observations included: (i) exclusive presence of *Ae albopictus*; (ii) indications about the spread of *Ae. albopictus* from rural to urban areas.
- Dengue, Chikungunya, JE, Scrub typhus and Lyme disease with co-infections of *P. falciparum* and *P. vivax* reported for first time from forested regions of Tripura.
- Dengue outbreak investigation was carried out in Dhemaji and Dhubri districts of Assam. Serotyping revealed the circulating Dengue virus to be of Serotype 2.
- Huge number of *P. malariae* infections have been identified (for the first time) in Dhalai District, Tripura
- In outbreak samples from Tripura and Nagaland, scrub typhus was observed to be the major health burden caused by non-viral pathogen with positive test rate of 18.44%.
- Geospatial patterns underlying vitamin A supplementation coverage among under-five children were mapped across two policy-relevant administrative unit levels (states and districts) in India. Further, a spatial template for carrying out targetted supplementation of vitamin A across the country was explored by the study team.
- The centre developed rapid (~1 hour), point-of-care, visual detection, one-pot-assay using isothermal methods and CRISPR technologies for *P. falciparum* K13, C580Y mutation (artemisinin resistance).
- An in-house incubator-cum-detector was developed which can be used for incubation of CRISPR reactions as well as visualization. The device is battery operated and thus suitable for field-use.
- New members of the *Paragonimus westermani* and *Paragonimus heterotremus* complex were discovered in India. Incrimination of *Maydelliathelphusa harpax*, *M. edentula* as new intermediate hosts of lung flukes.
- Regional-VRDL Dibrugarh had sequenced 310 samples for SARS-CoV-2 whole genome since August 2022. The NGS data obtained during this period had been submitted to public data base *i.e.*; GISAID.

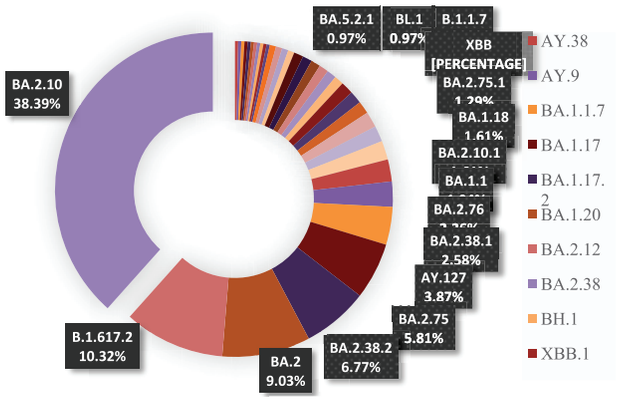


Fig. 9: Lineage distribution of SARS-CoV-2 variants detected by NGS.

During the period, Regional VRDL had screened a total of 1347 samples for SARS-CoV-2 and 129 samples were reported as SARS-CoV-2 positive (PTR=9.57%). Regional VRDL, Dibrugarh had overall performed over 3,80,000 RT-PCR tests for SARS-CoV-2.

- Omicron BA.2 sub lineage was found as the major circulating strain of the SARS-CoV-2 virus in the region (70.32%, 218/310) during the reporting period.
- Drug resistance-associated HCV variants were detected in NER, which may compromise use

of directly acting antivirals (DAAs) in the region. The generally common genotype 3b and relatively uncommon genotypes 6xa and 6n were found to circulate in the NER.

- A mobile application, FeverTracker with dashboard has been developed for real time epidemiological surveillance. It has been successfully deployed in Tripura and being updated for the malaria endemic areas of other northeastern states.
- For malaria mapping with ecological data, land use and land cover (LULC) maps of study districts have been created.
- Operational feasibility of additional intervention package for accelerated malaria control was done in selected high malaria endemic areas targeting Jhum Cultivators in Dhalai District, Tripura. The following results on higher coverage and/or quality of Health program have been found:

  a) Shortage of Long-Lasting Insecticide Treated Nets (LLINs) is being addressed, with special focus on Jhum cultivator population of Dhalai District, Tripura.

  b) Based on the Centre's reports on the physical verification of LLINs showing the quality, usability and availability issues and proposed solutions, the requirement for new LLINs was set and sent by the Mission Director, National Health Mission.

  c) Following the findings on the repellent use by Jhum cultivators in association with malaria, authorities also supplied repellents in those areas.

  d) Based on reports on the gaps on the fever surveillance, several changes were made in the reporting system leading to betterment.

  e) Based on increasing trends in *P. vivax* cases in erstwhile *P. falciparum* dominated Dhalai District, focus on *P. vivax* drug availability, compliance, adherence has been given.

  f) A high coverage of active fever surveillance and corresponding treatment achieved in Dhalai and South Districts of Tripura with the institute's continuous surveys.

ICMR-NATIONAL INSTITUTE OF IMMUNOHAEMATOLOGY (ICMR-NIIH), MUMBAI

- **'Centre for Research Management and Control of Haemoglobinopathies'** under ICMR-NIIH was inaugurated on 11th Dec 2022 by Honble' Prime Minister Shri Narendra Modi. This centre will carry out basic and translational research in the area of haemoglobinopathies. It will contribute to the human resource development, and support centre, state and district administration for control and management of haemoglobinopathies. The centre will also provide prenatal diagnostic services for the local population and strengthen the capabilities of the government medical colleges in the region through collaborative research.
- Screening of 64,474 newborns from 8 centres from 6 states has helped to understand the prevalence of Sickle Cell Disease (SCD) in these areas. Total 540 (0.83%) babies were found to be SCD. The comprehensive care being given to 367 SCD babies, will go a long way in reducing the morbidity and mortality.
- ICMR-NIIH has performed field validation for two indigenously developed kits for SCD.

- For the first time, indigenous red cell screening panel suitable for Indian population has been prepared and distributed to 78 blood banks all over the country for detection of antibodies.
- Based on study on mechanism of RhD negativity in Indians a population-specific data was generated and an Indian-specific diagnostic algorithm was developed which can provide the correct RHD status and simultaneously characterize the serologically-weak D samples. The strategy will be applied for non-invasive fetal RhD typing for management of pregnancy in Indian RhD negative antenatal women.
- Study conducted for the first time in India by ICMR-NIIH has shown a high rate of HNA alloimmunization in multiparous female donors (18.2%) as compared to males (2.4%) using a granulocyte antibody screening assay. This data suggests that deferring the allo-immunized female donors will reduce the risk of HNA associated antibodies in transfusion setting.
- Diagnostic tests for non-invasive prenatal diagnosis, for foetal RhD typing from maternal plasma, for management Rh-HDN have been standardized at the institute. This is now ready for transfer of technology and further commercialization.
- The multicentric project funded by WHO, India, titled **'Study on polio and non-polio enterovirus infections in patients with primary immunodeficiency disorders (PID) at multiple medical institutes across India -Phase II'** where ICMR-NIIH is the nodal centre for providing diagnostic assistance to all the 23 participating centres across India. Under the projects, all the patients diagnosed with PID are monitored for prolonged excretion of polio vaccine virus. In last one year, two patients were identified as vaccine-derived polio virus excretors. They are being further followed up by WHO, India and NIV to look for long-term excretion status of the virus.
- ICMR-NIIH initiated two multicentric projects in the area of autoimmune diseases has helped in establishing diagnostic facilities at 14 centres across India, including 4 centres in NE region. The data generated from all the centres will also help in planning future multicentric research activities in the area of autoimmune diseases.
- The technology for rapid, simple and cost-effective lateral flow immunoassay for the diagnosis of severe Haemophilia A and von Willebrand disease , developed by the institute, has been transferred for commercialization to Bhatt Biotech and has been approved by CDSCO and is ready for marketing.

Fig. 10: Haemophilia A Rapid Card Test and Von willebrand disease (VWD) Rapid Card Test.

ICMR-NATIONAL INSTITUTE OF TRADITIONAL MEDICINE (ICMR-NITM), BELAGAVI

- A Database on herb-drug interaction has been developed by ICMR-NITM with curated information available on interactions of commonly used drugs & herbs for the treatment/management of Diabetes mellitus (DM), Arthritis, and Gastrointestinal disorder (GI) (nausea, vomiting, diarrhoea, acidity). The database is a first of its kind in India and is expected to facilitate the safe and rational use of concomitant medications from multiple systems of medicine as India moves towards achieving its integrative health goals.
- ICMR-NITM validated the diabetic wound healing activity of essential oil obtained from flower buds of *Mammea suriga* and elucidated its molecular mechanism of action. It has public health relevance as a home remedy for management of diabetic wounds.

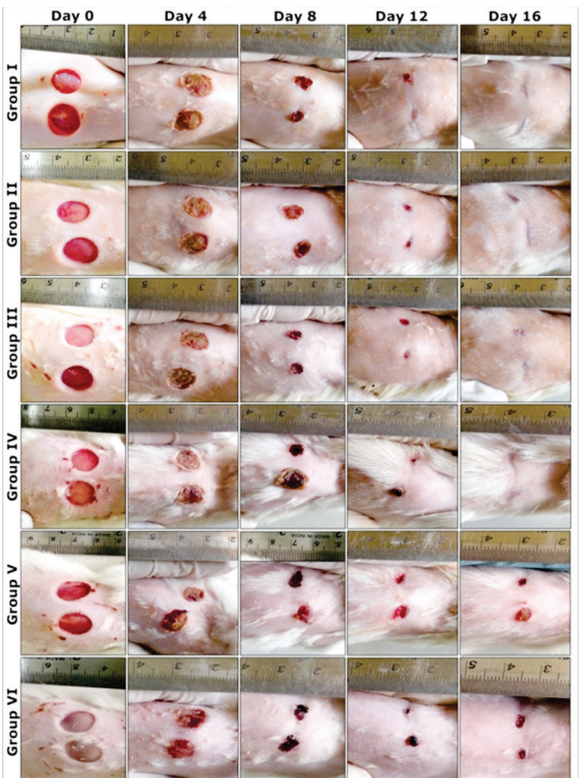


Fig. 11: Wound contraction on different post wounding days. Group I: Essential oil 1%, Group II: Essential oil 2.5%, Group III: Essential oil 5%, Group IV: Positive control (Mupirocin ointment), Group V: Ointment base, Group VI: Negative control.

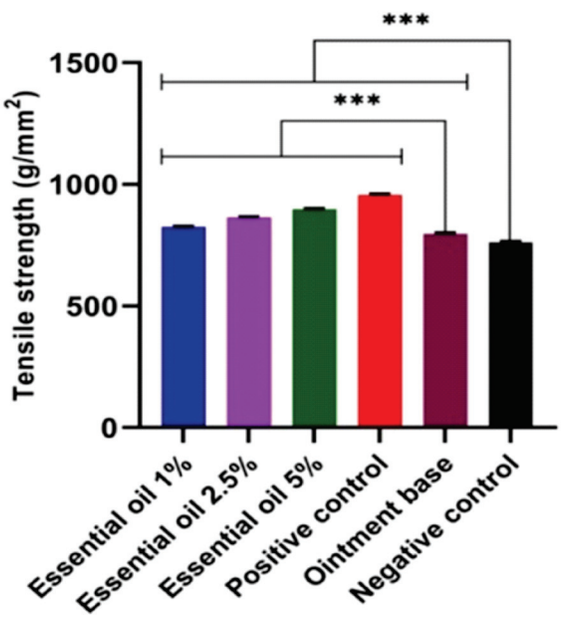


Fig. 12: Effect of topical application of EO ointment on tensile strength in linear incision wound model.

- Working on a lead from the traditionally used plant *Gymnema sylvestre*, NITM established the efficacy of gymnemagenin, a major phytoconstituent of the plant as an inhibitor of 11β-HSD1 and in regulating glucocorticoid action in modulating adipose tissue and obesity. Gymnemagenin improved lipid metabolism by increasing triglyceride hydrolysis (lipolysis), up-regulating the crucial genes involved in adipogenesis and increasing the expression of anti-inflammatory adipokine, providing the basis of its therapeutic importance as anti-obesity phytocompound.

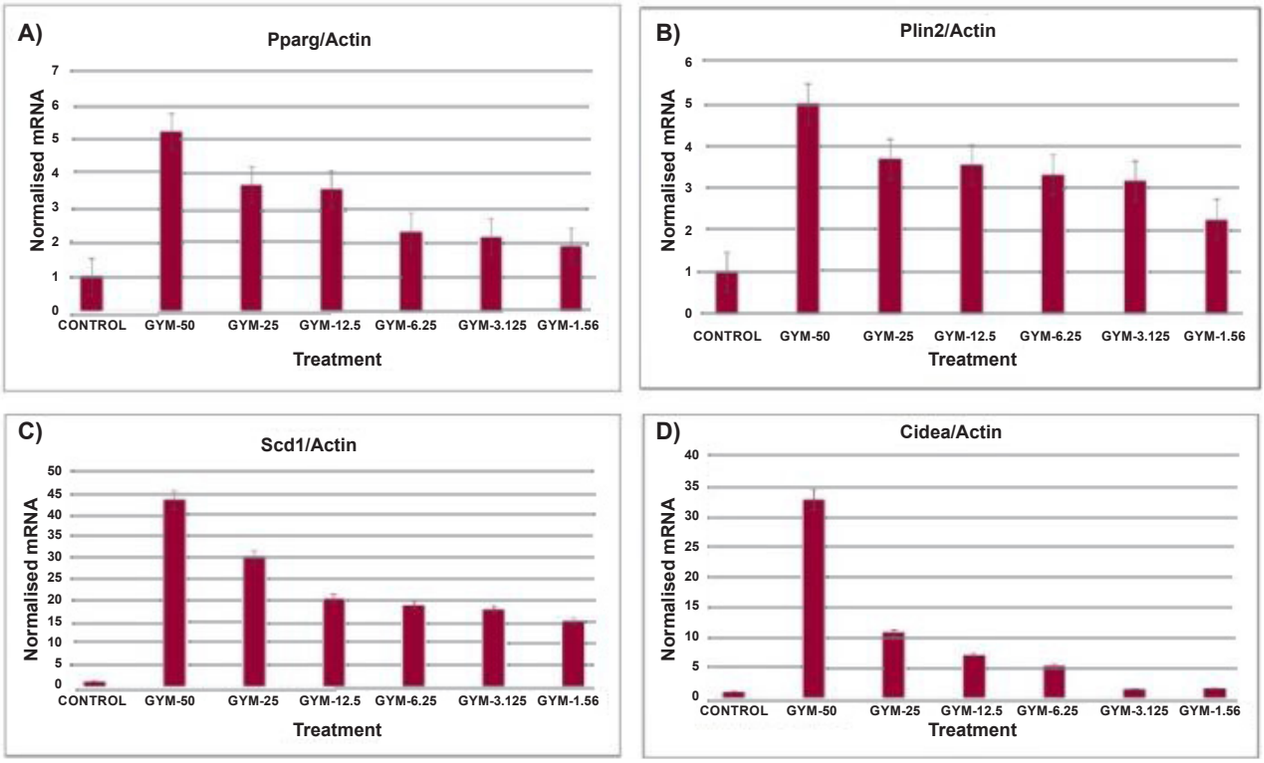


Fig. 13: Effect of gymnemagenin on genes involved in adipogenesis in 3T3L1 adipocytes.

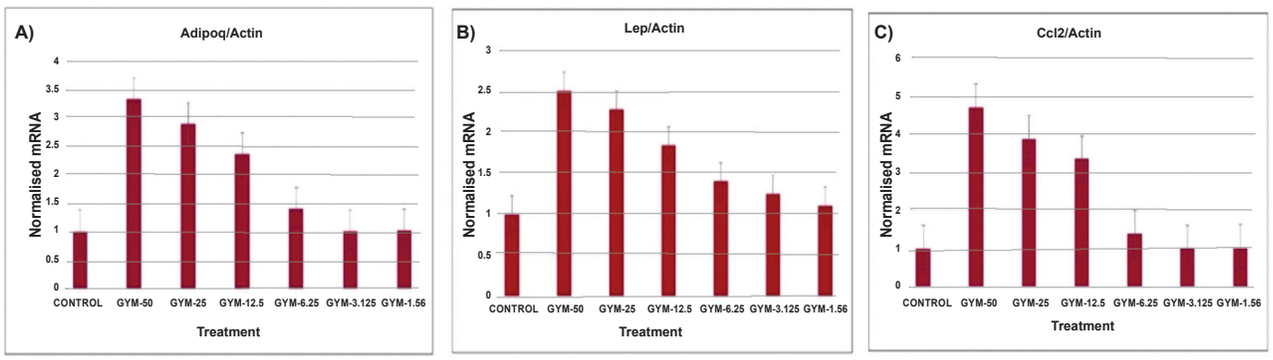


Fig. 14: Effect of gymnemagenin on expression of adipokines secreted by adipocytes.

- The Institute developed a phytopharmaceutical formulation with leads from traditional medicines for the management of COVID-19. A patent has been filed.

ICMR-NATIONAL INSTITUTE FOR RESEARCH IN ENVIRONMENTAL HEALTH, BHOPAL (ICMR-NIREH)

- Investigation of fire at Brahmapuram Solid Waste Treatment Plant (BSWTP) located in the outskirts of Kochi city in Ernakulam district of Kerala highlighted that the waste management should be done in appropriate way, else it will have public health issues. The emissions from the fire had led to heavy air pollution and consequent health hazards being faced by the citizens of the Kochi city and villages located near BSWTP. A team from ICMR-NIREH investigated the environmental and health impacts of the incidence.

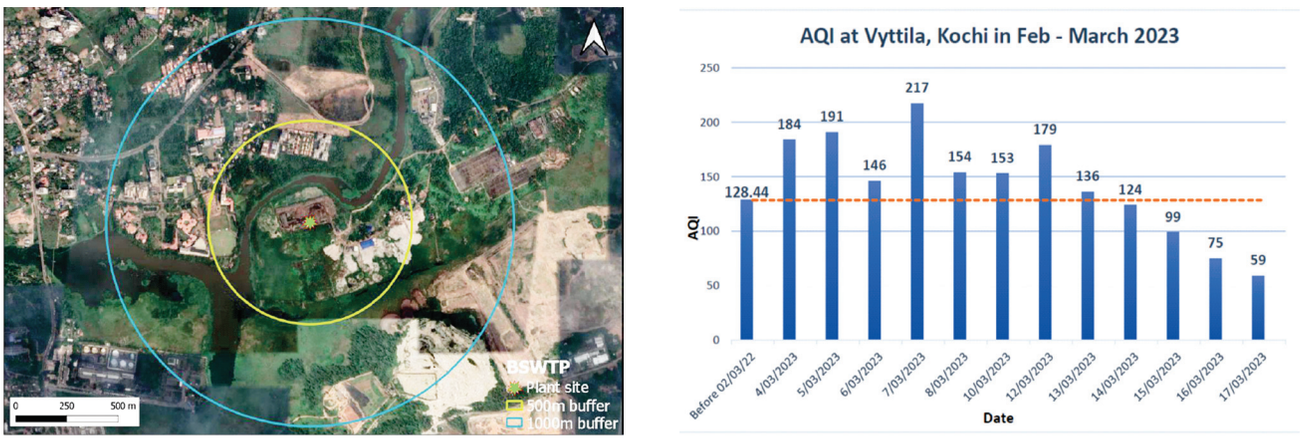


Fig.15: AQI at Vytilla, Kochi in Feb-Mar 2023.

