Department of Health Research
Ministry of Health and family Welfare
Government of India

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INDIAN COUNCIL OF MEDICAL RESEARCH
Serving the nation since 1911

INDIAN COUNCIL OF MEDICAL RESEARCH

ANNUAL REPORT 2023-2024

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

Designed & Printed at Machis 360

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Message from The Director General

As we reflect on the past year, I am filled with immense pride at the remarkable strides the Indian Council of Medical Research (ICMR) has made in advancing research and innovation for societal betterment. This year has been evidence to our unwavering commitment to addressing pressing challenges, fostering impactful collaborations, and driving solutions aligned with our mission towards Viksit Bharat 2047.

Our journey has been marked by numerous milestones, showcasing the dedication and expertise of our teams. From institutional reforms in extramural and intramural programs to groundbreaking research initiatives, we have consistently expanded into new research domains, created sustainable ecosystems for medical devices and innovations, and achieved transformative outcomes. Notable achievements include advancements in public health research, the development of innovative diagnostic tools, and transformative policies that have directly impacted lives. Additionally, our focus on capacity building and knowledge dissemination has empowered the next generation of researchers to carry forward this mission.

ICMR demonstrated its agility and efficiency in outbreak management through effective responses to public health emergencies. During the recent Nipah virus outbreak in Kerala, our swift actions included immediate deployment of diagnostic teams, a bat survey, and the establishment of a mobile BSL-3 facility within 24 hours. This rapid response resulted in the timely identification of cases, strict biosafety measures, and effective outbreak control. Ensuring future pandemic preparedness of the nation, initiatives under the National One Health Mission (NOHM), including the establishment of the National Institute of One Health (NIOH) in Nagpur, a national network of BSL-3 and BSL-4 labs, and approval of SFC for NOHM activities, highlight our proactive approach to interconnected health challenges.

Looking toward the national goal of eliminating tuberculosis and reducing the burden of non-communicable diseases (NCDs), ICMR has prioritized indigenous innovation and evidence-based interventions. In the fight against TB, technologies such as the PathoDetect drug resistance kits, developed under the Make-in-India initiative, have strengthened the National Tuberculosis Elimination Programme. Similarly, initiatives like the India Hypertension Control Initiative (IHCI), Mission DELHI, and the Mobile Stroke Unit leverage digital technologies to address NCDs through effective monitoring and timely interventions.

ICMR continues to focus on emerging critical health concerns, including the sudden deaths of young adults. A multicentric case-control study was conducted to investigate potential links between such incidents and COVID-19 infection or vaccination, providing clarity and addressing public apprehensions.

Innovation and technology have been central to our efforts. The i-Drone initiative has revolutionized healthcare logistics, enabling the delivery of vaccines and medical supplies to remote terrains. The launch of MedTechMitra, a collaborative program with CDSCO under the guidance of NITI Aayog, has supported MedTech innovators, fostering the development of affordable and high-quality medical devices and diagnostics to reduce import dependency and enhance indigenous capabilities. ICMR has also made significant strides in leveraging artificial intelligence (AI) for healthcare, including thematic hubs for medical imaging and AI tools for tuberculosis diagnosis developed in collaboration with IISc Bangalore. Additionally, the AMR Diagnostics Taskforce is driving innovations in early pathogen detection and susceptibility profiling by developing Target Product Profiles (TPPs), conducting cost-effectiveness studies, and field testing rapid diagnostic tools for conditions like sepsis.

Capacity building through the development of a talent pipeline of health research scientists especially physician-scientists has been another cornerstone of our work. A Memorandum of Agreement (MoA) with the Academy of Scientific and Innovative Research (AcSIR) for creating Faculty of Medical Research is transforming medical research in India by promoting transdisciplinary research and awarding Ph.D degrees. Our focus on knowledge dissemination and fostering the next generation of researchers ensures a robust foundation for future advancements.

Infrastructure development remains a key enabler for national research capacity building. This year saw the inauguration of five new facilities at the ICMR-National Institute of Malaria Research (ICMR-NIMR), including a 300-seat auditorium, a preclinical testing laboratory, and an innovation complex. The new building of the ICMR-National Institute of Traditional Medicine (ICMR-NITM) in Belagavi and the foundation stone for a BSL-3 laboratory at ICMR-NARI reflect our commitment to strengthening research infrastructure and expanding national capabilities.

As we look ahead, our vision is clear: to deepen the relevance and reach of our research while embracing cutting-edge technologies and interdisciplinary approaches. We remain steadfast in our commitment to addressing emerging health challenges, fostering inclusivity, and contributing to sustainable development. I extend my heartfelt gratitude to our dedicated teams, partners, and stakeholders for their unwavering support. Together, we have laid a robust foundation for a brighter, healthier, and more equitable future. Let us move forward with renewed vigor, innovation, and compassion to realize our shared vision of a healthier and more equitable world.