- The completion of 59th round of follow up of the Bhopal gas tragedy survivors cohort helped state government for resource allocation and other policy decisions.
- The project on waste management highlights that waste segregation is an important component of waste disposal and it needs to be improved. Qualitative studies were done among different stakeholders including community members (demand side), service providers (supply side), scrap dealers (informal waste workers) to understand the existing practices, preparedness, barriers and challenges of solid waste segregation and sorting at household-level in the city of Ujjain in central India. Three themes were constructed: motivation, where household members are motivated to sort waste yet fear the consequences of improper sorting; ability, where household waste segregation is rapidly gaining acceptance as a social norm; and opportunities, involving convenient facilities and a social support system for household members towards waste segregation.

Fig.16: Waste segregation is an important component of waste disposal and it needs to be improved.

ICMR-NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHEMDABAD (ICMR-NIOH)

- A sequential mixed method study involving 138 patients with silico-tuberculosis and 2610 TB patients without silicosis from Gujrat found that patients with silico-tuberculosis

had 2.3 (95% CI 1.6-3.4) times higher odds of unfavorable treatment outcomes, suggesting that collaborative TB-silicosis activities are required for improving treatment outcomes in patients with silico-tuberculosis.

- A retrospective cohort study to find association of active case finding (ACF) with TB treatment outcome among newly diagnosed pulmonary TB patients, followed by in-depth interviews among the program managers showed that ACF survey had 1.5 times higher odds of successful treatment outcomes.
- In workers occupationally exposed to lead (Pb smelting plant, n=87), mean BLL showed significant association with the prevalence of hypertension (BP ≥ 140/90) (p = 0.041), suggesting the need for more stringent regulations and control measures.
- Ambient and personal air samples and nasal swab from the employees of two biomedical waste processing plants in Ahmedabad revealed airborne spread of MDR, XDR and pan-drug resistant (PDR) strains of ESKAPE pathogens. Such mode of transmission of AMR needs to be investigated in other potential settings and considered during policy development to combat AMR.
- A study team found that E-waste recycling workers had significantly higher ($p<0.05$) blood levels of metal contaminants like of chromium, nickel and lead, and urine concentrations of arsenic (As), cadmium (Cd), chromium (Cr)) and lead (Pb) compared to the office staff from the same industries. They also had a urine 8-OHdG levels ($p<0.01$) and a high frequency of DNA damage index shown by Comet and MN assays.
- A study on Ceramic industry workers from Morbi in Gujrat found that these workers suffer from high prevalence (17%) of abnormal lung functions (obstructive/restrictive disease) due to high PM4 and crystalline silica exposure, especially in the spray drying and ball milling sections. Periodic screening programmes of workers for early detection of pulmonary compromise is recommended in ceramic tile industry, since the duration of job was associated with compromised spirometry measurements.

ICMR-BHOPAL MEMORIAL HOSPITAL & RESEARCH CENTRE, BHOPAL (ICMR-BMHRC)

- The Bhopal Memorial Hospital and Research Centre (BMHRC) with its eight Outreach Health Centres was started with a mission to provide free health care to those affected by the Bhopal Gas tragedy (1984), and to provide affordable healthcare to the public at large. The hospital was started in the year 2000, while services at the outreach centres were initiated in 1998. Healthcare services have been continuously provided, since then, to the victims of the gas disaster, their dependents, and to the public at large.
- The clinical work at this multi-speciality hospital involves treatment of patients in the out-patient department (OPD), investigations (Pathology, Radiology and Microbiology), procedures and surgeries, in-patient department (IPD) care and rehabilitation. Seventeen specialties are present at the main hospital to cater to the needs of patients *viz*. the departments of Anesthesiology and Critical Care, Cardiology, Cardiothoracic Surgery, Medical Gastroenterology, Microbiology, Nephrology, Neurology, Neurosurgery, Ophthalmology, Pathology, Psychiatry, Pulmonary Medicine, Radiology, Research,

Surgical Gastroenterology, Surgical Oncology, Transfusion Medicine, and Urology. OPDs are run at the eight Health Centres 6 days a week, Radiological and Pathological investigation are done here too. The patients receive high quality health services almost at their doorstep.

- Ayushman Bharat Pradhan Mantri Jan Arogya Yojana (AB PM-JAY) started in BMHRC in January 2019 and is empanelled with the National Health Authority, New Delhi. BMHRC, Bhopal is the only Super Speciality hospital in Central India which has been empanelled for ABPM-JAY. The departments which are covered running under this scheme are Cardiology, Cardio Thoracic Vascular Surgery, Neurosurgery, Urology, Surgical Gastroenterology, Ophthalmology, Psychiatry and Pulmonary Medicine. Since the start of this scheme in BMHRC, Bhopal, 2169 beneficiaries have been benefited till date.

- The OPD footfall in the hospital and its outreach health centres in the year 2022-2023 was approximately 5 lakhs. Inpatients in the year 2022-2023 were approximately 700 per month. Total number of diagnostic investigations done in this period are 6,84,969 (Radiology 33,686, Microbiology 96,144, Pathology and Biochemistry 5,55,139) including 40,218 COVID19 tests (RT-PCR, Rapid Antigen tests and Cartridge-based Nucleic Acid Amplification Tests). 263 COVID19 suspects /cases were admitted and provided treatment in the COVID19 isolation facility. 6232 doses of COVID19 vaccine were administered during this period.

Fig. 17: Nephrology - Dialysis Unit.

Fig.18: Department of Pathology-Routine histological and cytological techniques for tissue/fluid sectioning and staining.

- **TEACHING /TRAINING FACILITIES:**

❖ DNB (Diplomate National Board) in Ophthalmology course is ongoing.

❖ MD Anaesthesia course (Post Graduation) is currently running. The 2nd batch has been admitted.

❖ The Bhopal College of Nursing conducts the following courses:

- ➢ M.Sc. Nursing
- ➢ B.Sc. Nursing
- ➢ Post Basic BSc Nursing.

These courses are recognized by Indian Nursing Council, MP State Nursing Council, and affiliated to MP Medical Science University, Jabalpur. Admissions were taken into Post Basic B.Sc Nursing and M.Sc. Nursing in 2022-23. Total number of admissions in the year is 57. A B.Sc. Nursing student (2016-2021) received Gold Medal from MP Medical Science University, Jabalpur.

- Two batches of BSc Nursing students have been admitted in 2022-23 through the NEET-UG examinations. MSc Nursing is offered in two branches: Obstetrics & Gynecology, and Medical & Surgical Nursing. The Nursing department provided clinical training to students from various institutes in Bhopal.
- **The Paramedical Institute at BMHRC conducts the following Diploma Courses:**

➢ Diploma in Anaesthesia Technician

➢ Diploma in Blood Transfusion Technician

➢ Diploma in Dialysis Technician

➢ Diploma in Cath Lab Technician

➢ Diploma in Medical Lab Technician

➢ Diploma in Optometry & Refraction Technician

➢ PG. Diploma in Perfusion Technology

➢ Diploma in X-Ray & Radiographer Technician.

- Total number of admissions in the academic year 2022-2023 is 64. Currently, there are 122 students pursuing their paramedical courses in the institute.
- 33 students of Psychology underwent internship in Department of Psychiatry.
- Four-days training program with six batches of staff nurses from various districts of Madhya Pradesh was organized by the Department of Psychiatry, BMHRC, Bhopal for National Health Mission (NHM). In each batch there were approximately 20 staff nurses participating.
- Various blood donation camps and Donor registration programmes were organized during Raktdaan Amrit Mahotsav Abhiyaan from 17th September 2022 to 1st October 2022.

Fig. 19: Outdoor Voluntary Blood Donation Camp in Blood Collection and Transportation Vehicle.

Fig. 20: Raktdaan Amrit Mahotsav Abhiyaan.

ICMR-NATIONAL INSTITUTE OF PATHOLOGY (ICMR-NIOP), DELHI

- **Evaluation of the role of mir-495 at an early stage of bladder cancer patients: In vitro therapeutic potential of phytochemicals in bladder cancer cells:** This study determined the role of miR-495 and PTEN/P-Akt in Bladder Cancer (BC), and whether phytochemicals can reduce inflammation and invasion by inhibiting miR-495, PI3K/PTEN/Akt, and activating apoptosis. Microscopic examinations revealed that 42/70 (60%) BC tissues have positive expression of PTEN while rest had negative expression of PTEN in tumor cells of BC tissues. The team examined the expressions of p-Akt(Ser-473) in BC tissues and 57/70 (81.43%) were found to have positive expressions of p-Akt(Ser-473). The results indicate that expression of PTEN was negatively correlated to high grade muscle invasive urothelial bladder tumor suggesting that high stage tumors may have poor prognosis.

- **Detection of 2-Hydroxyglutarate in biofluids of glioma patients-Potential role as a circulatory biomarker:** There is a noticeable difference in levels of D2HG oncometabolite in plasma of IDH mutant and wild type patients. A significant decrease was observed in D2HG levels of Diffuse Astrocytoma when compared in pre op and post op samples. Results suggest that quantification of 2HG in IDH1 mutant gliomas could facilitate the diagnosis, prognosis, monitoring of treatment responses and disease recurrence.

- **TANK binding kinase inhibitors as therapeutic target in triple negative breast cancer: a comparative study in C57/BL/6J versus Mongolian Gerbil model:** The study revealed that NVP-BEZ235 in combination with Amlexanox can synergistically inhibit the proliferation of MDA MB 231 cells by inducing cell cycle arrest in the G1 phase through deregulating the PI3K-Akt-mTOR pathway. The results show a potential in clinical application of the combination of NVP-BEZ235 and Amlexanox in the treatment of triple negative breast cancer.

- **Old Drugs New Tricks: Drug Repurposing for Psoriasis Treatment Using In-silico Approach:** The study has identified Pioglitazone (an antihyperglycemic), Trimipramine (a tricyclic antidepressant) and Dimetindene (an antihistamine/ anticholinergic) as the top contenders for repurposing in Psoriasis treatment. These drugs require further testing in animal models before clinical trials.

- **Integrative analysis of psoriasis transcriptome for identification of potential therapeutic targets:** The integrative analysis indicated the role of IL1β, CDH1 and CDK1 in the development of psoriasis. The identified hub targets could be utilized for developing precision medicine using both structure-based molecular modeling techniques and artificial intelligence.

- **Investigations into biofilm formation by colistin resistant Acinetobacter baumannii and identification of compounds with antibiofilm properties:** Cases of antibiotic-resistant *Acinetobacter baumannii* infections among hospital patients are increasing at an alarming rate and carbapenem-resistant *A. baumannii* is seen as a high-priority pathogen for drug discovery. In an effort to identify compounds with antibacterial and antibiofilm activity against *A. baumannii* , the study team screened 400 compounds provided as Pandemic Response Box by MMV and DNDi using a robust resazurin assay. The screening identified 30 compounds with growth inhibitory properties against the planktonic state and MIC ≤ 50µM (Fig. 21).

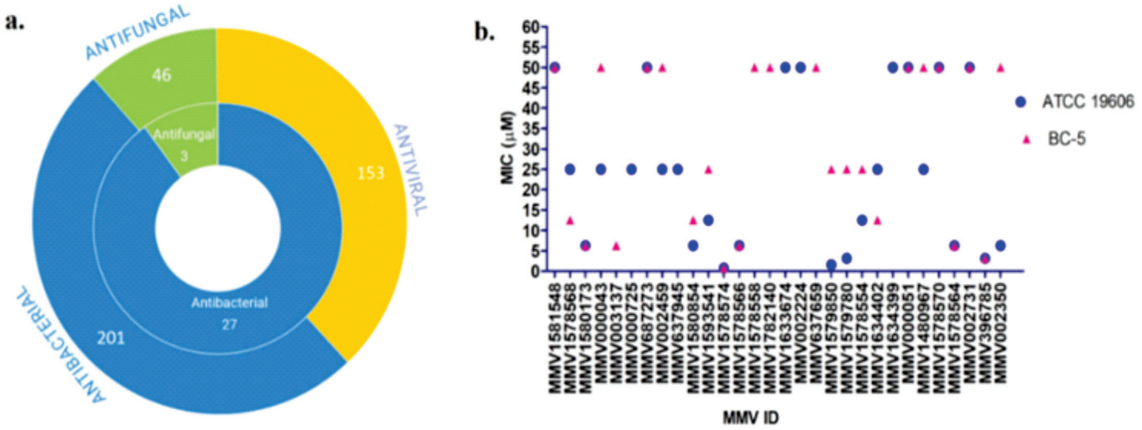


Fig.21: (a) MMV pandemic box screening identified 30 compounds (3 antifungal and 27 antibacterial) with antimicrobial activity against *A. baumannii*. Outer circle represents total compounds classified as antibacterial, antifungal and antiviral according to MMV. Inner circle represents antimicrobial compound hits with MIC ≤50 µM. **(b)** MIC of 30 identified antimicrobial compound against *A. baumannii* isolates ATCC 19606 and BC-5.

Among these, five compounds with MMV ID, MMV396785, MMV1578568, MMV1578574, MMV1578564, and MMV1579850, were found to be effective in reducing metabolically active cells in the biofilm state. MMV396785 showed the most significant potential with an MIC, MBIC, and MBEC of 3.125 µM, 12.5, and 25-100 µM, respectively. It was able to inhibit biofilm formation by 93% and eradicate pre-formed biofilms by 60-77.4%. In addition, MMV396785 reduced the surface area and thickness of biofilms significantly. Further investigation revealed that exposure to 50 µM MMV396785 downregulated biofilm-associated genes in all tested strains. This study identified the novel compound MMV396785 as having potential in vitro antibacterial and antibiofilm efficacy against *A. baumannii.*

- **Application of new tools for molecular diagnosis and surveillance of PKDL and cutaneous leishmaniasis in India:** Post-kala-azar dermal leishmaniasis (PKDL) is a dermatological complexity in apparently cured visceral leishmaniasis (VL) patients. PKDL patients serve as major reservoir of *Leishmania* parasite. To facilitate rapid and accurate diagnosis, this study evaluated the application of CL Detect™ Rapid Test for diagnosis of active PKDL. A total of 82 PKDL cases (macular/polymorphic presentation) and 63 other skin disease cases, often confused with PKDL, were recruited. CL Detect™ Rapid Test was performed using slit skin smear (SSS) samples of 82 confirmed PKDL and 63 other skin disease cases. CL Detect™ Rapid Test showed a sensitivity of 67% and specificity of 100%. A significant co-relation was observed among positive CL detect test samples with those showing presence of LDB in microscopy ($p = 0.0001$) and samples with lower RT-PCR Ct values ($p = 0.001$), compared to CL detect test negative samples.

EXTRAMURAL RESEARCH

- The study on **Strengthening state NCD programme** for diagnosis and treatment of suspected cases of Breast Cancer at medical colleges/institutes has established self-breast examination as a tool for early diagnosis & treatment.
- Contrary to expectations, **ICMR's young diabetes registry** showed almost 23% of T2DM in age group <25 years of age. **ICMR-INDIAB** is the only nationwide survey of diabetes and pre-diabetes completed in all

states of country along with risk factors – hypertension/diabetes/lipids/obesity/ diet. **Mutational analysis in MODY and NDM** helped in changing treatment from insulin to OHA. Studies reported beneficial effects of yoga on cognitive parameters and inflammatory markers.

- IHCI exemplary work in strengthening hypertension treatment within India's primary healthcare system has been recognized by the United Nations Interagency Task Force on the Prevention and Control of Non-Communicable Diseases (UNIATF), with an award in September 2022.

Fig. 22: Award granted by UN Interagency Task Force for IHCI exemplary work.

- **India Hypertension Control Initiative (IHCI):** IHCI best practices are incorporated in the guidelines of the National Programme for Control of Diabetes, Cancers, Cardiovascular diseases and Stroke (NPCDCS).
- The hub and spoke strategies of the **STEMI ACT** project of ICMR are included in the STEMI guidelines of the NPCDCS.
- **Guidelines for Management of Type 1 Diabetes, 2022:** The ICMR formulated guidelines for management of type 1 diabetes and also used leads obtained from ICMR's Young Diabetes Registry data. The document spanning 12 chapters address epidemiology and diagnosis, lifestyle, drugs, monitoring, acute, microvascular and macro vascular complications, education and special group. Document has been published and is available on ICMR website.
- **"IBD NutriCare App"** was released for Inflammatory Bowel Disease (IBD) patients on World Inflammatory Bowel Disease Day (19th May 2022). This is a mobile app which will help patients in recording their real time diet data on a regular basis, track their nutrient intake, monitor their disease activity, and keep a tab on their medicine intake and lifestyle. This will also help physicians and dieticians in the assessment of nutritional status of patients and provide tele-nutrition counseling.

Fig. 23: IBD NutriCare App.

- The study team contributed **two policy documents**:

a) Tobacco Control in India 2022

b) National Injury Prevention strategy document

- **I-MANN- the first mental health database for research in India**: The I-Mann database contains all data of the Capacity Building Task Force.

- **Development and Validation of the Screening Version of the Indian Scale for Assessment of Autism, A screening version of ISAA**: The simple, 10-minute, yes-no questionnaire, the Indian Autism Screening Questionnaire (IASQ), was developed which is an ideal instrument for screening of Autism in community settings and identifying autism early. The early identification can lead to early intervention benefitting the child. The IASQ has a sensitivity of 97-99% in different settings.
- **Development of Panic and Anxiety National Indian Questionnaire (PANIQ):** The team developed Indian version of Anxiety and Panic Questionnaire which is a culturally validated instrument to identify and measure anxiety and panic for Indian population
- **Development of intervention manuals in Mental health:**

❖ For nurse-led intervention for perinatal depression (BIND-P).

❖ For telephonic interventions in suicide attempts.

❖ For detecting physical illness in the seriously mentally ill in the community (Community Level Intervention for Physical Illness in Mentally Ill People-CLIPMI).

❖ For ASHA to detect serious mental illnesses, common mental illnesses and substance use disorders in the community.

❖ The mindfulness intervention module has been also standardized for use in patients with diabetes and depression.

- **Effectiveness of addition of Virtual NIMHANS ECHO telementoring model for Skilled Capacity building in providing Quality care in Alcohol Use Disorders (AUDs) by existing staffs of the DMHP Districts of Karnataka:** NIMHANS ECHO tele-mentoring proved to be an effective model for improving health provider competency and knowledge in Alcohol use disorders. This can connect front-line healthcare workers in the primary care setting of the community and train them to identify alcohol abuse and intervene. NIMHANS ECHO can act as both "knowledge creation" and "knowledge application (action)."

- **ICMR MONOGRAPH PUBLICATIONS:**

❖ Reviews on Indian Medicinal Plants. 2022. Vol 24 (Sa-Sc). Indian Council of Medical Research, New Delhi. pp. 1-1008.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 25 (Se-Sm). Indian Council of Medical Research, New Delhi. pp. 1-833.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 26 (So-Sp). Indian Council of Medical Research, New Delhi. pp. 1-716.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 27 (St-Sy). Indian Council of Medical Research, New Delhi. pp. 1-859.

Fig. 24: Reviews of Indian Medicinal Plants Vols. 24-27.

- **National List of Essential Medicines, 2022**: NLEM, 2022 was released by Hon'ble Minister of Health, Dr. Mansukh Mandaviya on 13th September, 2022. The Standing National Committee on Medicine (SNCM) was constituted by Ministry of Health and Family Welfare with a mandate to revise National List of Essential Medicine (NLEM) 2015. National List of Essential Medicines (NLEM) is expected to result in better quality of medical care, better management of medicines and cost-effective use of health care resources. The NLEM, 2022 contains 384 medicines in 27 therapeutic categories. There are 34 additions and 26 deletions from NLEM, 2015. Special Issues addressed in the revision of NLEM includes Anti-Microbial Resistance (AMR), anti-cancer drugs, Fixed Dose Combinations (FDCs) and inclusion of Patented Drugs. From the 19 antibiotics listed in the Access Category of WHO EML 2021, 16 antimicrobial agents are present in the NLEM 2022. From the 12 antibiotics listed in the Watch Category of WHO EML 2021, 12 antimicrobial agents are present in the NLEM 2022. From the 7 antibiotics listed in the Reserve Category of WHO EML 2021, antimicrobial agents are listed in the NLEM 2022. A section has been added in the list for the medicines considered essential for supportive management of COVID-19.
- **National Hospital based Registry on Venous Thromboembolic Disorder (i-RegVeD)** was inaugurated on 13th June, 2022 at ICMR Headquarter, New Delhi. The aim is to establish a nationwide registry through selected hospitals and collect data for generating evidence on venous thromboembolism (VTE) prevalence for planning response, and strengthening healthcare facilities across different treatment settings.

- **CENTRES FOR ADVANCED RESEARCH & EXCELLENCE:**

This scheme encourages research in causation, progression, management, and/or prevention in identified research areas to get a better insight into the diseased condition.

❖ **Centre for Advanced Research on Virtual Autopsy:** CT scanning of the dead body is found to be useful in age estimation and analysis of internal neck findings which are very important aspects especially in neck injuries. This study has also been able to determine the frequency of internal neck injuries including hyoid-laryngeal fractures in relation to hanging, strangulation and throttling in hanging and to identify the possible mechanism of neck structure injuries utilizing the CT study for more informed medico-legal opinion of post-mortem cases in the interest of truth and justice delivery system.

❖ **Centre for Advance Research & Excellence in Clinical Pharmacology:** Pharmaceutical development of powders for oral suspension (PFOS) of 6-mercaptopurine and PFOS formulation manufacturing has been scaled up to industrial scale and stability of those batches has been tested resulting in more accurate delivery and bioavailability in pediatric population.

❖ **Centre for Advanced Research &Excellence in Neuromodulation:** Theta burst repetitive transcranial magnetic stimulation (rTMS) in individuals with predominantly negative symptoms of schizophrenia and also in other neurological and psychiatric disorders is found to be useful. This study established a research

platform for cognitive science research and training at AIIMS, New Delhi, and contributed to the national and international knowledge

- **CARE in Kidney Diseases: Biomarkers and newer therapeutics:** This centre focuses on the utility of urinary exosomes (uE) as non-invasive biomarkers in kidney diseases and may obviate the need for kidney biopsy in the future. The first project under this centre focuses on early prediction of incident chronic kidney disease (CKD) in high-risk population, the second project on the non-invasive diagnosis of diabetic kidney disease (DKD) and non-diabetic kidney disease (NDKD) and the third on therapeutic potential of exosomes. Several potential miRNA signatures that are differentially regulated between DKD and NDKD have been identified by microarray analysis and are under validation. Kidney-derived exosomes have been isolated and in vivo testing has shown their successful delivery to the kidney tissue in rats. Diabetic rats treated with kidney-derived exosomes displayed renal pathology that was milder as compared to untreated rats after 10th week of diabetes induction.

- **Centre for Advanced Research (CAR) in Pediatric Uropathies and CKD:**The aim of this centre is to diagnose individuals at high risk of end stage renal disease (ESRD) due to congenital uropathies at the earliest and to prevent or slow the progression of ESRD and optimize treatment. The presence of the D allele of angiotensin-converting enzyme (ACE) and/or the A allele of angiotensin II receptor type-2 (AT2R) and elevated urinary trefoil factor 3 (TFF3) levels have been found to be significantly associated with progressive deterioration in kidney function. A progressive increase in plasma renin activity (PRA) in children has been shown to be associated with asymptomatic prenatally diagnosed hydronephrosis and reflects obstructive stress in the tubulo-interstitial compartment. This stress is relieved by pyeloplasty and is reflected by a drop in PRA after surgery. PRA can thus serve as a discriminatory factor to identify hydronephrosis patients 'at-risk' for surgery even before the current criteria for pyeloplasty are met.

- Under CARE ALS, a study on "Glia mediated Neuro-inflammation in ALS- A translational approach through human studies and experimental models" is investigating the relation between microglial activation and the potential biomarker for early detection of ALS i.e. CHIT-1 levels.

- **Human Skeletal Muscle Disease Biobank:**ICMR has established a Human Skeletal Muscle Biobank at NIMHANS, the first of its kind in the country in 2017. From 2017 till date a total of 5466 muscle biopsies have been banked till now. Other related biomaterials that have been banked include serum samples (1738), DNA (1643), RNALater (262) and skin punch biopsies (64). The major categories of neuromuscular disorders (NMDs) that have been banked include muscular dystrophies, neurogenic atrophy, inflammatory myopathies, congenital myopathies and metabolic myopathies. The biobank has developed a hospital-based database of neuromuscular disorders to estimate the burden of NMDs in our country. In the future, the biobank will continue to provide a rich source of high-quality biological materials (serum, DNA, muscle tissue) to the scientific community for basic and advanced research in the field of neuromuscular disorders.

❖ **Center for Advanced Research and Excellence in Intestinal diseases:** The centre is focusing on Intestinal diseases with major emphasis on Inflammatory Bowel disease (Ulcerative colitis, Crohn's Disease), Celiac disease and Abdominal Tuberculosis. The major development was of "IBD NutriCare App"

❖ **Centre for research and excellence – Heart Failure (CARE-HF):** CARE-HF has following projects:

➢ **The National Heart Failure Database** has migrated data from 25,158 patients from 4 registries (Kerala Heart Failure Registry, Trivandrum Heart Failure Registry, National Heart Failure Registry and Medanta Registry) in the country to a single database.

➢ **National HF Biobank,** Bio-specimens samples including serum, whole blood, deoxyribonucleic acid (DNA), peripheral blood mononuclear cells, and tissue samples, have been collected from 2123 patients to date.

➢ **Targeted Next-Generation Sequencing in Hypertrophic Cardiomyopathy (HCM),** a hospital-based case-control study designed to validate the association of pathogenic mutations with HCM in Indian patients using targeted mutation testing. Data collection of 200 patients is completed. Overall, 51% of the probands (102/200) harbor likely pathogenic variants or variants of uncertain significance (VUS) in cardiac sarcomere or Z-disc genes.

➢ **Quality of Life among HF patients and its correlates** An India-specific quality of life (QOL) tool for HF patients has been developed and is being compared with six different standard QOL tools. The baseline data of the 1000 heart failure patients is completed and follow-up is ongoing.

➢ **Development of a point of care (POC) device for measuring NT pro-BNP**. This project is developing a point-of-care (POC) device for the detection of NT-pro BNP with a detection level of 50 pg to 10,000 pg/ml (CHITRA NT-proBNP). Currently, the validations and testing of the minimum viable prototype are ongoing to meet ISO13485, before clinical validations.

- **INDO-EUROPEAN COLLABORATION ON CANCER:**

❖ **Role of HPV in Head and Neck cancer in Rural and Urban India:** With an attempt to investigate the natural history and the prognosis of head and neck cancer with respect to HPV infection status and presence of other risk factors after stratification for known prognostic markers and treatment, it was found that overall prevalence of HPV in HNC was 39.43%; the sub-site analysis showed HPV prevalence in oral cancer-36.27%; oropharynx-50%; hypopharynx-50% and larynx-26.32%. The most prevalent HPV genotype was HPV16 amongst all HNC sub-sites.

❖ **Role of HPV Infection and other Co-factors in Aetiology of Head and Neck Cancers in India & Europe:** Multicentric study involving five Indian sites, Cancer Institute (WIA), Chennai; V N Cancer Centre, GKNM Hospital, Coimbatore; Motilal Nehru Medical College, Allahabad; Regional Cancer Centre, Trivandrum and Rajiv Gandhi Center for Biotechnology, Trivandrum recruited 5,000 HNSCC specimens, which remained the largest collection of samples. The study reported HPV16 prevalence of 20% in oropharynx and 7.33% at the oral cavity. The proportion of HPV16 positive oral cancers was 7% in this population, similar to estimates worldwide.

Marginal regional variation was observed, while the estimates for HPV prevalence in oropharyngeal cancer varied between 18 to 32%. No difference was noted for HPV involvement in laryngeal tumors, which was noted consistently to be around 13%. Oral cancer HPV prevalence varied from 4 to 10%.

- **HEART FAILURE INITIATIVES:**

❖ **Trivandrum Heart Failure (HF) Cohort**: ICMR continued its support to country's first heart failure patients' urban rural cohort at Trivandrum City and the rural Athiyannoor block Panchayat. The registry had enrolled 1205 HF patients who were followed up every three months. The 5- year mortality rate was 59% (n = 709 deaths), and median survival was 3.1 years. Sudden cardiac death and pump failure caused 46% and 49% of the deaths, respectively. The study showed HF patients in the cohort were younger, more likely to be men, had a higher prevalence of IHD, reported longer lengths of hospital stay, and had higher mortality compared with published data from other registries.

❖ **National Heart Failure Registry Program (NHFR)**: This is largest Nationally representative heart failure registry in the country, was established in 2018, had 53 centres and registered 10850 patients. The mean age of HF patients was 60 ±13.5, ten years younger than the Western population. Patients with reduced ejection fraction have a higher risk of life-threatening complications like cardiac arrest.Sixty-three percent of patients had reduced ejection fraction (HFrEF). There was an excellent follow-up rate (95.2%, n=10326) among patients for one year. The most common cause of HF in these patients was IHD (72.3%). Rheumatic heart disease was responsible for HF in 6% of patients.

❖ **Congenital Heart Diseases Initiatives:** A study "Assessing the neurodevelopmental outcomes in infants undergoing surgery for congenital heart defects" has been initiated in five clinical centres. This multicentric study in 5 centres has enrolled 1151 children with CHD undergoing corrective cardiac surgery. The first and second neurodevelopmental assessments at 6 and 12 months have been completed in 604 and 304 of these children. Preliminary analysis suggests that 29.8% had delayed motor and 19.1% had delayed mental development at the first assessment. Similarly, 15.8% and 11.7% of the children had delayed motor and mental development, respectively, during the second assessment. The study found high in-hospital mortality (8.6%), the most common cause being septicaemia.

❖ **Channelopathies initiatives:** This is a systematic investigation of 500 patients with suspected channelopathy and their available family members to understand the genetic variations landscape in cardiac channelopathies and to study the outcomes of genotype-phenotype-guided management strategy in these patients from North and South Indian patient cohorts. The study has recruited 207 subjects (46 probands and 161 first-degree relatives) so far. Exome sequencing and analysis have been completed for 44 samples. Bioinformatic analysis has revealed likely pathogenic gene variations such as KCNQ1, CACNA1C, SCN5A, and KCNQ1 and novel pathogenic variations in GJA5. Additionally, a novel pathogenic frameshift variation in RYR2 was identified in the study.

- **NEUROSCIENCES:**

❖ **Surveillance and Management System through Community involvement and Technology in rural Tirunelveli:**Of the 218 stroke patients registered in the study, about 88.1% were ischemic stroke, 61% and 46.3% had hypertension and diabetes mellitus, respectively. Maximum cases (61%) were in the age group of 51-70 years. Most common mode of transportation used by the patients was hired vehicle (62%); ambulance was used by only 8.7% of the patients. Only 22.3% patients reached the hospital within the golden hours (<3 hrs). The reasons for the delay were non-recognition of symptoms, non-availability of transport, delay in referral and imaging process. This project developed a mobile application named TAEI-"**SMART**" (Stroke Mobilization and Rapid Treatment) for reducing the onset to door time to enhance the Management of Stroke patients effectively and reduce mortality and morbidity.

❖ **Establishment of Population-Based Stroke Registry in Dibrugarh, Assam:** This population-based stroke registry, covering the geographical limits of Lahowal & Barbaruah blocks of Dibrugarh district, aims to provide data on stroke burden in north-east region. Approximately, above 18 years population in two blocks was 2,51,520. Data was collected from 24 health care facilities including a tertiary care teaching hospital (AMCH), private hospitals, tea garden hospitals, scan centres; from community using ASHAs and ANMs; and from municipal corporations' death records. Total number of stroke cases registered were 5650 of which 1223 were from the study area. Haemorrhagic stroke was the most prevalent type of stroke in this population (65.1 %) and these patients were younger (56.4 years±12.2) as compared to ischemic stroke patients (60.4 years ±12.8) and 64.2% were men. The most prevalent stroke risk factor among stroke patients in this registry was hypertension (62.4%) followed by alcohol consumption (54.9%), tobacco smoking (13.6%), diabetes (12.9%). Poor control of blood pressure and monitoring could be related to high proportion of strokes in this northeast population. Raising community awareness about hypertension can reduce its prevalence and improve its treatment.

❖ **Stroke Care Pathways in Northeast:** In view of the large burden of stroke and absence of care facilities in Assam, ICMR is building stroke Care Pathway models at Dibrugarh and Tezpur, Assam. The aim is to decrease response time of stroke victim through establishment of 24-hour Stroke Emergency Helpline, a 6-7 bedded stroke care unit at a Stroke Care Facility, a Mobile Stroke Unit (MSU), 'State of Art' ambulance with mobile CT scanner, telemetry and facility to provide thrombolytic therapy in consultation with neurologist.

❖ **Establishment of Clinical Stroke Care Pathway using Mobile Stroke Unit in Tezpur:**

The present study is being conducted in three blocks of Tezpur district with establishment of Baptist Christian Hospital (BCH) and Tezpur Medical College Hospital (TMCH) as stroke ready facilities. BCH & TMCH set up a 24-hour stroke emergency helpline 9126091260. Training and awareness programs were conducted for 2600 health workers including medical officers, lab technicians, pharmacists, ASHA, ANM, nurses, teachers, anganwadi workers, tea garden workers, chowkidars and villagers from Feb 2022 to Jan 2023.

❖ **Establishment of Clinical Stroke Care Pathway using Mobile Stroke Unit in**

Dibrugarh: Thrombolysis was not being done at Assam Medical College Hospital (AMCH), Dibrugarh before this project was initiated. Stroke Unit was setup at AMCH in March 2021. Emergency alarm system (Green Channel) and patient care pathway for patients attending casualty of AMCH was developed. A total of 2838 stroke patients were admitted at AMCH between February 2021 and December 2022, of which 27.07% had ischemic stroke and 72.6% had haemorrhagic stroke. Around 37% of haemorrhagic stroke were less than 50 years old. The male: female ratio of stroke cases was recorded as 63:37. Only 569 (20%) stroke patients reached hospital within window period. Out of 443 cases which were from study site 172 (39%) cases arrived AMCH within 4.5 hours of stroke onset. Of the total stroke patients, 44.6%, travelled by 108 ambulances, 29.1%, by own car and 14.13% by Private ambulance. Out of the 132 ischemic stroke cases, 41 reached within window period and 34 were thrombolysed. The median door to CT time was 6.49 hours before setup of stroke unit and improved to1 hr 38 minutes.The MSU ambulance is parked regularly at PHCs, CHC and sub-centres for generating awareness in community. 829 calls were received by the stroke helpline number at AMCH, of which 39 calls were related to stroke patients. MSU was dispatched in 37 cases and CT was performed in the periphery; 8 cases were diagnosed as Ischemic and 29 cases were diagnosed as hemorrhagic stroke. The average door to CT time was 16 min and door to thrombolysis time was 20 minutes. Out of the 8 ischemic stroke, 3 patients of ischemic stroke were thrombolysed in the periphery. With the introduction of MSU in this area and setting up of stroke unit , the number of patient coming to AMCH has increased six fold.

- **Establishment of the Indian Stroke Clinical Trial Network (INSTRuCT):** The Indian Stroke Clinical Trial Network (INSTRuCT) was setup in 2017, with the objective to establish a state-of-the-art stroke clinical trial network and to conduct pharmacological and non-pharmacological stroke clinical trials relevant to the nation. This network is the 4th government sponsored network of the world and only of its kind in developing world. **With the successful setup of the INSTRuCT network in Phase I in 30 centres, INSTRuCT Phase II** network has been initiated recently and extended to 50 centres. Four new clinical trials have been initiated recently under this network:

  - INTRINSIC Trial- Indian Trial of Tranexamic acid in Spontaneous intracerebral haemorrhage.
  - STENOSIS- Long-term Single versus Dual Antiplatelet Therapy In Patients With Ischemic Stroke due to Intracranial Atherosclerotic Disease: A Randomized Trial.
  - RE-OPEN- Randomized Trial of Biosimilar TNK Versus TPA during Endovascular Therapy For Acute Ischemic Stroke Due To Large Vessel Occlusion.
  - MOBILITY- Medical Application based Post Stroke care Strategy for survivors and their caregivers: A Randomized Controlled Trial.

- **Development of a skill-based Neurocognitive testing protocol to assess cognition and diagnose dementia in a context of complex skills and low literacy:** Multilingual Dementia Research and Assessment Toolbox (MUDRA)/ ICMR Neuro Cognitive Tool box (ICMR-NTB) has been developed in five different Indian languages in an earlier

project that can be used to assess cognitive impairment due to stroke and other dementias in different populations within India. This tool has been provided free of cost to research teams and clinicians. In phase-II a project has been initiated**.** A healthy cohort of 64 illiterate and literate subjects has been developed to serve as a control for this study. The illiterate individuals have low levels of digital literacy – using computers (nil), smartphones, social media etc. Therefore, it was found that innovative tools have to be built to test the cognitive ability.