Dr. Rajiv Bahl
Director General
Indian Council of Medical Research

Executive Summary (Year in Review: A Snapshot of 2023-24)

99.7%	3300+	40+	35+
Budget Utilized	Publications	Patents	Technologies Validated

The Indian Council of Medical Research (ICMR), India's apex bio-medical research organization, achieved significant milestones in 2023-24, driving advancements in public health, clinical care, and innovation through groundbreaking research, strategic collaborations, and evidence-based policy support. This summary encapsulates our key achievements across its core focus areas.

We utilised 99.71% of our ₹2,350.12 crore allocation to strategically fund both intramural research (conducted by our institutes) and extramural initiatives (driven through funding external projects and institutions). This enabled us to foster impactful collaborations, build capacity, and develop state-of-the-art infrastructure, reinforcing our role as a catalyst for health innovation and excellence.

At ICMR, we ensured that our research translates into tangible impact on the ground while staying at the forefront of the innovation cycle to address both existing and emerging diseases. In what has been a landmark year, we filed 31 Indian patents, 6 design patents, 9 copyrights, 4 trademarks, and 4 foreign patents, alongside securing 24 Indian patents and 4 foreign patents previously filed. A total of 35 technologies were successfully validated, with 3 key innovations transferred—one addressing bleeding disorders and two focused on pandemic preparedness. Furthermore, 3 strategic licensing and commercialization agreements were finalized, ensuring these advancements are effectively positioned to strengthen public health and address critical healthcare challenges.

Intramural and Extramural Grants:

We utilized ₹698.94 crore in intramural grants to advance high-impact initiatives across our institutes. In communicable diseases, we focused on critical areas such as vector-borne diseases, viral and bacterial infections, and antimicrobial resistance. For non-communicable diseases, our efforts addressed pressing health concerns like diabetes, cancer, cardiovascular diseases, and mental health. In reproductive, child health, and nutrition, we tackled key challenges in maternal and child health, malnutrition, and neonatal care. In this year, intramural research, mostly funded in previous years culminated in over 1,500 publications highlighting our significant contributions to scientific advancement and evidence-based solutions for improving public health outcomes. Notable new initiatives included 36 multisite projects in communicable diseases, 34 in non-communicable diseases, and 7 multicentric projects in reproductive, child health, and nutrition, highlighting our strategic focus on addressing India's critical health challenges.

We allocated ₹896.18 crore in extramural grants to drive impactful biomedical research across four key categories: Discovery, Development, Delivery, and Description. A significant portion of the funding was dedicated to Discovery (38%) and Development (35%), underscoring our commitment to innovation and the application of foundational research. Delivery (19%) focused on translating research into practical, real-world solutions, while Description (8%) supported targeted observational studies to

enhance understanding of health challenges. In total, 725 new grants were initiated across the Small, Intermediate, and Centre for Advanced Research programs, emphasizing our dedication to fostering research and innovation. In this year, extramural projects resulted in 1,809 publications, advancing scientific knowledge and driving solutions to improve public health outcomes.

In addition to intramural and extramural grants, we provided targeted support for research addressing National Health Research Priorities, emphasizing the Government of India's commitment to tackling critical public health challenges through evidence-based approaches. This year, 16 projects were funded across priority areas, including Primary Health Care, Acute Emergency Care, Oral Health, Neonatal Mortality (NMR), Stillbirth, Anemia, Cancer, Ambulatory Care for Non-Communicable Diseases, Mental Health, Tuberculosis (TB), and Antimicrobial Resistance (AMR). These projects span 177 sites across the country, ensuring comprehensive regional and demographic representation to address diverse healthcare needs effectively.

Transformative Initiatives for India's Biomedical Research Ecosytem:

We achieved a significant milestone with the launch of the ICMR Faculty of Medical Research (AcSIR-ICMR-FMR) in collaboration with the Academy of Scientific and Innovative Research. This transformative initiative is aimed at revolutionizing biomedical research in India by fostering transdisciplinary studies and awarding PhD degrees, thereby significantly strengthening the nation's research capacity. To further strengthen its research ecosystem, we undertook a mission-mode recruitment drive to fill existing vacancies, significantly expanding its workforce. This strategic effort bolstered the capacity of ICMR and its institutes, ensuring robust support for advancing critical research and innovation initiatives.

We made significant strides in healthcare innovation, with ICMR leading the charge through our MedTech Mitra Platform, a collaborative initiative with CDSO and under the guidance of NITI Aayog. This platform provides comprehensive support, including regulatory facilitation, pre-clinical and clinical evaluations, Health Technology Assessment (HTA), and the uptake of new products. By bridging the gap between research and application, MedTech Mitra has expedited the development and deployment of life-saving medical technologies, making them more accessible and efficient within India's healthcare system.

Key Research results:

ICMR played a pivotal role in addressing emerging infectious diseases, antimicrobial resistance, and strengthening early detection mechanisms for potential public health threats through remarkable advancement in diagnostics. Key highlights include the development of a rapid, cost-effective diagnostic kit for Haemophilia A and von Willebrand Disease (vWD). Additionally, we introduced India's first rapid Mpox test kit, delivering results within an hour at a low cost of ₹350–400. These advancements have significantly improved our ability to respond swiftly to outbreaks. Our innovations extended to molecular diagnostics, where we developed tools for detecting clarithromycin-resistant Helicobacter pylori, co-infections like visceral leishmaniasis, and CRISPR-Cas13-based diagnostics for tuberculosis and malaria. These breakthroughs underscore ICMR's commitment to delivering accessible, precise, and impactful diagnostic solutions. Furthermore, to enhance the pandemic preparedness of the country, ICMR identified the priority pathogens for various acute syndromes including undifferentiated fever, encephalitis, diarrhoea and respiratory infections. Surveillance for comprehensive testing of these syndromic illnesses is conducted at virus research and diagnostic labs (VRDLs). The aim is to test for all known pathogens to pick up unknown/newly emerging pathogens. Indigenous manufacturers have been promoted and hand-held for developing multiplex molecular diagnostic tests for various pathogens prevalent in India. This will enable availability of low cost diagnostic tests in India.

The validation of the Indian Diabetic Risk Score as a cost-effective screening tool for diabetes in Asian Indians underscored ICMR's commitment to addressing diverse health challenges with impactful, evidence-driven solutions.

ICMR-DHR has been designated as the secretariat for the activities of the National One Health Mission, launched under aegis of the Principal Scientific Advisor to Govt of India. Under the mission, an interdepartmental network of 21 BSL3 labs has been established and trained for holistically testing samples of human, animal and environmental origin. Under public-private partnerships, initiatives were taken to develop Medical countermeasures for locally endemic diseases including vaccine for Kyasanur Forest Disease and monoclonal antibodies for Nipah virus disease. Pilot projects for implementing surveillance at animal-human interface such as bird sanctuaries, slaughterhouses, and zoos, have been initiated for early detection of newly emerging pathogens.

We also made significant achievements in innovations in the development of medical devices. Through extramural project funding and collaborations with ICMR-DHR Centers of Excellence at IITs, we developed innovations including i-Scope, an automated microscopy tool that is revolutionizing cervical cancer diagnosis, and Artsens, an image-free ultrasound device that enables greater accessibility for vascular screening. Furthermore, AI-powered tools for tuberculosis diagnosis and reproductive outcome prediction have demonstrated our dedication to leveraging cutting-edge technology. A portable Point of Care device developed for albumin, direct bilirubin, total bilirubin, and total protein detection in serum for liver and kidney disorders underscored ICMR's dedication to delivering sustainable, cost-effective, and transformative healthcare solutions tailored to India's needs.

ICMR has been instrumental in advancing drug and vaccine development. ICMR supported the development of a powder for oral suspension (PFOS) of 6-mercaptopurine (PREVALL), which has reduced leukemia treatment costs by 90%. Comparative immunogenicity and safety study of Oral Cholera Vaccines (OCV) Euvichol-Plus with Shanchol demonstrated the non-inferiority of Euvichol-Plus to Shanchol, contributing to the licensure of Euvichol-Plus for use in India

ICMR has made remarkable contributions in treatment regimens that significantly improved disease management and patient outcomes. Our work in tuberculosis (TB) care provided evidence for three shorter oral regimens for MDR-TB, while a clinical trial demonstrated the efficacy of adding piperine to standard TB treatment in accelerating recovery. Our advancements in cancer care include the introduction of isotretinoin for high-risk neuroblastoma, ensuring precise dosing and improving accessibility.

ICMR continues to be at the forefront of India's response to public health emergencies and outbreaks, demonstrating resilience and innovation in safeguarding the nation's health. The rapid test kit enabled swift disease detection and management of Mpox. We played a pivotal role in containing the Nipah virus in Kerala through coordinated efforts in contact tracing, environmental investigations, and critical care interventions. Our preparedness for emerging threats, such as yellow fever during Operation Kaveri, showcased our strategic foresight and diagnostic readiness. Furthermore, our response to outbreaks of measles and hepatitis combined advanced testing, community outreach, and capacity-building efforts for local healthcare systems. We also focused on strengthening surveillance and control measures for vector-borne diseases like dengue, chikungunya, and West Nile Virus, further bolstering India's capacity to address public health challenges.

ICMR continued to support national health programs in various ways. For example, we made significant contributions to the National Tuberculosis Elimination Program by validating diagnostic tools, deploying handheld X-ray devices, and facilitating active case finding in collaboration with state teams. Our contributions to the Anemia Mukt Bharat

initiative, especially our recommendations on intravenous iron use during pregnancy, helped strengthen the national programme. We also scaled up the Indian Hypertension Control Initiative, pioneered rapid diagnostics for sickle cell anemia, and supported universal health coverage through Ayushman Bharat.

In, conclusion, during the year 2023-24, we leveraged data-driven insights, cutting-edge technology, and strategic partnerships to tackle critical health challenges. ICMR's commitment to addressing these challenges and fostering impactful solutions aligns with both national and global health goals, positioning us as a leader in healthcare innovation and delivery. Through these efforts, ICMR has played a transformative role in advancing India's healthcare landscape. We continue to work relentlessly in research, innovation, strategic funding, and policymaking, significantly improving public health and driving India toward its vision of Viksit Bharat 2047.