❖ **Indian Multiple Sclerosis and allied demyelinating disorders registry and research network (MS-Registry) (IMSRN):**ICMR's 'Indian Multiple Sclerosis and allied Demyelinating Disorders Registry and Research Network' is the country's first nationwide database on rare diseases like multiple sclerosis (MS) and related demyelinating conditions of the Central Nervous System. This project was started in August 2021 and has 25 centres around the country. In this study, online portal for adding and accessing patient records from the site https://imsrn.icmr.org.in/ have been developed. There are two portals under this site: one for the extensive clinical record forms (CRF), and the other for MRI imaging data, to track disease progression. The registry has already registered 1828 cases- Multiple Sclerosis (MS)-619, Neuromyelitis Optica Spectrum Disorder (NMOSD)-166, Myelin oligodendrocyte glycoprotein (MOG) antibody disease-139, Clinically Isolated Syndrome (CIS)-26, Chronic relapsing inflammatory optic neuropathy (CRION) - 15, Acute disseminated encephalomyelitis (ADEM) -9), Radiologically Isolated Syndrome (RIS) -5 and CLIPPERS-1.

❖ **Establishment of satellite Brain banks in India for neuroscience Research:** The aim of the study is to promote establishment and networking of Brain Banks at PGIMER, Chandigarh and AIIMS, Bhubaneshwar with NIMHANS as a nodal centre to facilitate neuroscience research in the country. Standard Operating protocols for collecting, processing and storing the brain samples have been developed, Training videos have been developed. A brochure has been created to spread awareness of organ donation. Total 45 brain tissue samples have been collected so far, of which 9 are fetal brain samples. The PGIMER, Chandigarh biobank is planned as fetal brain bank for neuro developmental research, the first of its kind in the country. Digital brain bank to collect neuro-imaging data in post-mortem brains is planned.

- **ORAL HEALTH INITIATIVES:**

❖ **Assessment of Emotional and Behavioral Problems and Quality of Life among Children and Adolescents with Cleft and Lip Palate:** This project has been started to assess the kind and severity of the emotional and behavioral problems experienced by children and adolescents with CLP.In the current sample of 30 participants, the results highlight that the CLP group has lower self esteem and quality of life with more difficulties as compared to the control group. The assessment is indicative of emotional and behavioral problems being more prominent in children and adolescents with CLP as compared to those without CLP.

- **RESEARCH ON SNAKEBITE:**

❖ Under the "ICMR-National Task Force for Research on Snake Bite" the following multi-

centric projects on snake bite have been initiated:

- Nationwide Study to estimate incidence, mortality, morbidity and economic burden due to snakebite in India. This multi-centric study is being conducted covering 14 states, 39 districts, 372 Blocks across the country with about 7% population as 2011 census.
- ICMR National Snakebite Project (INSP) on capacity building of health system on prevention and management of snakebite envenomation including its complications.

REPRODUCTIVE, CHILD & NUTRITION HEALTH

ICMR is undertaking research in the field of reproductive, child and Nutrition health through its research institutes viz. National Institute of Research in Reproductive Health, Mumbai, National Institute of Nutrition, Hyderabad as well as extramural research projects. These studies are aimed to protect and enhance the reproductive and nutritional health of people through research and development of technologies and programmes for field applications which can be incorporated into National Programmes.

INTRAMURAL RESEARCH

ICMR-NATIONAL INSTITUTE FOR RESEARCH IN REPRODUCTIVE AND CHILD HEALTH (NIRRCH), MUMBAI

- The institute established National clinical database and biorepository of endometriosis.
- The Biomedical Informatics Centre of the institute has created an online resource - GeDiPNet freely accessible at http://gedipnet.bicnirrh.res.in/. It currently has information on 7297 diseases associated with 12,280 genes with their relevant annotations. This resource can accelerate disease informatics and health research initiatives.
- The institute has developed the first-ever online tool for polypharmacological target and drug prediction, which accurately identified popular repurposed drugs such as sildenafil (Viagra) for hypertension and erectile dysfunction (which was otherwise an accidental discovery) and metformin for PCOS and diabetes mellitus.
- The Biomedical Informatics Centre of the institute has released the fourth online version of database for antimicrobial peptides - $CAMP_{R4}$ that is freely accessible at http://www.camp.bicnirrh.res.in/. It contains manually curated information on sequence, protein definition, accession numbers, activity, source organism, target organisms, protein family descriptions, N and C terminal modifications of antimicrobial peptides. It also has ML-based algorithms for prediction and rational design of natural and synthetic AMPs.

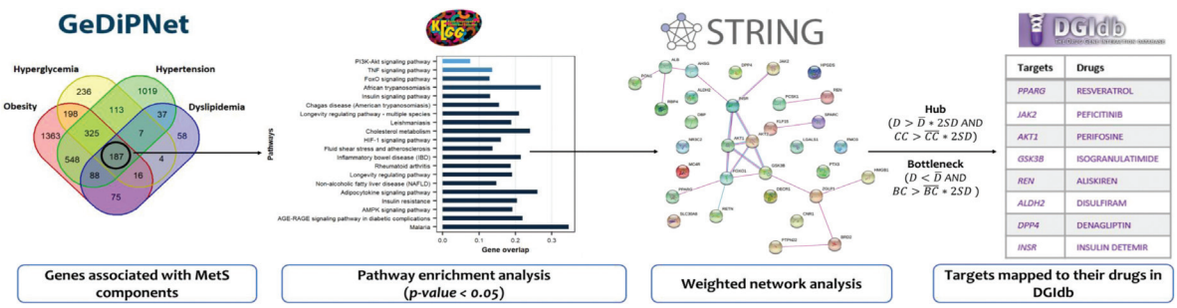


Fig.1: GeDiPNet algorithm for identification of polypharmacological targets for metabolic syndrome.

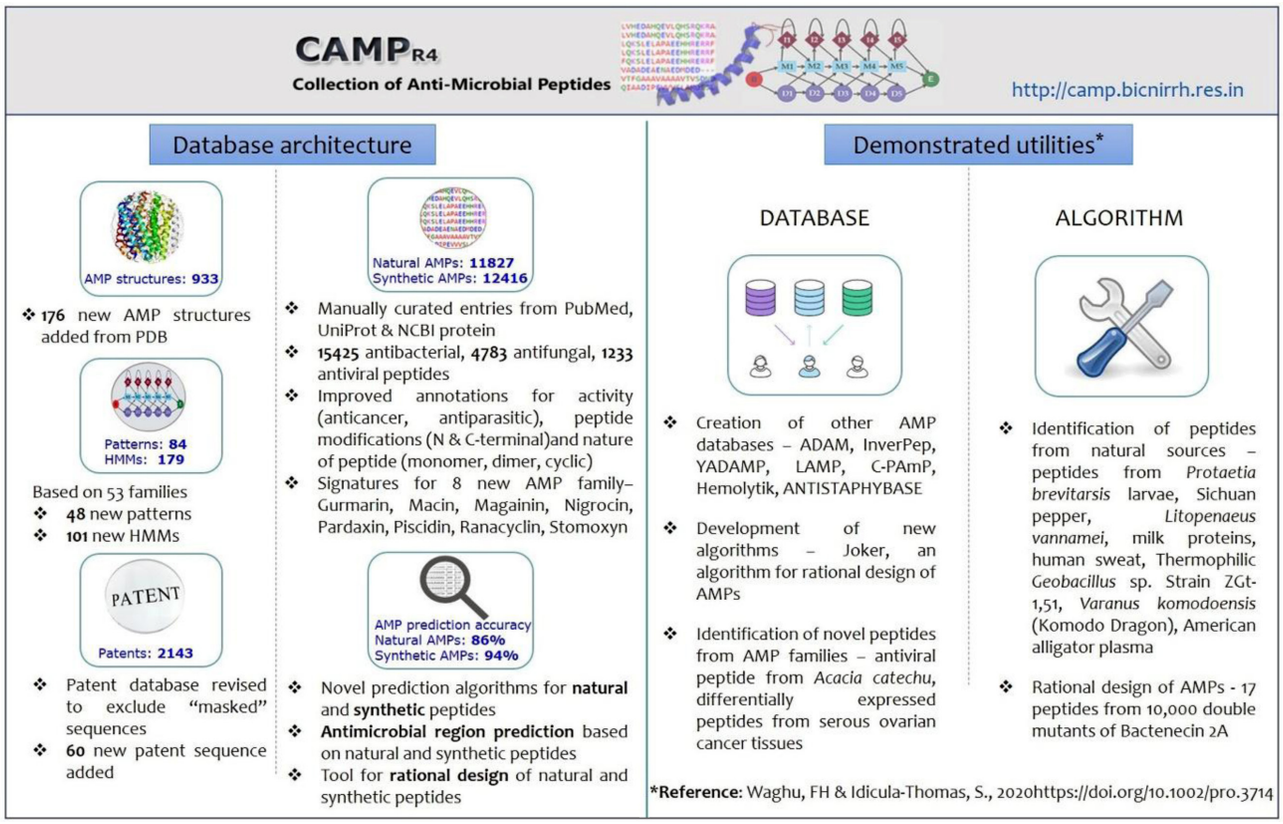


Fig. 2: Overview of $CAMP_{R4}$ database.

- The centre established promising therapeutic and prophylactic potential of a recombinant fragment of human SP-D (rfhSP-D) in the hamster and transgenic mice model of COVID-19.
- Point of care sickle cell tests were rolled out in the national program at a cost estimated through HTA study conducted at the institute.
- Future road map for the national program on prevention and control of snakebite in India was provided to Niti Ayog.

ICMR- NATIONAL INSTITUTE OF NUTRITION (ICMR-NIN), HYDERABAD

- Comprehensive Nutrition Assessment of Tribal Population in Attappadi Taluk, Kerala – A Rapid Exploratory Study revealed that the deficit of median dietary intake of micronutrients against their RDAs was high pertaining to vitamin A (78-80%), followed by riboflavin (69-73%), calcium (67-74%), iron (45-50%), niacin (41-44%) and vitamin C (24-52%) in children under five years. Inadequate dietary intake of a nutritious diet was a significant contributor to undernutrition and hidden hunger. Although there has been a marginal reduction in the prevalence of malnutrition from 2013 to 2022, underweight children prevalence has remained a serious public health concern.

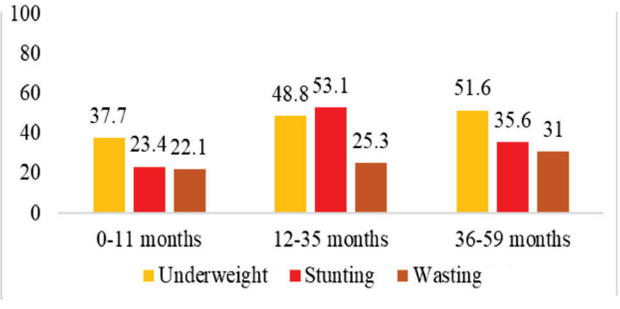


Fig. 3: Prevalence (%) of under-nutrition among children by age (in months).

- An outbreak of acute gastrointestinal and neurological symptoms among workers at an apparel factory in Anakapalle was investigated and it was found that clinical picture and epidemic pattern are characteristic of a common source, single exposure outbreak suggestive of inhalation of Imidacloprid, organophosphate insecticide.
- An android app e-STAR is a digital Innovation by the Institute to implement 'screen and treat anaemia' at the population level.
- The Institute established that combined prenatal to postnatal protein restriction in rats led to reduction in body weight and skeletal muscle atrophy through enhanced protein degradation in the offspring. These results suggest that chronic exposure of rats to a maternal low-quality protein and protein restricted diets induced adverse effects by influencing body composition, and skeletal muscle proteolysis.
- A functional food mix of amla, turmeric, cinnamon, black pepper, ginger and fenugreek in a specific proportion has been found to be very effective in delaying cataract progression in rats.

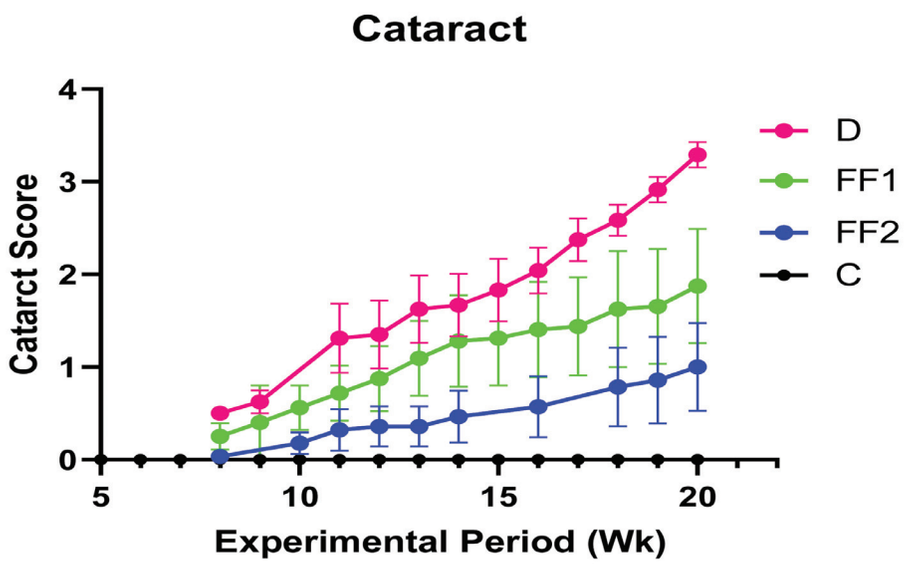


Fig. 4: A functional food mix delayed the progression of cataract in diabetic rats. Quantitative representation of cataract progression in the experimental groups with time. Data is mean ± SEM. C-control, D-diabetes, FF1-diabetic rats treated with functional food dose-1, FF2-diabetic rats treated with functional food dose-2.

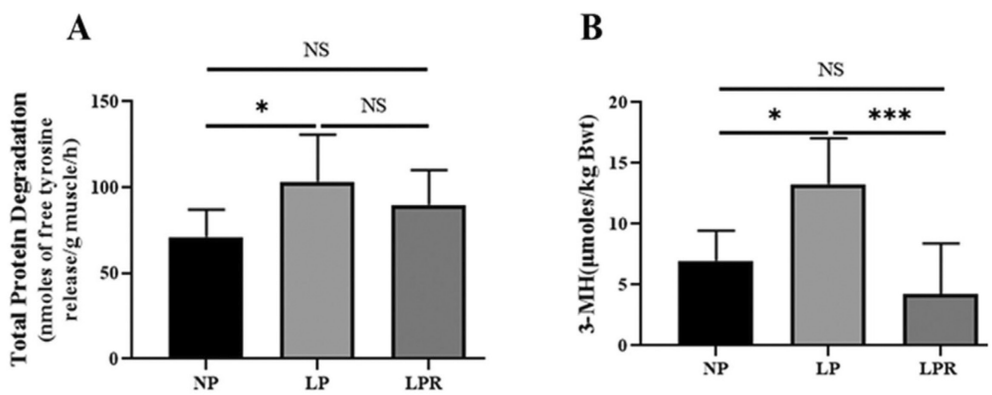


Fig. 5: Effect of chronic protein restriction on skeletal muscle proteolysis of the offspring: Total protein degradation (TPD) was measured in the gastrocnemius muscle. (Panel A) the TPD was measured by the amount of free tyrosine released into the medium (Panel B) estimation of 3-methylhistidine excreted in the urine. Values are the mean ±SD; *P < .05, and ***P < .001. NP, normal protein; LP, low-protein; LPR, low-protein group rehabilitated with NP diet.

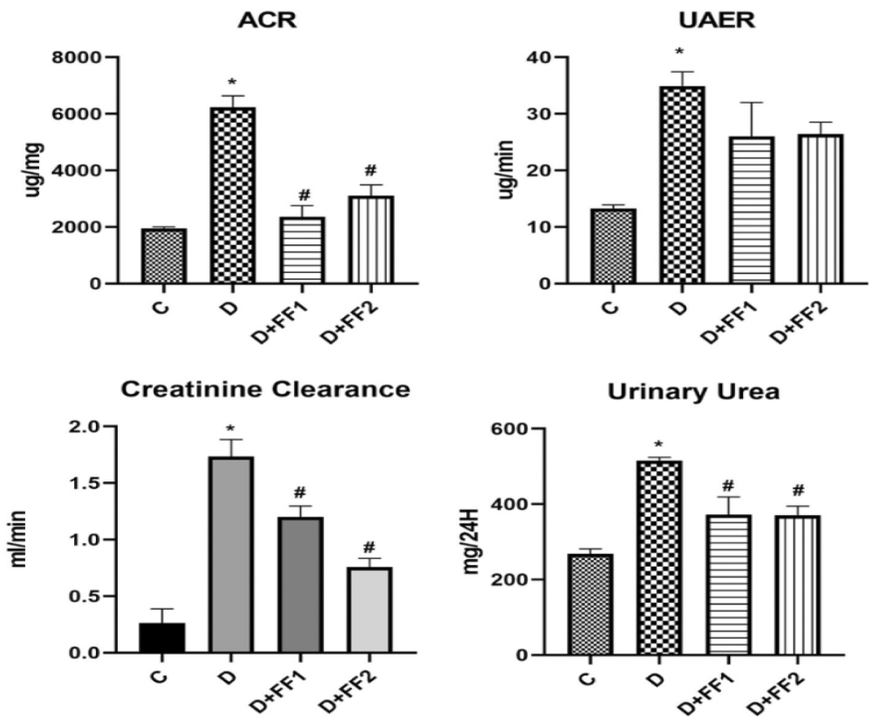


Fig. 6: A functional food formulation (FFF) attenuated proteinuria and renal pathological changes in diabetic rats. Effect of FFF on renal parameters. Data is mean ± SEM. C-control, D-diabetes, FF1-diabetic rats treated with functional food dose-1, FF2-diabetic rats treated with functional food dose-2.

- A functional food formulation containing amla, turmeric, cinnamon, ginger, and black pepper has been developed and study team has provided preclinical evidence that this formulation can prevent diabetic nephropathy in rats.
- First time in India, the food chemistry Division of the Institute has established an exclusive facility with the CDC support, using stable isotope dilution GM-MS method, to measure and monitor the Trans-fat levels in blood and foods.
- The institute validated a novel point-of-care Hb measurement in pooled capillary blood by a portable autoanalyzer which has better Hb estimates than conventional point of care methods being used.
- In a study on impact evaluation of screen and treat strategy for anaemia reduction, it was found that a new behavioural change communication (BCC) method like IVRS (Interactive Voice Response System) may improve adherences to oral iron therapy
- The study team found that n-3 PUFA deficient diets during pregnancy might potentially increase adiposity and affect the growth adversely.
- It was found that Nano-entrapped curcumin has improved bioavailability compared to native curcumin. It was also shown to suppress the expression of pro-inflammatory cytokines more efficiently than native curcumin and thus could have a greater anti-inflammatory effect than native molecules.
- Pre-clinical data demonstrated that maternal exposure to bisphenol A (BPA) and its substitution bisphenol S (BPS) in rats, at concentrations much lower than those detected in the human population, might alter the programming of endocrine-directed metabolic changes in the offspring. Early exposure to bisphenol may result in adverse impact on male reproductive health in later life.
- The institute estimated the glycaemic or available carbohydrate content of different food items in vitro by carefully mimicking

their digestion in the human body in controlled laboratory conditions.