Most Important Outcomes

1 First Reports of Vectors and Pathogens

a. New Vector Species Identified: Sergentomyia ashwanii sp. nov. and Phlebotomusajithii sp. nov.

b. First Detection of Viruses in Vectors: Reported Culexflavivirus in Culex quinquefasciatus for the first time.

c. Novel Drug-Resistant Fungal Strains: First identification in India of drug-resistant fungal strains responsible for:

i. Mycetoma: Madurellafahalii.

ii. Chromoblastomycosis: Fonsecaeanubica and Fonsecaeamonophora.

iii. Keratitis: Phaeoacremonium- fuscum, Neodeightoniasubglobosa, and A. rasikaravidrae (first in the world).

d. First-Time Identification of Bacterial Strains in India with Outbreak Potential:

i. A new drug-resistant strain of Salmonella serovars (Takoradi, Tananarive, and Uganda), resistant to Azithromycin—a commonly prescribed antibiotic for salmonella infections in India.

ii. Shigella dysenteriae Type I, re-emerging after 14 years.

iii. A diarrhoeagenic strain of Proteus mirabilis, previously considered a harmless commensal.

2 New Health Technology

a. Diagnostic Kits and Tools:

i. Developed a simple, rapid, and cost-effective diagnostic kit for the diagnosis of Haemophilia A and von Willebrand Disease (vWD) for the first time globally.

ii. ICMR-NIV introduced India's first rapid Mpox (monkeypox) test kit, a groundbreaking tool that provides results within an hour and costs Rs. 350–400, addressing the urgent need for timely diagnosis.

iii. Designed a low-cost nested PCR assay for direct detection of clarithromycin-resistant Helicobacter pylori strains from biopsy samples.

iv. Created a diagnostic kit for co-infections like visceral leishmaniasis (VL) and post-kala-azar dermal leishmaniasis (PKDL).

v. Developed a novel diagnostic device and method to differentiate Asthma-COPD Overlap Syndrome (ACO) from Asthma and COPD.

vi. Produced isothermal PCR-based molecular diagnostic kits for Chikungunya.

vii. A Point-of-Care (PoC) diagnostic kit for scrub typhus was developed.

viii. Introduced PathDetect M.TB Rif. & INH, validated for detecting resistance to Rifampicin and Isoniazid in TB/MDR-TB patients.

ix. Developed an indigenous CRISPR-Cas13 molecular diagnostic tool for the detection of Mycobacterium tuberculosis.

x. Created PoC detection kits for malaria and TB using CRISPR-CAS technology.

xi. Created a Point-of-Care assay for the early detection of silicosis and silico-tuberculosis.

b. Medical Devices:

i. Developed i-Scope, an automated microscopy tool for diagnosing cervical cancer using Pap smear tests.

ii. Designed Artsens, an image-free ultrasound device for vascular aging and screening.

iii. Created an AI-enabled handheld X-ray device for affordable tuberculosis diagnosis.

iv. Developed an AI-based tool to predict outcomes of assisted reproduction in men with Y chromosome microdeletion.

v. Established an AI-powered tool for TB X-ray screening, achieving over 96% sensitivity and specificity, ready for nationwide deployment.

vi. Developed a portable PoC device for albumin, direct bilirubin, total bilirubin, and total protein detection in serum for liver and kidney disorders.

vii. Developed a non-invasive PoC diagnostic for neurological conditions like epilepsy.

viii. Designed a flexible laparoscopy surgery instrument to improve precision and accessibility in surgical procedures.

ix. Developed a reusable and adjustable biopsy gun for efficient and sustainable diagnostic applications.

3 Data for decision making/new technology development

i. Established ICMR MYCONET Inpatient Clinical Registry, a pan-India analytics platform for invasive fungal infections, enhancing disease surveillance. This empowers policymakers to identify high-burden areas and optimize resource allocation effectively.

ii. Incorporated a database of chest X-rays with clinical data on the ICMR-NIRT website. This resource will aid in research and the development of AI-based software for TB interpretation of chest X-rays, facilitating prompt diagnosis as a point-of-care solution.

iii. Conducted a health technology assessment for the telemedicine-enabled otoscope, demonstrating its potential for diagnosing ear conditions at the primary healthcare level.

iv. Evaluated the cost-effectiveness of the DAMaN program, a malaria intervention initiative by the Government of Odisha. This assessment supports scaling up the program for broader impact.

v. A mixed-methods study in Khambhat revealed a 58% prevalence of latent tuberculosis infection (LTBI) among agate-stone workers, nearly double the general population rate. Key risk factors included prolonged exposure duration and work type. The findings highlight the need for policy changes to prioritize silica-dust-exposed populations for LTBI testing.

vi. Young Diabetes Registry provided critical insights into high incidences of co-morbidities like autoimmune thyroid disease and hypertension among young diabetic patients, emphasizing the need for integrated care strategies.