- The study team estimated the glycaemic index and glycaemic loads of more than 150 foods such as breakfast foods, lunch and dinner foods, fast foods, bakery foods, chat foods, junk foods etc.
- Data of Microbiological Safety and Quality of commonly consumed herbal drugs can be used to establish microbiological criteria for herbal drugs regulations in India.
- A study conducted among 3231 participants (Adults – 2616, and adolescents – 615) in the age group 10-60 years in five regions of India on acceptability and potential use of different formats of Front-of-pack nutrition labels (FOPNL) in promoting informed food choices suggested that warning labels can deter choice and consumption of even moderately unhealthy foods, while summary ratings like health star or NutriScore can help identify healthier variant among the available foods.
- Six e-dialogues were conducted under the 'Let'sFixOurFood' consortium activities supported by UNICEF. The six E-dialogues were held on (i) restricting advertising and marketing exposure of unhealthy foods and beverages for children (ii) Impact of advertising and marketing on adolescent food choices (iii) Front of Pack Nutrition Labelling for promoting healthy food choices among adolescents (iv) Nutrition literacy among adolescents (v) Taxation on HFSS foods to discourage consumption (vi) Priorities in nutrition education for school age children. Several knowledge products and policy briefs were co-developed with PHFI and other consortium partners to be shared with NITI Ayaog.

EXTRAMURAL RESEARCH

- ICMR multi-centric task force study on polycystic ovarian syndrome (PCOS) is one of the largest studies providing data on prevalence of PCOS and regional phenotypic variation in India. The study provides valuable information relevant for clinical management and policy on PCOS. The ongoing study on individualised lifestyle intervention in PCOS-affected women is expected to provide information on the impact of intervention on improvement in quality of life indicators and metabolic parameters. The study team is currently also facilitating research evaluating the role of various environmental, genetic and epigenetic factors in the onset and progression of PCOS.
- The Centre for Advanced Research on pre-eclampsia identified predictive biomarkers for early detection of pre-eclampsia including saturated fatty acids, long chain polyunsaturated fatty acids, higher delta 6 desaturase activity, low magnesium, low vitamin D as well as imbalance in angiogenic factors.
- Preconception Care (PCC) is critical for improving pregnancy outcome but implementation of PCC services through government programs remains a challenge. The mission mode study initiated this year will provide important evidence on the acceptability, feasibility and costs of implementing PCC services through health system and will help further scale up of the intervention.
- Two task force studies on gestational diabetes mellitus (GDM) have been initiated in this year for evaluating the appropriateness of prevalent criteria used to diagnose GDM in India and the preparedness of the health systems in implementing the Government of India guidelines for the diagnosis and management of GDM. These studies will provide important evidence to improve management of GDM and implementation of guidelines.
- Two centres for advanced research on paediatric respiratory and kidney diseases have developed newer diagnostic techniques

like high-speed video microscopy for Primary Ciliary Dyskinesia and improved treatment options in frequently relapsing nephrotic syndrome.

- National Registry of Rare Diseases and other Inherited Disorders has progressed this year with enrolment of total 9100 patients till now with the help of a network of hospitals diagnosing and treating these rare diseases
- Two task force studies on Anaemia evaluating 'screen and treat approach for anaemia reduction' and efficacy of multiple micronutrient supplementation compared to iron folate supplementation have been completed providing helpful evidence for the Anemia Mukt Bharat program.
- ICMR-Cochrane Affiliate Centre conducted workshops imparting training on systematic reviews where more than 300 participants joined. ICMR Advanced Centre for Evidence based child health, PGIMER, Chandigarh also organized nine workshops as a part of capacity building of young researchers.
- As a contribution to the country's effort to manage COVID 19, the Centre for nutrition research and training was actively involved in inventory management and distribution of COVID 19 diagnostic kits to laboratories across the country through a network of 4 central depots and 13 regional depots and has facilitated the distribution of around 10 lakh COVID 19 diagnostic kits (RT-PCR, RNA) during the year 2022-23.

INTELLECTUAL PROPERTY RIGHTS

The IP protection of innovations generated either through intramural or ICMR supported extramural innovation research project had been considered. After carrying out proper due diligence such as identification of IP component, establishment of novelty, non-obviousness and industrial applicability, the protection of IP need to be made through patents, copyright, designs and trademark. Converting the innovative and technical information into techno-legal information involves activities viz. due diligence of new invention reports, patentability examination, patent filing and prosecution (India & abroad), patent grant & monitoring, weeding out unproductive patents. A total of 42 Indian patent applications, 4 design applications, 3 copyright applications and 6 foreign patent applications were filed. 2 Indian patent and 4 foreign patents were granted.

Table 1: Indian Patent Application, Design and Copyright Applications.

S N	Tile of invention	Patent Application No
1.	Quantum dot antibody conjugate and method of preparation thereof.	202211021649
2.	A biomarker panel for early prediction or detection of liver metastasis in lung cancer.	202211021943
3.	A composition for isolating exosomes and method thereof.	202211022537
4.	Loop mediated isothermal amplification primers for simultaneous detection of multiple human Plasmodium species.	202211022727
5.	Photoacoustic spectroscopy and machine learning-based method to detect human breast tumor in xenografts.	202211023646
6.	A System and Method for Phase Imaging and Absolute Refractive Index Measurement.	202211026976
7.	Customized 3D Printed Hollow Capsular Device, Uses And Method Of Fabricating Thereof.	202211027762
8.	Novel aptamers against bacterial vaginosis associated bacteria (BVAB).	202211029191
9.	A biodegradable implant for Deep wound healing and process for preparation thereof.	202211031167
10.	A method for identification and classification of proteins based on auto fluorescence.	202211031669
11.	A bivalent typhoidal bacterial ghost (BTBG) immunogenic formulation and method for preparation thereof.	202211034380
12.	Device And Method For Design And Development Of A Medical Glove For Hand Tremor Management Caused By Parkinson's Disease.	202211035303
13.	An Innovative Artificial Diet for Adult Female Aedes Aegypti Mosquitoes	202211038493
14.	A fusion construct containing Salmonella Typhi outer membrane protein as a candidate vaccine.	202211039222
15.	Transdermal delivery of cyclosporine A using ionic liquids mediated pluronic gel.	20221103907

16.	Natanite- A soft, self-dispensable, and sustained release ocular insert formulation of natamycin using 3D-printing and its composition thereof.	202211041047
17.	Novel method on Diagnosis of SARS Cov-2 using Nucleic acid extraction free real time PCR system.	202211041619
18.	A new biomedical device for improving shape of nose after septo-rhinoplasty.	202211044156
19.	Development and Evaluation of Novel Multifunctional Nanocarriers loaded with Rivastigmine and siRNA for the management of Alzheimers Disease.	202211046214
20.	A Device For Measuring Dynamic Changes In Optical Properties Under Different Conditions For Photothermal Theranostics.	202211046195
21.	Designing of patient specific Total Elbow Replacement prosthesis for Indian Population".	202211047926
22.	Low Volume device for glycated hemoglobin detection in capillary or venous blood.	202211048056
23.	Avian Embryo Chorioallantoic Membrane as a Biological Testing Membrane.	202211050928
24.	A Culture Media Formulation for inducing angiogenic differentiation.	202211051584
25.	NIV's multiplex single tube Influenza and SARS- CoV-2 RTPCR detection kit.	202211052927
26.	Novel bone graft to be used as scaffold in bone tissue engineering in critical sized defects.	202211055922
27.	LAMP assay for rapid detection of Monkeypox virus.	202211057074.
28.	Microwave assisted screw conveyor for rice fortification.	202231057966
29.	Visual and simple detection system for BK Virus.	202211058621
30.	A Gastro-Floating Sustained Release Tablet Of Penicillin.	202211062012
31.	Nano-biosensor SANS for breast cancer risk-assessment in rural women exposed to biomass fumes.	202211064249
32.	Development of a colorimetric isothermal (RT-LAMP) assay for rapid detection of Nipah virus.	202211066352.
33.	Method for cardiovascular risk assessment in diabetic patients by performing oxidative stress test and uses thereof.	202211071150
34.	Versatile and cost-effective microspheres to prepare radiolabeled formulations with trivalent cationic radionuclides of variable energies and properties.	202211072667
35.	Fiber optic nano-antenna based excitation of whisper gallery made resonator and various sensing applications.	20221100468
36.	A self-gelling and self-setting bioactive cement formulation for dental tissue regeneration.	202311005516
37.	compositions for metabolic reprogramming of cells by modulating the expression of tumor suppressor candidate 1 (TUSC1) and methods thereof.	20221100397
38.	A Rapid and Sensitive Colorimetric Assay For Detection Of Ergosterol In Candida albicans.	202211077099
39.	Development of genetically tailored 3-D organotypic model of human intestine for study of enteroviruses.	202311003845
40.	"Dendrimer Stabilized Albumin Nanoparticles Loaded with Asiatic Acid for the Management of Alcohol Addiction".	202311009523
41.	Injectable pH and thermo-responsive hydrogel incorporated with photothermal agent and method of preparation thereof for controlled on-demand drug release.	202311008786
42.	Process technology for whole-grain rice fortification.	202311010189

Table 2: Foreign Application Numbers.		
S. No	**Foreign application number**	**Patent Application title**
1.	Korean Patent Application no. 10-2023-7008609	A diagnostic device and method for differentiating asthma-COPD overlap syndrome (ACO) from asthma and COPD.
2.	Uganda Application No. UG/P/2023/000003	A method for developing a rapid immunochromatographic assay for identifying hepatitis E infection.
3.	US patent app. No. 17/904,201	A point of care device, method and kit involving club cell protein 16 as a marker for silicosis.
4.	Brazil patent app. No. BR112022 018935-4	
5.	South African patent app. no. 2022/08022	
6.	European patent app. No. EP 21781546.3	
7.	South African patent app. No. 2022/11453	A paper disc based method for determining the drug susceptibility of *Mycobacterium tuberculosis.*

Table 3: Indian and Foreign Patent granted during the period (April 2022 to March 2023)		
S. No	**Tile of invention**	**Patent no**
	Indian Patent Granted	
1.	A process for engineering nucleotide specificity.	410956
2.	A process for the preparation of a fibrinolytic enzyme.	391961
	Foreign Patent Granted	
3	Alginate chitosan nanoformulation of OMPA—a shigella protein subunit	US 16093237
4	Biomarkers for Predicting Malaria Severity and Methods Thereof.	Nigerian Patent no. F/P/2021/493
5	A novel molecular diagnostic technique for detecting the different species of plasmodium.	Indonesian Patent Number : IDP000082545
6	Apparatus, Method and Kit for Detection of Von Willebrand Factor and Factor VIII.	South AfricanPatent No. 2021/07051

Table 4: Copyright Applications.		
S. No	**Tile of invention**	**Copyright Application No.**
1	A Matlab based framework for automated sorting and consolidation of multivariate, multistep blood investigation data - Data Clearing Tool.	15687/2022-CO/SW
2	A Python based framework for automated extraction of blood investigation data from patient reports in Portable document format - Data Extraction Tool.	15688/2022-CO/SW
3	Computer Software titled: Stroke Mobilization Assessment & Rapid Treatment -TAEI-SMART.	17655/2022-CO/SW

Table 5: Design Applications.		
S. No	**Tile of invention**	**Design Application No.**
1	Humerus1_Ulna1-	362853-001
2	Humerus2_Ulna2-	362854-001
3	Humerus 3_Ulna 3-	362855-001
4	Device for Printing Lateral Flow Assay Strip.	366562-001

PUBLICATIONS

During the year2022-23, the total number of Research papers published in peer reviewed journals through the several intramural Research Programmes by 27 institutes of ICMR organization are **1018**. The best 50 publications in Internationally acclaimed Scientific Journals with high impact factor are tabulated below.

1	GBD 2020 Cancer Collaborators. The global burden of cancer attributable to riskfactors, 2010–19: a systematic analysis for the Global Burden of Disease Study 2019. Lancet.2022; 400(10352):563–591. Available from: https://www.researchgate.net/publication/367053144_Canceroge	202.731
2	WHO Solidarity Trial Consortium Collaborators: Godbole S, etal. Remdesivir and three other drugs for hospitalised patients with COVID-19: results of the WHO Solidarity randomised trial and updated meta-analyses. *The Lancet.* 2022 May 21-27; 399(10339): 1941-53.	202.731
3	GBD 2020 Alcohol Collaborators. Population-level risks of alcohol consumption by amount, geography, age, sex, and year: a Systematic analysis for the Global Burden of Disease Study 2020. Lancet. 2022 Jul 16;400(10347):185-235. doi: 10.1016/S0140- 6736(22)00847-9. PMID: 35843246; PMCID: PMC9289789.	202.731
4	Christina Z, Dheepa J, Anna P, Kevin K, Vani S, Zivai M, SubbaRao M G, Kathryn B: World Children's Day 2022: power, policy, and children's rights to nutrition. Lancet. 18; doi: 10.1016/S0140-6736(22)02352-2.	202.731
5	Kanungo S, Azman AS, Ramamurthy T, Deen J, Dutta S. Cholera. Lancet. 2022 Apr 9;399(10333):1429-1440. doi: 10.1016/S0140-6736(22)00330-0. PMID: 35397865.	202.7
6	Saxena N, Saha KB, Das A. India at 75 years: improving tribal health for self-reliance. Lancet. 2022 Nov 5;400(10363):1581. doi: 10.1016/S0140-6736(22)01801-3.	202.7.
7	Saxena N., Singh S. Traditional healers in South Africa: a parallel health care system connecting tribal healers to primary health care: A dire need to alleviate health of indigenous and tribal populations (Letter to editor). BMJ. March 2022, https://www.bmj.com/content/310/6988/1182/rr-0	107.7
8	Grant R, Sacks JA, Abraham P, Chunsuttiwat S, Cohen C, Figueroa JP, Fleming T, Fine P, Goldblatt D, Hasegawa H, MacIntrye CR, Memish ZA, Miller E, Nishioka S, Sall AA, Sow S, Tomori O, Wang Y, Van Kerkhove MD, Wambo MA, Cohen HA, Mesfin S, Otieno JR, Subissi L, Briand S, Wentworth DE, Subbarao K. When to update COVID-19 vaccine composition. *Nat Med.* 2023 Feb 20. doi: 10.1038/s41591-023-02220-y.	87.241
9	GBD 2019 Adolescent Transport and Unintentional Injuries Collaborators. Adolescent transport and unintentional injuries: a systematic analysis using the Global Burden of Disease Study 2019. Lancet Public Health. 2022 Aug;7(8):e657-e669. doi: 10.1016/S2468-2667(22)00134-7. Epub 2022 Jun 30. Erratum in: Lancet Public Health. 2022 Dec;7(12):e992. PMID: 35779567; PMCID: PMC9329128.	72.427

10	Kanungo S, Chatterjee P, Bavdekar A, Murhekar M, Babji S, Garg R, Samanta S, Nandy RK, Kawade A, Boopathi K, Kanagasabai K, Kamal VK, Kumar VS, Gupta N, Dutta S. Safety and immunogenicity of the Rotavac and Rotasiil rotavirus vaccines administered in an interchangeable dosing schedule among healthy Indian infants: a multicentre, open-label, randomised, controlled, phase 4, non-inferiority trial. Lancet Infect Dis. 2022 Aug;22(8):1191-1199. doi: 10.1016/S1473-3099(22)00161-X. Epub 2022 May 16. PMID: 35588754; PMCID: PMC9464301.	71.421
11	A multinational Delphi Consensus to end the COVID-19 public health threat. Nature 2022; 611: 322-345. https://doi.org/10.1038/s41586-022-05398-2	69.504
12	NCD Risk Factor Collaboration (NCD-RisC), Chaturvedi, H.K. Menon, G.R (2023). Diminishing benefits of urban living for children and adolescents' growth and development. *Nature, 615*, 874–883. https://doi.org/10.1038/s41586-023-05772-8	69.504
13	Skou S.T, Mair F.S, Fortin, M. et al. Multimorbidity. Nature Reviews Disease Primer. 2022. Doi:https://doi.org/10.1038/s41572-022-00376-4	65.038
14	Alcantara LCJ, Amenga-Etego L, Andersson R, Bhaumik M, Choi YK, Decaluwe H, Geoghegan J, Haagmans BL, López S, Mukhtar MM, Nelwan E, Rahal EA, Sato K, Sklan EH, Fang YSC. Methods for fighting emerging pathogens. Nat Methods. 2022Apr;19(4):395-397. doi: 10.1038/s41592-022-01441-2.	47.99
15	Muniyandi M: Global, regional, and national burden of hepatitis B, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *The lancet Gastroenterology & Hepatology* 2022.	45.042
16	GBD 2019 Colorectal Cancer Collaborators. Global, regional, and national burden of colorectal cancer and its risk factors, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Gastroenterol Hepatol*. July, 2022, 7(7):627-647.	45.042
17	L Preethi, MS Alina, Lakshmi Chandran, S Asvin, M Jagadeesan, TM Vijayakumar, V Chitra, Ashok Kumar Pandey, Mahendra M Reddy, BR Misra, Rajni Kant, PL Bhukya, Gururaj Deshpande, Priya Abraham, Gajanan Sapkal and Kamran Zaman (2022). Duration of Seroprotection of the live attenuated SA-14-14-2 Japanese encephalitis vaccine in children in India. *Journal of Travel Medicine*, 2022, 1–8. https://doi.org/10.1093/jtm/taac147	39.194
18	Deshpande GR, Bhukya PL, Yadav PD, Salunke A, Patil C, Tilekar BN, Rakhe A, Srivastava R, Gurav YK, Potdar V, Abraham P, Sapkal GN. Comparison of neutralizing antibody response in first and second waves of SARS CoV-2 pandemic in India. *J Travel Med*. 2022 May 31;29(3):taab196. doi: 10.1093/jtm/taab196.	39.194
19	Deshpande GR, Yadav PD, Abraham P, Nyayanit DA, Sapkal GN, Shete AM, Gupta N, Vadrevu KM, Ella R, Panda S, Bhargava B. Booster dose of the inactivated COVID-19 vaccine BBV152 (Covaxin) enhances the neutralizing antibody response against alpha, Beta, Delta and omicron variants of concern. *J Travel Med*. 2022 May;29(3): taac039. doi: 10.1093/jtm/taac039.	39.194
20	Preethi L, Alina MS, Chandran L, Asvin S, Jagadeesan M, Vijayakumar TM, Chitra V, Pandey AK, Reddy MM, Misra BR, Kant R, Bhukya PL, Deshpande GR, Abraham P, Sapkal G, Zaman K. Duration of Seroprotection of the live attenuated SA-14-14-2 Japanese encephalitis vaccine in children in India. *J Travel Med.* 2022 Dec 10: taac147. doi: 10.1093/jtm/taac147.	39.194
21	Sapkal G, Deshpande GR, Tilekar B, Yadav P, Abraham P, Salunke A, Patil C, Deshpande K, Patil R, Pawar N, Joshi A, Vaidya A, Shivankar A. Antibody responses to Sputnik Vaccination in naïve and COVID 19-recovered vaccine recipients, India. *J Travel Med.* 2022 May 31;29(3): taac040. doi: 10.1093/jtm/taac040.	39.194
22	Sapkal G, Srivastava RK, Dwivedi G, Sahay RR, Yadav PD, Deshpande GR, Singh R, Nyayanit DA, Patil DY, Shete-Aich AM, Zaman K, Chaudhari AK, Gupta N, Panda S, Abraham P, Bhargava B. Immune responses against different variants of SARS-CoV-2 including omicron following six months of administration of heterologous prime-boost COVID-19 vaccine. *J Travel Med*. 2022 May 31;29(3): taac033. doi: 10.1093/jtm/taac033.	39.194