vii. Tobacco Waste Study provided the first national-level evidence on the types and quantities of waste generated by smoked and smokeless tobacco products in India, aiding in environmental and health policy formulation.

viii. The Patterns of Care and Survival Studies (POCSS) on gall bladder cancer (GBC) conducted through Indian hospital-based cancer registries outlined the disease's patterns in the country. This study informs improved care strategies and early detection measures.

ix. Surveillance of food borne pathogens in North-east India identified eight clinically significant, enteric pathogens, potential to cause food borne outbreak from environment, food, human and outbreak samples which is crucial evidence for food safety measures and to reduce risk of outbreaks.

x. Population based stroke registry provided stroke incidence data in Assam. It provided an insight into the higher incidence of hemorrhagic stroke in this region emphasizing the need for hypertension control and a neurosurgery centres at medical colleges.

xi. Study on implementation of HPV vaccine program and vaccine acceptance among adolescent girls in Punjab showed acceptance of was above 98% in adolescent girls and above 96% in parents of unvaccinated children

4 Improved clinical or public health care

i. Provided evidence of 3 shorter oral drug regimens for MDR-TB.

ii. A clinical trial showed the efficacy of adding piperine to standard TB treatment, achieving early culture conversion.

i. A 4-month clofazimine-based regimen for drug-sensitive TB (DS-TB) was evaluated as safe and effective, recommended for use under operational research

ii. A TB reduction project in a Saharia-dominated district demonstrated a 49–95% reduction in new TB cases through molecular diagnostics, hand-held X-rays, and telemedicine

iii. Paediatric formulation of isotretinoin (13-cis-retinoic acid) to improve survival in children with high-risk neuroblastoma; provides an age-appropriate solution, improving accessibility and dose accuracy.

iv. A powder for oral suspension (PFOS) of 6-mercaptopurine (PREVALL)was developed, which helps in accurate dosing for children undergoing treatment for Acute Lymphoblastic Leukaemia (ALL) and is available at one tenth cost of its international comparators.

v. Comparative immunogenicity and safety study of Oral Cholera Vaccines (OCV) Euvichol-Plus with Shanchol demonstrated the non-inferiority of Euvichol-Plus to Shanchol, contributing to the licensure of Euvichol-Plus for use in India.

vi. Implemented the first statewide differentiated TB care model (called Tamil Nadu KasanoiErapillaThittam), aimed at reducing TB deaths. Through TN-KET, the real-world evidence was generated. This strategy is the way to go ahead in the context of differentiated TB care in resource constrained settings. TN-KET was found to be feasible to implement and reduced TB deaths by 10-20% within two quarters of implementation.

vii. The Indian Diabetic Risk Score was evaluated and found to be a cost-effective tool for screening diabetes in Asian Indians

viii. Conducted a multicentric matched case–control study across 47 tertiary hospitals in India, to identify factors associated with unexplained sudden deaths in young adults. The study demonstrated the protective effect of COVID-19 vaccination.

ix. A stroke care pathway project in North East region of the country provided evidence that a physician/neurologist led stroke unit set up at Medical College can help in diagnosis and management of stroke patients.

x. A STEMI care pathway developed in districts of Himachal Pradesh, Punjab, Uttar Pradesh and Andhra Pradesh demonstrated that STEMI (severe heart attack) patients can be diagnosed at CHC level through tele ECG and provided lifesaving thrombolytic therapy.

5 Program Support

i. Disease Outbreaks investigations provided for Nipah, Monkey Pox, west Nile virus etc.

ii. ICMR initiated integrated surveillance across 30 Viral Research & Diagnostic Laboratories (VRDLs) and 90 sub-sites nationwide. This effort tracks trends in Influenza A, Influenza B, and their subtypes, alongside SARS-CoV-2, to identify and monitor new or evolving strains with outbreak potential.

iii. A national risk map highlighting hotspots for zoonotic diseases of human importance is under development, along with appropriate preventive measures.

iv. Surveillance networks for Kyasanur Forest Disease (KFD) and Crimean Congo Hemorrhagic Fever (CCHF) established in 10 VRDLs. These cover the Western Ghats for KFD (Karnataka, Kerala, Goa, and Maharashtra) and states like Gujarat, Rajasthan, and Uttar Pradesh for CCHF.

v. Annual HIV Sentinel Surveillance and Integrated Biological and Behavioural Surveillance (IBBS) were conducted in

Tamil Nadu, Andhra Pradesh, Telangana, Karnataka, Odisha, Kerala, Pondicherry, and Lakshadweep. These data inform national HIV burden estimates and assess the impact of interventions in antenatal care (ANC) and high-risk groups (FSW, MSM, IDU, etc.) and supported NACO in preparation of Annual HIV estimates through modeling.

vi. DBS sample validation for detecting Treponemal antibodies under the National AIDS Control Program showed satisfactory results for three laboratory assays (TPHA-Biorad, EIAs-Biorad, and Transasia Biomedicals) as per CDSCO criteria.