23	Kumar NP, Banurekha VV, Kumar CPG, Nancy A, Padmapriyadarsini C, Shankar S, Hanna LE, Murhekar M, Devi KRU, Babu S. Inactivated COVID-19 vaccines: durability of Covaxin/BBV152 induced immunity against variants of concern. J Travel Med. 2022 Sep 17;29(6):88.	39.194
24	Muzembo BA, Kitahara K, Mitra D, Ohno A, Khatiwada J, Dutta S, Miyoshi SI. Burden of Shigella in South Asia: a systematic review and meta-analysis. J Travel Med. 2022 Nov 4: taac132. doi: 10.1093/jtm/taac132. Epub ahead of print.	39.194
25	Local Burden of Disease Household Air Pollution Collaborators. Mapping development and health effects of cooking with solid fuels in low-income and middle-income countries, 2000-18: a geospatial modelling study. Lancet Glob Health. 2022 Oct;10(10):e1395-e1411.	38.927
26	Murhekar MV, Kumar CG. Health-care-associated infection surveillance in India. Lancet Glob Health. 2022 Sep;10(9):e1222-e1223.	38.927
27	Rosu L, Madan JJ, Tomeny EM, Muniyandi M, Nidoi J, Girma M, Vilc V, Bindroo P, Dhandhukiya R, Bayissa AK *et al*: Economic evaluation of shortened, bedaquiline-containing treatment regimens for rifampicin-resistant tuberculosis (STREAM stage 2): a within-trial analysis of a randomised controlled trial. *Lancet Glob Health* 2022.	38.927
28	Pandit P, Bhatt P, Sahay RR, Joshi Y, Patil DY, Yadav PD. A case of breakthrough infection with SARS-CoV-2 Delta derivative and reinfection with Omicron variant in a fully vaccinated health care professional. *J Infect*. 2022 Jul;85(1):e15-e17. doi:10.1016/j.jinf.2022.04.023.	38.637
29	Sahay RR, Patil DY, Sapkal GN, Deshpande GR, Shete AM, Nyayanit DA, Kumar S, Yadav PD. SARS-CoV-2 Delta and delta derivatives impact on neutralization of Covishield recipient sera. *J Infect*. 2022 Apr;84(4):e36-e38 doi: 10.1016/j.jinf.2022.02.018.	38.637
30	Shete AM, Yadav PD, Kumar A, Patil S, Patil DY, Joshi Y, Majumdar T, Relhan V, Sahay RR, Vasu M, Gawande P, Verma A, Kumar A, Dhakad S, Krishnan AB, Chenayil S, Kumar S, Abraham P. Genome characterization of monkeypox cases detected in India: Identification of three sub clusters among A.2 lineage. *J Infect.* 2023 Jan;86(1):66-117. doi: 10.1016/j.jinf.2022.09.024.	38.637
31	Yadav PD, Reghukumar A, Sahay RR, K S, Shete AM, Raman A, Vk P, Abraham P, Benson R, Sm S, Mohandas S, Patil DY, Gupta N, George AE, Vijay N, U A, Suresh M, A RR, Sapkal GN, Ravindranath M, Sreenivasan S, James P, Mk S. First two cases of Monkeypox virus infection in a traveller returned from UAE to India, July 2022. *J Infect.* 2022 Nov;85(5):e145-e148. doi: 10.1016/j.jinf.2022.08.007.	38.637
32	Yadav PD, Sahay RR, Agrawal S, Shete A, Adsul B, Tripathy S, Nyayanit DA, Manrai M, Patil DY, Kumar S, Marwah V, Sapkal GN, Shastri J, Viswanathan R, Pandit P, Mishra Y, Chavan S, Joshi Y, Kumar TA, Majumdar T, Kumar A, Patil S, Munshi R, Desai U, Kaushal H, Suryawanshi A, Dudhmal M, Gawande P, Jain R, Waghmare A, Kalele K, Vedpathak P, Yemul J, Bodke P, Kore T, Kakrani AL, Athavale P, Suryawanshi P, Patsute S, Padbidri V, Awate P, Abraham P. Clinical, immunological and genomic analysis of the post vaccinated SARS-CoV-2 infected cases with Delta derivatives from Maharashtra, India, 2021. *J Infect.* 2022 Jul;85(1):e26-e29. doi: 10.1016/j.jinf.2022.04.014.	38.637
33	Yadav PD, Sapkal GN, Sahay RR, Patil DY, Deshpande GR, Jain R, Nyayanit DA, Shete AM, Suryawanshi A, Nandapurkar A, Gurav YK, Abraham P. Elevated neutralization of Omicron with sera of COVID-19 recovered and breakthrough cases vaccinated with Covaxin than two dose naïve vaccinees. *J Infect.* 2022 Jun;84(6):834-72.doi: 10.1016/j.jinf.2022.03.016.	38.637
34	Yadav PD, Sapkal GN, Sahay RR, Patil DY, Agrawal S, Adsul B, Tripathy S, Deshpande GR, Nyayanit DA, Shete AM, Shastri J, Abraham P. Reduced neutralizing antibody response in naïve Covishield vaccinees against Omicron emphasizes booster vaccination. *J Infect.* 2022 Jul;85(1):90-122. doi: 10.1016/j.jinf.2022.04.031.	38.637

35	Yadav PD, Sapkal GN, Sahay RR, Potdar VA, Deshpande GR, Patil DY, Nyayanit DA, Shete AM, Shastri J, Awate P, Malhotra B, Abraham P. Substantial immune response in Omicron infected breakthrough and unvaccinated individuals against SARS-CoV-2 variants of concerns. *J Infect*. 2022 May;84(5):e80-e81. doi: 10.1016/j.jinf.2022.02.005.	38.637
36	Murhekar MV, Gupta N, Hasan AZ, Kumar MS, Kumar VS, Prosperi C, Sapkal GN, Thangaraj JWV, Kaduskar O, Bhatt V, Deshpande GR, Thankappan UP, Bansal AK, Chauhan SL, Grover GS, Jain AK, Kulkarni RN, Sharma SK, Chaaithanya IK, Kharwal S, Mishra SK, Salvi NR, Sharma S, Sarmah NP, Sabarinathan R, Duraiswamy A, Rani DS, Kanagasabai K, Lachyan A, Gawali P, Kapoor M, Shrivastava AK, Chonker SK, Tilekar B, Tandale BV, Ahmad M, Sangal L, Winter A, Mehendale SM, Moss WJ, Hayford K. Evaluating the effect of measles and rubella mass vaccination campaigns on seroprevalence in India: a before-and-after cross-sectional household serosurvey in four districts, 2018-2020. *Lancet Glob Health.* 2022 Nov;10(11):e1655-64. doi: 10.1016/S2214-109X(22)00379-5.	38.927
37	Carvalho MJ, Sands K, Thomson K, Portal E, Mathias J, Milton R, Gillespie D, Dyer C, Akpulu C, Boostrom I, Hogan P, Saif H, Ferreira A, Nieto M, Hender T, Hood K, Andrews R, Watkins WJ, Hassan B, Chan G, Bekele D, Solomon S, Metaferia G, Basu S, Naha S, Sinha A, Chakravorty P, Mukherjee S, Iregbu K, Modibbo F, Uwaezuoke S, Audu L, Edwin CP, Yusuf AH, Adeleye A, Mukkadas AS, Zahra R, Shirazi H, Muhammad A, Ullah SN, Jan MH, Akif S, Mazarati JB, Rucogoza A, Gaju L, Mehtar S, Bulabula ANH, Whitelaw A, Roberts L; BARNARDS Group; Walsh TR. Antibiotic resistance genes in the gut microbiota of mothers and linked neonates with or without sepsis from low- and middle-income countries. Nat Microbiol. 2022 Sep;7(9):1337-1347. doi: 10.1038/s41564-022-01184-y. Epub 2022 Aug 4.	30.96
38	Hoffman SA, LeBoa C, Date K, Haldar P, Harvey P, Shimpi R, An Q, Zhang C, Jayaprasad N, Horng L, Fagerli K, Borhade P, Chakraborty D, Bahl S, Katkar A, Kunwar A, Yewale V, Andrews JR, Bhatnagar P, Dutta S, Luby SP. Programmatic Effectiveness of a Pediatric Typhoid Conjugate Vaccine Campaign in Navi Mumbai, India. Clin Infect Dis. 2023 Mar 22: ciad132. doi: 10.1093/cid/ciad132. Epub ahead of print. PMID: 36947143.	20.999
39	Padmapriyadarsini C, Vohra V, Bhatnagar A, Solanki R, Sridhar R, Anande L, Muthuvijaylakshmi M, Bhatia M, Jeyadeepa B, Taneja G *et al*: Bedaquiline, Delamanid, Linezolid and Clofazimine for Treatment of Pre-extensively Drug-Resistant Tuberculosis. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America* 2022.	20.999
40	Padmapriydarsini C, Mamulwar M, Mohan A, Shanmugam P, Gomathy NS, Mane A, Singh UB, Pavankumar N, Kadam A, Kumar H, Suresh C, Reddy D, Devi P, Ramesh PM, Sekar L, Jawahar S, Shandil RK, Singh M, Menon J, Guleria R. Randomized Trial of Metformin with Anti-Tuberculosis Drugs for Early Sputum Conversion in Adults With Pulmonary Tuberculosis. *Clin Infect Dis.* 2022 Aug 31;75(3):425-434.	20.999
41	Wilkin T, Chen H, Sahasrabuddhe V, Matining R, Mngqibisa R, Chinula L, Mbilizi Y, Magure T, Omoz-Oarhe AE, Rassool M, Riviere C, Bhosale R, Godbole S, Naranjo R, Coombs R, Michelow P, Godfrey C, Firnhaber C. A Randomized Clinical Trial of Human Papillomavirus Test-and-Treat as Compared to Cytology-Based Screening for Prevention of Cervical Cancer Among Women With Human Immunodeficiency Virus: AIDS Clinical Trials Group Protocol A5282. *Clin Infect Dis*. 2022 Oct 12;75(8):1280-1288.	20.999
42	Chavan VR, Ahir S, Kerkar S, Ansari Z, Samant-Mawani P, Nanavati R, Mehta P, Mania-Pramanik J. Th1 cytokine gene polymorphism and the corresponding plasma cytokine levels: A comparative study in HIV-1 positive and exposed uninfected infants. *J Med Virol* 94(2): 625-633, 2022	20.693
43	Gupta SM, Warke H, Chaudhari H, Mavani P, Katke RD, Kerkar SC, Mania-Pramanik J. Human Papillomavirus E6/E7 oncogene transcripts as biomarkers for the early detection of cervical cancer. *J Med Virol* 94(7): 3368-3375, 2022	20.693
44	Banerjee A, Mazumder A, Roy J, Das J, Majumdar A, Chatterjee A, Biswas NK, Chawla Sarkar M, Das S, Dutta S, Maitra A. Emergence of a unique SARS-CoV-2 Delta sub-cluster harboring a constellation of co-appearing non-Spike mutations. J Med Virol. 2023 Jan;95(1): e28413. doi: 10.1002/jmv.28413. PMID: 36541745; PMCID: PMC9878222.	20.693

45	Kumar N, Misra BR, Reddy MM, Deval H, Zaman K, Rajni Kant (2022). COVID-19 transmission among vaccinated laboratory workers during the second wave in eastern Uttar Pradesh, India. *J Med Virol*. 2022;94(8):3512-3514. doi:10.1002/jmv.27788	20.693
46	Nandi SS, Sawant S, Gohil T, Lambe U, Sangal L, Patel D, Krishnasamy K, Ghoshal U, Harvey P, Deshpande J. Poliovirus nonpermissive CD155 knockout cells derived from RD cell line for handling poliovirus potentially infectious materials in virology laboratories. *J Med Virol.* 2022 Oct;94(10):4901-9. doi: 10.1002/jmv.27897.	20.693
47	Patil DY, George S, Sahay RR, Chenayil S, Shete AM, Bhaskaramenon SC, Anish TS, Jain R, Nazeer FA, John R, Joshi Y, Sivaprasad R, Waghmare P, Ray S, Balakrishnan S, Kumari V, Sathe S, Yadav PD. A case of human buffalopox in Malappuram, India: The role of mpox surveillance in 2022. *J Med Virol.* 2023 Feb;95(2):e28580. doi: 10.1002/jmv.28580.	20.693
48	Ranshing S, Ganorkar N, Ramji S, Gopalkrishna V. Complete genomic analysis of uncommon G12P[11] rotavirus causing a nosocomial outbreak of acute diarrhea in the newborns in New Delhi, India. *J Med Virol.* 2022 Jun;94(6):2613-23. doi: 10.1002/jmv.27468.	20.693
49	Relhan V, Sahay RR, Shete AM, Yadav PD, Sahoo B, Patil DY, Kumar S, Premachandran Syamaladevi KS, Dar L, Mohandas S, Abraham P. Clinical presentation, viral kinetics, and management of human monkeypox cases from New Delhi, India 2022. *J Med Virol.* 2023 Jan;95(1):e28249. doi: 10.1002/jmv.28249.	20.693
50	Tandale BV, Khude PM, Deshmukh PS, Narang R, Qazi MS, Padmaja GV, Jain M, Jain D, Guduru VK, Deshmukh PR, Raut AV, Narlawar UW, Jha PK, Rajderkar SS; Japanese Encephalitis Epidemiology Study Group. Effectiveness of Japanese encephalitis vaccination among children in central India. *J Med Virol.* 2023 Jan;95(1):e28399. doi: 10.1002/jmv.28399.	20.693

INDIAN JOURNAL OF MEDICAL RESEARCH

The Indian Journal of Medical Research (IJMR) is a monthly biomedical journal of national and international repute and is the flagship journal of the Indian Council of Medical Research (ICMR). During the financial year 2022-23, it has completed 109 successful years of uninterrupted publication, with 12 issues brought out in two volumes each year. Since July 2022, all research content in the IJMR are being published under three main categories namely, POLICY, PROGRAMME and PRACTICE.

Besides publishing original research articles, the IJMR publishes Editorials, Commentaries and Review/Mini review articles on topics of contemporary biomedical interest contributed by eminent global experts. Other than these, Research Correspondences, View Points, Perspectives, Systematic reviews & Meta-analyses, Clinical Images, StudentIJMR, Letters to the Editors and Book reviews are also published in addition to Policy Documents and Special/Status Reports occasionally.The impact factor for the year 2021increased to5.274 (Clarivate Analytics, 2022) which was an all-time high.

A total of 10 issues (including 4 special issues) were published in the year 2022-23, with the total number of submissions amounting to more than 2500. Of the total number of submissions received in this year, around 30 per cent were from foreign countries. Over 3000 reviewers were involved in the peer-review process, of whom around 38 per cent were from foreign countries. Among these, 7% were from USA, 3% each from UK and Canada, 4% from Italy,2.4% from Australia,2.2% each from Turkey and France, 1.9% each from Germany and Brazil, around 1.7% each from the Netherlands

and Spain, 1.45% from Switzerland and <1% each from Japan, China, Sweden, Denmark, Malaysia, Norway, Nigeria, Sri Lanka, Slovakia, Poland, *etc*.

A total of 180 articles were published in the said financial year. Fig. 1 provides a snapshot of the total number of articles published in the IJMR under various categories.

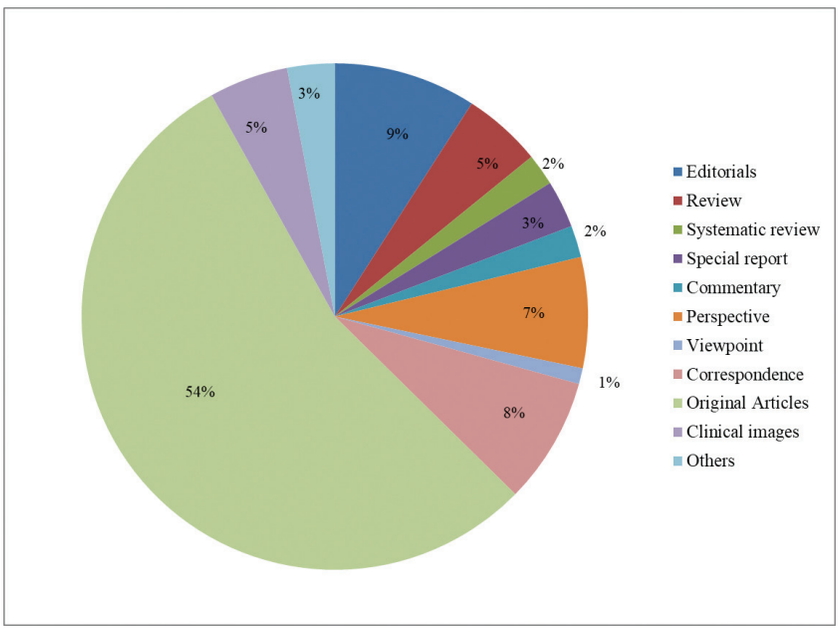


Fig. 1: Articles published in the IJMR under various categories during 2022-23 financial year.

In 2022-23, a Special Issue on 'India & COVID-19 (Part VI)' was published (May-June 2022 issue; Fig.2) in view of the ongoing pandemic and vaccination priorities of the country. Other than this, topics of national healthcare priorities other than COVID-19 were focused on, including a Special Issue on Tribal Health (August 2022 issue; Fig.3), a Special Issue on HIV & Co-Infections (December 2022 issue; Fig.4) and a Special Issue on Tuberculosis (Fig.5; February-March 2023).