vii. Enhanced KFD surveillance along the Western Ghats detected 250 new cases in Shimoga and North Goa, identifying emerging hotspots.

viii. A Rapid UTI Antibiogram kit (Rapidogram) was validated in West Bengal's peripheral health facilities. Manufacturer improvements, based on recommendations, led to its adoption by the National Health Mission.

ix. ICMR identified hidden burdens of P. vivax and mixed malaria infections, as well as other non-malarial fever pathogens in North East, while establishing seroprevalence for leptospirosis.

x. AI modeling performance for line probe assays (LPA) in TB diagnosis and feasibility studies of Trueprep-extracted DNA were validated and adopted under the National Tuberculosis Elimination Program (NTEP).

xi. Strengthened the State NCD Program in Jodhpur by establishing referral chains for diagnosis and treatment, which was handed over to the state government for broader implementation.

xii. Collaborated with NITI Aayog to revise Anemia Mukt Bharat strategies, leading to AMB 2.0 with enhanced treatment algorithms and comprehensive guidance on anemia management across age groups.

xiii. At the Ministry of Health & Family Welfare's request, ICMR analyzed maternal mortality data with the Registrar General of India and promptly shared actionable insights.

xiv. Collaborated with the Armed Forces to identify research priorities in combat medical care and ensure successful implementation of solutions.

xv. Partnered with the Government of Sikkim to explore solutions for declining fertility rates and establish research priorities.

xvi. Provided technical support to strengthen Information, Education, and Communication (IEC) components in Home-Based Newborn Care and Home-Based Care of Young Child programs.

xvii. Generated evidence on risk factors and interventions to reduce stillbirths, addressing a critical area of neonatal mortality.

xviii. Contributed to Poshan Abhiyan by identifying strategies to enhance the quality and uptake of Take-Home Rations, improving nutrition outcomes.

xix. Conducted an evaluation of the National Rice Fortification Program to assess its effectiveness in addressing iron deficiency anemia.

xx. Provided dietary recommendations for astronaut designates in India's Gaganyaan space mission.

xxi. Offered technical guidance to improve nutrition in the Integrated Child Development Scheme (ICDS) and Mid-Day Meal (MDM) programs.

xxii. Provided expert advice to strengthen nutrition policies under the National Food Security Act.

xxiii. Organized expert group meetings involving state government representatives, the Ministry of Health and Family Welfare (MOHFW), and domain experts to review the factors contributing to the rising rates of cesarean sections in India. This was followed by a research priority-setting exercise to guide future investigations in this critical area

xxiv. ICMR's IHCI project's key strategies – state specific protocols, task shifting, forecasting tools for drug supply based on morbidity and patient cohort monitoring through IT tools have been taken up by NP NCD.

xxv. STEMI Care pathway has been upscaled to entire state of Himachal Pradesh, Punjab and 4 districts of Andhra Pradesh.

Overview

Indian Council of Medical Research

CHAPTER 1
INDIAN COUNCIL OF MEDICAL RESEARCH: AN INTRODUCTION

The Indian Council of Medical Research (ICMR), headquartered in New Delhi, is India's apex organization for formulating, coordinating, and promoting biomedical research. As one of the world's oldest medical research bodies, ICMR operates under the Department of Health Research (DHR) within the Ministry of Health and Family Welfare, Government of India. Its research agenda aligns closely with national health priorities, focusing on communicable diseases, reproductive health, maternal and child health, nutritional disorders, environmental and occupational health issues, and non-communicable diseases such as cancer, cardiovascular conditions, diabetes, blindness, and mental health disorders. These efforts aim to reduce the national disease burden and promote the health and well-being of India's population.