The Special Issue on Tribal Health included articles to inform evidence-based policy, particularly in the context of the tribal population in India. The Special Issue on HIV & Co-Infections brought together articles on implementation research framework, HIV testing and cost-effectiveness, other associated infections in HIV. This issue saw a combination of evidence-based research and qualitative assessments among the marginalized HIV populations.

The Special Issue on Tuberculosis gives a recap of the origins of the tubercle bacillus (classics on the Koch's postulates) in combination with status view points from global key opinion leaders in TB research and other evidence-based analyses in context to the BCG vaccination, modelling, *etc*. This issue aims to provide context as well as content for the policy makers to deliberate on.

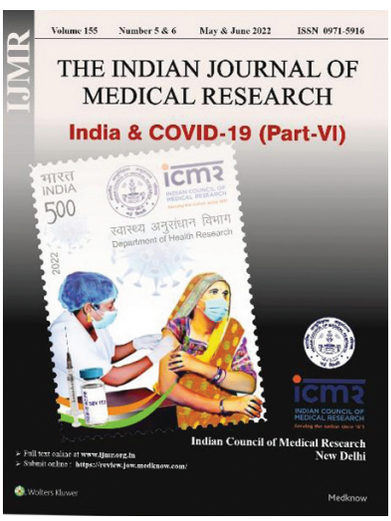


Fig. 2: Special Issue on 'India & COVID-19 (Part VI)'.

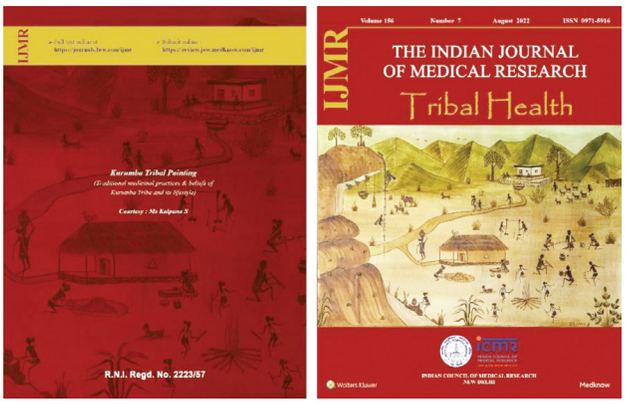


Fig. 3: Special issues on 'Tribal Health'.

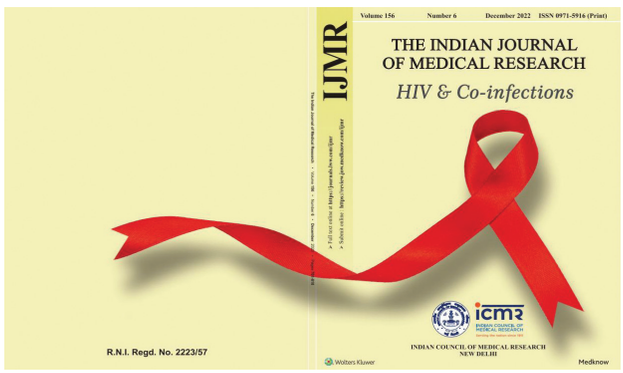


Fig. 4: Special issue on 'HIV & Co-Infections'.

Fig. 5: Special issue on 'Tuberculosis'.

INTERNATIONAL COLLABORATIONS

The International Health Division coordinates biomedical research between India and other countries as well as with National & International agencies such as Ministries of Health & Family Welfare, Science & Technology, Indian and Foreign missions, WHO etc. There are a few specific Agreements/MoUs/ Special Arrangements signed by the Ministry of Health and Family Welfare with other countries and others are signed directly by ICMR/DHR with international organizations/ institutions such as INSERM, France, German Federal Ministry of Education and Research (BMBF) and Helmholtz Association (HGF), Germany; National Institutes of Health (NIH), USA; International AIDS Vaccine Initiative (IAVI), USA; Swedish Research Council for Health Working Life and Welfare (FORTE), Sweden; Drugs for Neglected Diseases Initiative (DNDi), Switzerland; Global Alliance for Chronic Disease (GACD); The International Vaccine Initiative (IVI), South Korea; African Union (AU), Africa; Department of Medical Research (DMR), Myanmar; Nepal Health Research Council (NHRC), Nepal; Foundation for Innovative New Diagnostics (FIND) and GARDP, Switzerland**;** Ministry of Health & Social Protection and The Ministry of Science, Technology & Innovation, Colombia**;** Deutsche Forschungsgemeinschafte.V. (DFG), Germany**;** and University of Oxford, UK.

MOUs/LOI

- MoU between ICMR and Inserm, France, renewed through exchange of letters for a period of 4 years, was signed on 4th May, 2022 at ICMR, New Delhi.
- MoU between ICMR and Department of Medical Services of Ministry of Public Health, Thailand was signed on 17th August, 2022 during the 9th Joint Commission Meeting held between India and Thailand in Bangkok.
- LoI between ICMR and the Coalition for Epidemic Preparedness Innovations(CEPI), Norway for Cooperation on Vaccine Research, Development and Innovation was signed on 23rd Feb. 2023 at New Delhi.

ICMR-DHR INTERNATIONAL FELLOWSHIP PROGRAMME

The ICMR International Fellowship Programme for Indian biomedical scientists aims to augment capacity strengthening of institutions involved in basic, applied, epidemiological and clinical sciences through exposure of Indian researchers to the latest international advancements in medical knowledge, to understand the disease and find newer strategies for their prevention and cure. During the year 2022-2023, the ICMR-DHR International Fellowships were awarded to 25 Senior and 27 Young Indian Scientists.

HEALTH MINISTRY'S SCREENING COMMITTEE (HMSC)

The research projects involving foreign assistance and/or collaboration in biomedical/Health research are submitted online by the Indian investigators to ICMR for approval of Govt. of India through Health Ministry's Screening Committee (HMSC). The International Health Division of ICMR acts as the Secretariat for HMSC. The projects are screened by the concerned Scientific Divisions at ICMR and then placed before the HMSC for consideration and final decision. During the year 2022-23, six meetings of Health Ministry's Screening Committee were held wherein 201 projects were considered out of which 149 projects were approved for international collaboration.

INDIA AFRICA HEALTH SCIENCES PLATFORM

Sixteen ICMR/AU-STRC Health practitioner fellows were trained in the following two virtual courses organized at ICMR-NICPR, Noida & ICMR-NIRT, Chennai, respectively.

- Virtual Certificate Program in Advanced Cervical and Breast Cancer Screening Training Program held during 22nd March, 2022 to 7th June, 2022.
- Virtual course "Manage TB- An Online Course for Doctors" held during 25th April, 2022 to 30th June, 2022.

NEW INITIATIVES

- ICMR/NIH/BMGF Clinical Research Fellowships: The Indian Council of Medical Research (ICMR), the National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH) and the Bill & Melinda Gates Foundation (BMGF), signed a Declaration of Intent on 17th November, 2019, pertaining to a clinical research fellowship programme. It is a programme for early and mid-career scientists within India and USA to help in expanding the cohort of physician scientists focused on research that will advance discovery to improve clinical practice and benefit public health in both the countries. The implementation plan and guidance document were prepared in consultation with NIH & BMGF and the first Call for fellowships was announced in March, 2022. 21 applications from Indian clinicians were received & 4 Indian candidates have been selected.
- Investigator Initiated Research proposals scheme was launched in March, 2023 under Tripartite MoU between ICMR, DBT and IAVI in the area of HIV prevention.

Fig. 1: Signing of MoU between ICMR and Department of Medical Services of Ministry of Public Health, Thailand on 17th August, 2022 during the 9th Joint Commission Meeting held between India and Thailand in Bangkok.

NEW TECHNOLOGIES & COURSES

NEWER TECHNOLOGIES

- A novel colorimetric LAMP assay has been developed for the detection of the Nipah virus. This would be useful as a point-of-care assay for the detection of the Nipah virus.
- Real-time PCR for the Mpox virus was standardized and validated.
- A cost-effective colorimetric isothermal (LAMP) assay for rapid detection of Mpox virus. was developed. The assay can be applied in the field setting.
- The team published a study on understanding TB disclosure patterns and have developed a new tool to measure TB disclosure.
- The team Validated a measurement tool for patient-perceived quality of care for TB (PPQCTB) which measured the patient's satisfaction with reference to healthcare providers and health care services. This tool could support quality of care evaluation frameworks for TB health services in India.
- Developed a patient-centric interventions framework and module which is being used to implement patient-centric interventions under the TB program for in-patients to build treatment and life resilience.
- Developed a needs assessment form for the purpose of better implementation of Nikshay Mitra initiative.
- Developed innovative TB awareness materials which includes TB IEC tickets and TB Puzzle game for school students.
- Gold nanoparticle-aptamer complex has been developed that will specifically bind with HCV core antigen to develop a cost-effective and rapid HCV detection in blood that will be suitable for use in resource-limited settings.
- There was development of a multivalent, highly immunogenic candidate glycoconjugate vaccine with protective efficacy against *S.* Typhi, S. Paratyphi and NTS (*S.* Typhimurium and S. Enetritidis)
- The study team identified cyclic constrained peptides from different proteins of the *P. falciparum*, which can be developed as novel diagnostic tools for malaria.
- The team screened about 100 marine derived extracts/compounds for discovery of antimalarial drugs. Leads were generated with activities in micromolar concentrations. Further characterization of potential extracts is underway. Also developed novel single-step multiplex qPCR assay for detection of nonhuman malaria parasites *Plasmodium knowlesi* and *P. cynomolgi*.

- There was development and designing of improved lid of underground tanks where An. stephensi used to breed (20-40%). This action prevented An. stephensi from breeding in western Rajasthan.
- ICMR-NIMR team developed and validated discriminatory concentrations of nine insecticides with bottle bioassay and 2 insecticides with filter paper test against Aedes aegypti (first time) and An. stephensi mosquitoes, which are currently in use or under evaluation for various vector control applications (IRS, LLIN, space spray, household products, etc). This information is key to establish the baseline susceptibility of vector populations to the new insecticides and to detect any change in phenotypic resistance after their deployment. It will help the national programme in monitoring of insecticide susceptibility of mosquito vectors of public health importance. Results included in report published by WHO in March 2022
- ICMR-VCRC has synthesized 10 molecules, purified by column chromatography and characterized the chemical structures by FTIR, ^{1}HNMR and MS spectral analysis as part of drug design and synthesis and evaluation of select repurposed drugs against SARS-CoV-2.
- A molecular algorithm to diagnose vector borne diseases among acute undifferentiated febrile illness has been developed and is under in-house validation
- A spatiotemporal model was developed for forecasting visceral leishmaniasis and has been validated for block-level predictions and long-term forecasts of VL incidence. This model can be used to monitor progress of VL elimination and identify the risk of resurgence in post-elimination settings.
- A metagenomic based NextGen Sequencing (Illumina) Technology to Identify aetiology of Acute Encephalitis Syndrome (AES) technology has been developed.
- Two artificial diets have been developed as a substitute for blood meal for mosquitoes.
- ICMR developed a microprocessor-based mosquito feeding device for rearing and maintaining mosquito colonies.
- A toolkit for VL surveillance was developed by ICMR-RMRIMS in collaboration with SPEAK India.
- ICMR-RMRCBB has developed audio content in local tribal language for creating awareness pertaining to the cause, sign, symptoms, transmission mode & treatment of Anthrax disease.
- A rapid detection kit for *Orientia tsutsugamushi* diagnosis has been developed by ICMR-RMRCGKP. This technology is based on isothermal recombinase polymerase amplification and lateral flow analysis.
- ICMR-NIRRCH has developed the first-ever online tool for polypharmacological target and drug prediction, which accurately identified popular repurposed drugs such as sildenafil (Viagra) for hypertension and erectile dysfunction (which was otherwise an accidental discovery) and metformin for PCOS and diabetes mellitus.
- The Biomedical Informatics Centre of the institute has released the fourth online version of database for antimicrobial peptides - $CAMP_{R4}$ that is freely accessible at http://www.camp.bicnirrh.res.in/. It contains manually curated information on sequence, protein definition, accession numbers, activity, source

organism, target organisms, protein family descriptions, N and C terminal modifications of antimicrobial peptides. It also has ML-based algorithms for prediction and rational design of natural and synthetic AMPs.

- Point of care sickle cell tests were rolled out in the national program at a cost estimated through HTA study conducted at the institute of ICMR-NIRRCH.
- An android app e-STAR is a digital Innovation by ICMR-NIN to implement 'screen and treat anaemia' at the population level.
- The institute validated a novel point-of-care Hb measurement in pooled capillary blood by a portable autoanalyzer which has better Hb estimates than conventional point of care methods being used.
- A functional food formulation containing amla, turmeric, cinnamon, ginger, and black pepper has been developed and study team has provided preclinical evidence that this formulation can prevent diabetic nephropathy in rats.
- A low-cost indigenous automated cervical cancer screening device was validated as a stand -alone screening device for low-resource settings. This can be used to augment cervical cancer screening in settings with paucity of trained cytotechnologists/ pathologists**.**
- ICMR-RMRCNE developed rapid (~1 hour), point-of-care, visual detection, one-pot-assay using isothermal methods and CRISPR technologies for *P. falciparum* K13, C580Y mutation (artemisinin resistance).
- An in-house incubator-cum-detector was developed by ICMR-RMRCNE which can be used for incubation of CRISPR reactions as well as visualization. The device is battery operated and thus suitable for field-use.
- A mobile application, Fever Tracker with dashboard has been developed for real time epidemiological surveillance. It has been successfully deployed in Tripura and being updated for the malaria endemic areas of other northeastern states.
- For malaria mapping with ecological data, land use and land cover (LULC) maps of study districts have been created.
- ICMR-NIIH has performed field validation for two indigenously developed kits for SCD.
- For the first time, indigenous red cell screening panel suitable for Indian population has been prepared and distributed to 78 blood banks all over the country for detection of antibodies.
- Based on study on mechanism of RhD negativity in Indians a population-specific data was generated and an Indian-specific diagnostic algorithm was developed which can provide the correct RHD status and simultaneously characterize the serologically-weak D samples. The strategy will be applied for non-invasive fetal RhD typing for management of pregnancy in Indian RhD negative antenatal women.
- "IBD NutriCare App" was released for Inflammatory Bowel Disease (IBD) patients on World Inflammatory Bowel Disease Day,19th May 2022. This is a mobile app which will help patients in recording their real time diet data on a regular basis, track their nutrient intake, monitor their disease activity, and keep a tab on their medicine intake and lifestyle. This will also help physicians and dieticians in the assessment of nutritional status of patients and provide tele-nutrition counseling.

ON THE WAY TO COMMERCIALIZATION

- A cost-effective multiplex Real time PCR assay was designed for detection of GARV, HAdV-F, NoV GI, NoV GII and RNaseP. In-house and third-party validation in two laboratories revealed >96% sensitivity and 100% specificity. The kit is in process of technology transfer.
- Diagnostic tests for non-invasive prenatal diagnosis, for foetal RhD typing from maternal plasma, for management Rh-HDN have been standardized at the institute. This is now ready for transfer of technology and further commercialization.
- The technology for rapid, simple and cost-effective lateral flow immunoassay for the diagnosis of severe Haemophilia A and von Willebrand disease, developed by the institute, has been transferred for commercialization to Bhatt Biotech and has been approved by CDSCO and is ready for marketing.
- ICMR-NITM validated the diabetic wound healing activity of essential oil obtained from flower buds of *Mammea suriga* and elucidated its molecular mechanism of action. It has public health relevance as a home remedy for management of diabetic wounds.

NEW GUIDELINES/POLICY

- The study on Strengthening state NCD programme for diagnosis and treatment of suspected cases of Breast Cancer at medical colleges/institutes has established self-breast examination as a tool for early diagnosis & treatment.
- ICMR formulated guidelines for management of type 1 diabetes. The document spanning 12 chapters address epidemiology and diagnosis, lifestyle, drugs, monitoring, acute, microvascular and macro vascular complications, education and special group.
- ICMR contributed two policy documents

a) Tobacco Control in India 2022

b) National Injury Prevention strategy document

- Future road map for the national program on prevention and control of snakebite in India was provided to Niti Ayog by ICMR-NIRRCH.
- ICMR multi-centric task force study on polycystic ovarian syndrome (PCOS) is one of the largest studies providing data on prevalence of PCOS and regional phenotypic variation in India. The study provides valuable information relevant for clinical management and policy on PCOS.
- ICMR-NARI contributed to development of guidelines for STI surveillance.
- The institute also contributed to guidelines for elimination of vertical transmission of HIV and syphilis (EVTHS).

REPORTS/DATABASE/MANUALS

- A Report was released – The Environmental Burden of Tobacco Product Wastes in India, a joint study by ICMR-NICPR and AIIMS Jodhpur. The evidence thus generated may serve to reinforce and amend the existing policies on regulation of tobacco product packaging through Plastic Waste Management Rules (2016) and the provisions of environmental compensation.
- ICMR Bioethics Unit, under the aegis of ICMR, has published a reference book on 'Biomedical Ethics Perspectives in The Indian Context.' This is the first-of-its-kind book in India with a comprehensive and unique

compilation of topics addressing ethical aspects in various kinds of research in the Indian context by relevant experts.

- ICMR-NIIRRCH established National clinical database and biorepository of endometriosis.
- The Biomedical Informatics Centre of the institute has created an online resource - GeDiPNet freely accessible at http://gedipnet.bicnirrh.res.in/. It currently has information on 7297 diseases associated with 12,280 genes with their relevant annotations. This resource can accelerate disease informatics and health research initiatives.
- Bioethics Unit received emails with a wide range of queries concerning ethical aspects of research studies, functions of ethics committees, regulatory requirements, etc. A total of more than 150 Frequently Asked Questions (FAQs) have been framed. The FAQs are available on the website and are arranged section-wise to ascertain easy access and navigation to these particular topics. This would serve as a source of information for young researchers and newly constituted ethics committees in various colleges/ institutions across the country. The FAQ hard copy was released on 27th September 2022 by the Hon'ble Minister of State for Health, Ministry of Health & Family Welfare, Govt of India, Dr Bharati Pravin Pawar.
- 6 animated videos were prepared based on National ethical guidelines, Ethics preparedness in outbreak and emergencies and other relevant regulatory requirements. The videos are approximately 2-4 minutes each and are made freely available online in ICMR Bioethics Unit website. (https://ethics.ncdirindia.org/A_Videos.aspx).
- ICMR Bioethics unit aimed to develop the first of its kind- short educational movies in the country. The videos are based on case scenarios and are intended to aid young researchers, scientists, clinicians, EC members, and the community at large for a better understanding of the ethical issues they frequently face while conducting research. These self-learning videos also serve as a tool for addressing complex scenarios that deviate from the norm and assisting the stakeholders in taking appropriate action in such cases. 13 videos of approximately 2-5 minutes each were developed and released and are freely available online for easy accessibility.
- Report on "A Situational Analysis of Childhood Cancer Care Services in India -2022" prepared by ICMR-NCDIR in collaboration with the Directorate General of Health Services, Ministry of Health & Family Welfare and the World Health Organization (India office) was released on 27th September 2022 by the Hon'ble Union Minister of State for Health and Family Welfare, Dr. Bharati Pravin Pawar. The findings of the report emphasize the need to formulate a childhood cancer policy that would enable timely diagnosis, treatment, supportive care, and follow-up through well-defined care pathways.
- A Database on herb-drug interaction has been developed by ICMR-NITM with curated information available on interactions of commonly used drugs & herbs for the treatment/management of Diabetes mellitus (DM), Arthritis, and Gastrointestinal disorder (GI) (nausea, vomiting, diarrhoea, acidity). The database is a first of its kind in India and is expected to facilitate the safe and rational use of concomitant medications from multiple systems of medicine as India moves towards achieving its integrative health goals.