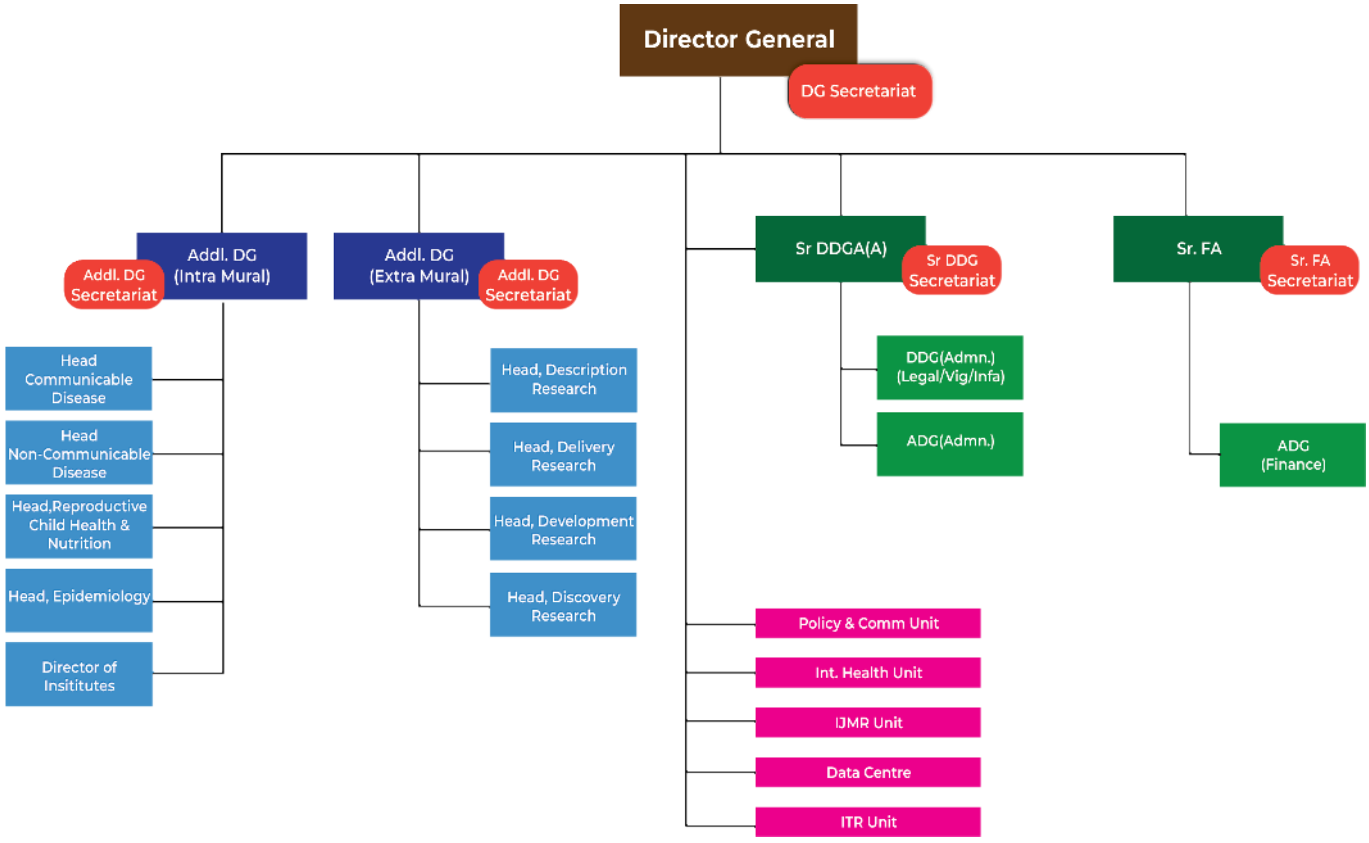


Figure 01: ICMR Organogram

ICMR plays a pivotal role in shaping the future of medical research by fostering capacity building and professional development. It organizes training programs, workshops, and short-term research studentships to equip aspiring researchers with the necessary skills and

knowledge. Additionally, research fellowships and short-term visiting fellowships are offered to early-career scientists, while Emeritus Scientist positions enable retired experts to continue contributing to critical research areas.

Globally, ICMR has established collaborations with institutions across the world through Memorandum of Understanding (MoUs). These partnerships focus on addressing pressing health challenges, including cancer, diabetes, infectious diseases, and vaccine development. They facilitate the exchange of knowledge, joint research projects, and the organization of scientific events such as workshops and seminars.

1.1 Intramural Research (Headed by Additional DG – Intramural Research)

At ICMR, intramural research is governed by three divisions – Communicable Disease, Non-Communicable Disease, and Reproductive and Child Health and Nutrition. These divisions guide the research activities of 26 ICMR institutes. The classification of research and governance of these divisions are as follows:

i. **Communicable Disease:** The Communicable Disease division at HQ has been entrusted with the responsibility of coordinating with ICMR - NIRBI (Formerly ICMR-NICED), Kolkata, ICMR - NIV, Pune, ICMR - NITVAR (Formerly ICMR-NARI), Pune, ICMR - NIMR, Delhi, ICMR - VCRC, Puducherry, ICMR - RMRIMS, Patna, ICMR - NIE, Chennai, ICMR - RMRC, Bhubaneshwar, ICMR - RMRC, Gorakhpur, ICMR - NIRT, Chennai, ICMR - NJIL&OMD, Agra, ICMR - NIRDHDS (Formerly, ICMR-NIMS), Delhi, ICMR - NIRTH, Jabalpur, ICMR-RMRC, Sri Vijaya Puram (Formerly Port Blair), and ICMR - NARFBR, Hyderabad.

ii. **Non-Communicable Diseases (NCD):** This division coordinates research at ICMR - NIOH, Ahmedabad, ICMR - NICPR, Noida, ICMR - RMRC, Dibrugarh, ICMR - NIIRNCD, Jodhpur, ICMR - NCDIR, Bengaluru, ICMR - NIREH, Bhopal, ICMR - NICHDR (Formerly ICMR-NIP), New Delhi, ICMR - NITM, Belagavi, ICMR - NIIH, Mumbai.

iii. **Reproductive and Child Health and Nutrition:** This division coordinates with ICMR - NIRRCH, Mumbai, and ICMR - NIN, Hyderabad.