- I-MANN- the first mental health database for research in India was launched.
- Development and Validation of the Screening Version of the Indian Scale for Assessment of Autism, A screening version of ISAA: The simple, 10-minute, yes-no questionnaire, the Indian Autism Screening Questionnaire (IASQ), was developed which is an ideal instrument for screening of Autism in community settings and identifying autism early. The early identification can lead to early intervention benefitting the child. The IASQ has a sensitivity of 97-99% in different settings.
- Development of Panic and Anxiety National Indian Questionnaire (PANIQ): The team developed Indian version of Anxiety and Panic Questionnaire which is a culturally validated instrument to identify and measure anxiety and panic for Indian population.
- Development of intervention manuals in Mental health:

❖ For nurse-led intervention for perinatal depression (BIND-P).

❖ For telephonic interventions in suicide attempts.

❖ For detecting physical illness in the seriously mentally ill in the community (Community Level Intervention for Physical Illness in Mentally Ill People-CLIPMI).

❖ For ASHA to detect serious mental illnesses, common mental illnesses and substance use disorders in the community.

❖ The mindfulness intervention module has been also standardized for use in patients with diabetes and depression.

- ICMR Monograph Publications.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 24 (Sa-Sc). Indian Council of Medical Research, New Delhi. pp. 1-1008.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 25 (Se-Sm). Indian Council of Medical Research, New Delhi. pp. 1-833.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 26 (So-Sp). Indian Council of Medical Research, New Delhi. pp. 1-716.

❖ Reviews on Indian Medicinal Plants. 2022. Vol 27 (St-Sy). Indian Council of Medical Research, New Delhi. pp. 1-859.

- National List of Essential Medicines, 2022: NLEM, 2022 was released by Hon'ble Minister of Health, Dr. Mansukh Mandaviya on 13th September, 2022. The Standing National Committee on Medicine (SNCM) was constituted by Ministry of Health and Family Welfare with a mandate to revise National List of Essential Medicine (NLEM) 2015. National List of Essential Medicines (NLEM) is expected to result in better quality of medical care, better management of medicines and cost-effective use of health care resources. The NLEM, 2022 contains 384 medicines in 27 therapeutic categories.
- A Report was released – The Environmental Burden of Tobacco Product Wastes in India, a joint study by ICMR-NICPR and AIIMS Jodhpur. The evidence thus generated may serve to reinforce and amend the existing policies on regulation of tobacco product packaging through Plastic Waste Management Rules (2016) and the provisions of environmental compensation.
- ICMR-NIN estimated the glycaemic index and glycaemic loads of more than 150 foods such as breakfast foods, lunch and dinner

foods, fast foods, bakery foods, chat foods, junk foods etc.

- Technical Report of the study undertaken by ICMR-NIMS on "Validation study on assigning cause of death" was released. It is envisaged that the evidence generated would inform the researchers and decision-makers for strengthening cause specific mortality statistics in India.
- Prescription Research Software (PrescReSof©) for the RUMCs of National Virtual Centre of Clinical Pharmacology (NvCCP) was developed and hosted at ICMR-NIMS.
- ICMR-National Hospital Based Registry on Venous Thromboembolic Disorders (i-RegVeD) developed and hosted at ICMR-NIMS aims to establish a nationwide registry through selected hospitals and collect data for generating to generate evidence on *Venous thromboembolism (VTE)* prevalence for planning response, and strengthening healthcare facilities across different treatment settings.
- ICMR prepared a report 'ICMR's Response to COVID-19', which documents the various interventions undertaken by ICMR and its 27 institutes to strengthen India's fight against COVID-19.

NEW COURSES

- ICMR rolled out an online health communications course. The curriculum of the program provided participants with an overview of critical topics like importance of strategic communication, health communication, media management and community engagement.
- ICMR-VCRC took a lead role in establishing a National Public Health Entomology (NPHE) Programme and facilitated in replicating the M.Sc. PHE course in other ICMR institutes, where vectors and vector borne disease research is undertaken. Accordingly, ICMR-RMRCGKP, Gorakhpur; ICMR-RMRIMS, Patna; ICMR-RMRCNE, Dibrugarh and ICMR- NIRTH, Jabalpur have been identified as Regional Campuses to conduct M.Sc., PHE course. Pondicherry Central University has provided Provisional Affiliation.
- Training module on VL, PKDL and VL-HIV co-infection was developed under DNDi sponsored Centre of Excellence program.
- The ICMR School of Public Health (ICMR-SPH) at ICMR-National Institute of Epidemiology has been conducting advanced (Master of Public Health and Epidemic Intelligence Services Program) and intermediate (FETP-NCD) field epidemiology training programs in India.
- The institute designed and developed an online certificate course on 'One Health', first-of-its-kind in India which was launched on 23rd January 2023 through the NPTEL platform.
- ICMR- BMHRC is conducting the following courses:

❖ DNB (Diplomate National Board) in Ophthalmology course.

❖ MD Anaesthesia course (Post Graduation).

- The Bhopal College of Nursing conducts the following courses:

❖ M.Sc. Nursing.

❖ B.Sc. Nursing.

❖ Post Basic BSc Nursing.

- The Paramedical Institute at BMHRC conducts the following Diploma Courses:

- Diploma in Anaesthesia Technician.
- Diploma in Blood Transfusion Technician.
- Diploma in Dialysis Technician.
- Diploma in Cath Lab Technician.
- Diploma in Medical Lab Technician.
- Diploma in Optometry & Refraction Technician.
- PG. Diploma in Perfusion Technology.
- Diploma in X-Ray & Radiographer Technician.

RESEARCH SUPPORT & OUTREACH

RESEARCH PROPOSAL MANAGEMENT

ICMR actively promotes extramural research through its Extramural Research Programme, encouraging open-ended investigations based on applications from Indian scientists outside ICMR institutes. This initiative is designed to facilitate research in the fields of medicine, public health, and allied disciplines, ultimately contributing to the enhancement of the health of the Indian population.

Under the Extramural Research Programme, research proposals are solicited through a Call for Proposals, and submissions are welcomed from researchers and scientists employed in universities, medical colleges, postgraduate institutions, recognized research and development laboratories, and NGOs across India.

To enhance the efficiency of processing and streamline the Extramural Research Program, ICMR has transitioned to the Electronic Project Management System (ePMS). This shift aims to simplify the application and evaluation process, ultimately saving time and effort for investigators. The central vision of the ePMS system is to provide a transparent and centrally controlled platform for electronic proposal evaluation and grant disbursement, supporting research and development institutions in their endeavors.

During the financial year 2022-23, a total of 5,148 adhoc proposals were submitted across different calls. The important calls were Impact of Climate Change on Vector-Borne Diseases (VBDs), Ayushman Bharat Health Infrastructure (PM-ABHIM), Interventional/Implementation Research in Mental Health, Therapeutics for Inherited Rare Diseases, Safe and Rational Use of Medicines (SRUM), i-Drone Task Force Study, developing novel tools and technologies for improving the diagnosis and treatment of venomous snake bite, PCOS study, studies in the area of Trauma, Injuries and Emergencies,Oral Health studies, Stillbirth studies,etc. Among these submissions, 691 proposals successfully received approval for funding.

OUTREACH ACTIVITIES

ICMR Health Communications Conclave "Connect and Collaborate 2022": The council's first conclave on health communications was held on July 15, 2022. Experts and leading voices in public health, communications and health journalism were brought together to exchange learnings on a range of issues like behaviour change communications, tackling health misinformation and fake news, ways to encourage inter-governmental collaboration for effective communications, and the evolving role of digital and social media in the health communications in India.

Fig. 1: ICMR Health Communications Conclave "Connect and Collaborate 2022".

Vaccine Injecting Hope:ICMR coordinated with National Council of Science Museums, India and the Science Museum Group, UK for establishing a travelling exhibition, "Vaccines: Injecting Hope" that explores the history and science of vaccines globally and rapid innovation through international collaboration for the recent SARS-COV 2 pandemic vaccine.

Changing the Nation's Health Landscape: A special collection of 75 stories celebrating the spirit of New India, titled 'Changing the Nation's Health Landscape' was published. From the country's first test tube baby to tackling leprosy to battling COVID19, the photobook is a collection of interventions by ICMR that have helped improve the health and wellbeing of all Indians.

Physical Installation of the Covaxin journey:ICMR designed, developed and facilitated the physical installation on the journey of Covaxin, a permanent display of India's first indigenous COVID-19 vaccine, at the ICMR HQ. The installation was designed to commemorate the landmark achievement and ICMR's role in developing the vaccine.

ICMR's Response to COVID-19- A Report: The team finalized a report 'ICMR's Response to COVID-19', which documents the various interventions undertaken by ICMR and its 27 institutes to strengthen India's fight against COVID-19.

"My World of Preventive Medicine": The team redesigned and republished the autobiography of Dr. C.G. Pandit, Founder & the first Director General of ICMR. The book titled 'My World of Preventive Medicine'provides a first-hand account of the early history of the institution and the seminal contributions made by its scientists during 20th century.

Fig. 2: Significant Publications of ICMR.

Developing films and websites for ICMR institutes: ICMR supported the development of films for ICMR institutes (NIV, NIRRCH, NARF-BR& NIRT) to promote awareness about their pioneering research work and contributions to national policies and programmes. The team supported ICMR-NIRRCH institute in the development of a film showcasing the life and achievements of Dr. Shanta Rao, an illustrious scientist, teacher, visionary and the founder-Director of the Institute for Research in Reproduction, the predecessor of ICMR-NIRRCH.

G20 Health Working Group Meeting & Expo:ICMR participated in the G20 Expo held during the 1st Health Working Group meeting at Thiruvananthapuram. The stall was conceptualized to display the council's achievements in the area of pandemic preparedness and translational research. Two films, on 'Outbreak Investigation and Pandemic Preparedness' and 'Translating Research into Action for Disease Management and Elimination' were also developed. Some milestones covered in the film included development of India's first indigenous COVID-19 vaccine- Covaxin, research on Tuberculosis elimination, India Hypertension Control Initiative and others.

Health Communications Course:ICMR rolled out an online health communications course.The curriculum of the program provided participants with an overview of critical topics like importance of strategic communication, health communication, media management and communityengagement.

Health Literacy among School Students: An ICMR-WHO study was undertaken on Health Literacy among school students in relation to pandemic and need based assessment for information dissemination using media and social media. About 24 Government, Government-aided and Private schools from across Delhi, were identified in liaison with Department of Education, Government of Delhi for trainings.Training curriculum was tailored to information needs of students and educators, comprising of two core modules on infodemic management and media literacy.Hands-on workshops and simulation game for students and teachers on identifying fake news online were also developed, suitable fordeployment in diverse socio-economic setups.

Research dissemination through Exhibitions: ICMR has been able to extend its outreach activities through various exhibitions, expos and summits in different parts of India. In the year 2022-23, ICMR participated in some of the major exhibitions such as 108th Indian Science Congress at Nagpur, India International Science Festival at Bhopal, Uttar Pradesh Global investor

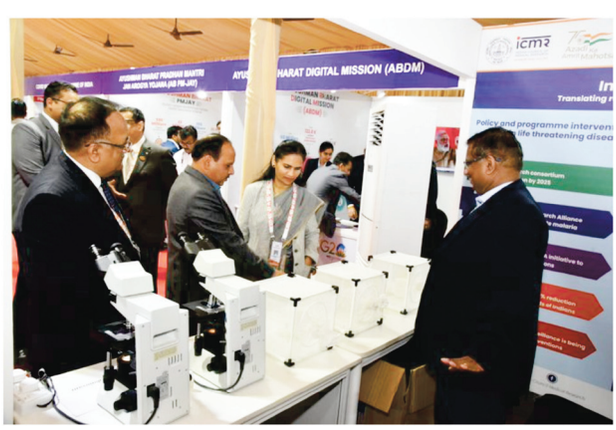


Fig. 3: G20 Health Working Group Meeting & Expo.

Fig. 4: Workshop on Health Literacy among School Students.

Summit 2023 at Lucknow and Bangalore Tech Summit at Bangalore. Through these outreach activities, ICMR showcased its technologies and achievements to the masses. ICMR bagged awards at some of these events, including "Most informative and Innovative pavilion award", "Best Interactive Award". ICMR participated in the 31st World Book Fair at New Delhi to increase awareness among larger audience through various publications on Nutrition, Medicinal Plants, and Diseases.

Media Campaigns and other Activities: ICMR initiated multiple social media campaigns on key health days (Poshan Maah, National TB day). The team facilitated the development and dissemination of short videos by scientists from ICMR-NIRT to raise awareness around various aspects of tuberculosis.Experts from NIRT addressed salient issues including the linkages between nutrition and tuberculosis and the preventive and curative measures for patients and care givers. The videos were disseminated through the official Twitter handle of TB Harega DeshJeetega, a National campaign against TB.

Fig. 5: 31st World Book Fair at New Delhi.

INSTITUTES/REGIONAL MEDICAL RESEARCH CENTRES

ICMR

Uttar Pradesh
- National JALMA Institute for Leprosy & Other Mycobacterial Diseases, **Agra**
- National Institute of Cancer Prevention and Research, **Noida**
- Regional Medical Research Centre, **Gorakhpur**

New Delhi
- National Institute of Malaria Research, **New Delhi**
- National Institute of Pathology, **New Delhi**
- National Institute of Medical Statistics, **New Delhi**

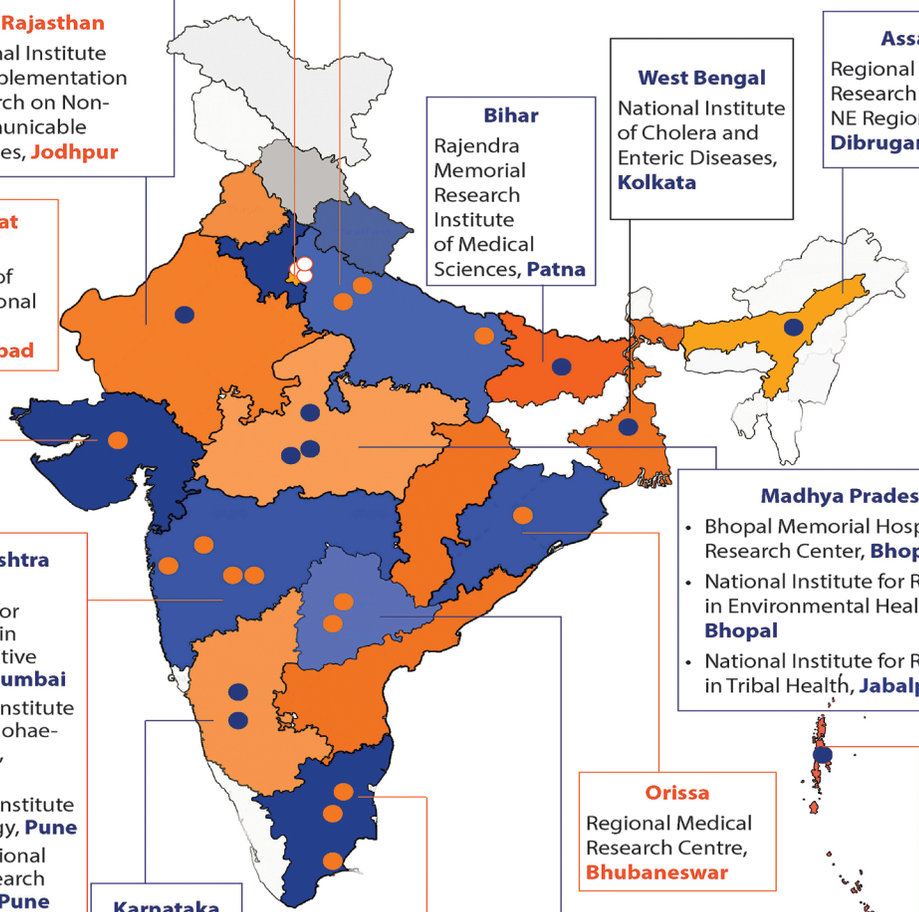
Rajasthan
National Institute for Implementation Research on Non-Communicable Diseases, **Jodhpur**

Assam
Regional Medical Research Centre, NE Region, **Dibrugarh**

West Bengal
National Institute of Cholera and Enteric Diseases, **Kolkata**

Bihar
Rajendra Memorial Research Institute of Medical Sciences, **Patna**

Gujarat
National Institute of Occupational Health, **Ahmedabad**



Madhya Pradesh
- Bhopal Memorial Hospital & Research Center, **Bhopal**
- National Institute for Research in Environmental Health, **Bhopal**
- National Institute for Research in Tribal Health, **Jabalpur**

Maharashtra
- National Institute for Research in Reproductive Health, **Mumbai**
- National Institute of Immunohae-matology, **Mumbai**
- National Institute of Virology, **Pune**
- ICMR-National AIDS Research Institute, **Pune**

Orissa
Regional Medical Research Centre, **Bhubaneswar**

Karnataka
- National Centre for Disease Informatics and Research, **Bengaluru**
- National Institute of Traditional Medicine, **Belagavi**

Tamil Nadu
- National Institute of Epidemiology, **Chennai**
- National Institute for Research in Tuberculosis, **Chennai**
- Vector Control Research Centre, **Puducherry**

Telangana
- National Institute of Nutrition, **Hyderabad**
- National Animal Resource Facility for Biomedical Research, **Hyderabad**

Port Blair
Regional Medical Research Centre, **Port Blair**

INDIAN COUNCIL OF MEDICAL RESEARCH
Department Of Health Research
(Ministry of Health & Family Welfare)
V. Ramalingaswami Bhawan, Post Box 4911,
Ansari Nagar, New Delhi-110 029
Phone: 91-11-26588980, 26589794, 26588895
E-mail: icmrhqds@sansad.nic.in
Website: http://www.icmr.nic.in