The 27th ICMR institute, the ICMR—Bhopal Memorial Hospital and Research Centre (BMHRC), is a separate institute dedicated to providing advanced tertiary-level super-specialty care to the victims of the Bhopal Gas Tragedy (1984) and extending its services to the public at large.

Although the institutes are administratively categorized into three major divisions, their contributions extend across all three research areas and have been accordingly reflected in the annual report.

These institutes receive intramural funding through a competitive grant mechanism encouraging high-quality proposals that address pressing health challenges, ensuring that research efforts remain responsive to national and regional needs.

ICMR provides financial assistance to ICMR institutes in conducting research based on its mandate and priorities. The intramural programme of ICMR intends to encourage high-risk, high-reward research from ICMR scientists. For this, there are two types of intramural grants:

a. **Early-career Small Research Support Grant (Ignition Grants):** This grant provides 30 lakhs per project for a maximum duration of 3 years. This seed grant aims to help newly recruited scientists establish themselves and secure future funding. All new ICMR scientists are eligible for this one-time special research support grant to undertake a project on a priority topic.

   This grant requires mentorship from a senior ICMR scientist (minimum Scientist E level) and a non-ICMR scientist, with thorough review and approval by the institutional Scientific Advisory Committee (SAC).

b. **Intramural Research Grant:** This grant provides up to 8 crores per project (for entire duration) and 30 crore per institute (every year). The maximum duration for

projects is four years. Projects should be designed as institute-initiated rather than investigator-initiated to reflect the vision and mandate of the specific ICMR institutes.

These grants enable scientists and researchers within the institutes to undertake cutting-edge investigations, develop innovative solutions, and contribute to the evidence base shaping India's health policies and practices.

1.2 Extramural Research (Headed by Additional DG – Extramural)

Extramural research is funded by ICMR at research institutes, medical colleges, and non-governmental organizations across the country, in four major research areas: Description research, Discovery research, Development research and Delivery research.

- Description Research: Focuses on understanding the disease or condition including its burden, risk factors and determinants and pathogenesis mechanism.
- Discovery research: Aims to find novel interventions (basic research) and validate them in in-vivo models.
- Development research: Involves developing interventions for screening, diagnosis, prevention, and treatment of diseases/conditions or to make existing interventions including devices & diagnostics simpler, safer, more efficacious, or more affordable.
- Delivery research: Seeks to find ways to overcome barriers in delivering effective interventions to the people who need them.

ICMR supports investigator-initiated projects through various grant mechanisms designed to cater to different stages of research and levels of complexity. The extramural research grants are as follows:

i. **Small Grants:** These grant proposals, intended primarily for proof-of-concept studies, provide funding of up to ₹2 crores and can be carried out over a maximum duration of four years.

ii. **Intermediate Grants:** Designed for larger-scale and more decisive studies that build on established preliminary data, these grants offer funding ranging from ₹2–8 crores over a similar four-year period. They enable researchers to delve deeper into their investigations, generate robust evidence, and potentially develop interventions that can shape health policies and practices.

iii. **Centres of Advanced Research (CAR):** Aimed at highly experienced research teams with a demonstrated track record of excellence, CAR grants offer a chance to undertake comprehensive, multidisciplinary studies aimed at addressing critical healthcare challenges. Each CAR is eligible for funding of up to ₹15 crores over five years, supporting in-depth inquiries that can yield transformative insights and solutions. These centres often integrate clinical, laboratory, field-based and policy-oriented research components, ensuring their outputs are both scientifically rigorous and pragmatically relevant.

1.3 National Health Priority Research

Complementing these funding mechanisms is ICMR's National Health Research Program, a mission-mode initiative that directs research efforts toward priority areas, including Primary Health Care, Acute Emergency Care, Oral Health, Neonatal Mortality (NMR), Stillbirth, Anemia, Cancer, Ambulatory Care for Non-Communicable Diseases, Mental Health, Tuberculosis (TB), and Antimicrobial Resistance (AMR). These priority areas reflect the country's most urgent health challenges, calling for solution-oriented research that can be translated into scalable interventions and informed policy-making. Through strategic investments, capacity building, and collaboration among diverse stakeholders, ICMR seeks to ensure that the research it supports not only advances scientific understanding but also translates into tangible improvements in health outcomes and

service delivery across India.

In addition to ICMR intramural and extramural research, ICMR is supported by several scientific support units that assist these divisions and ministries on matters such as parliament questions, international fellowship, international health projects, screening health research proposals etc. These units are the Bioethics Unit, Policy and Communications (P&C) Unit, International Health Division (IHD) Unit, Indian Journal of Medical Research (IJMR) Unit, Innovation and Translation Research Units.

1.4 Collaborative Research Ecosystem

Apart from the intramural institutes, ICMR has established a collaborative research infrastructure at leading health research institutions across the nation.

1.4.1. ICMR-Collaborating Centres of Excellence (ICMR-CCoE): To recognize and foster excellence in research, ICMR established the ICMR-CCoE program. This initiative promotes collaboration among recognized research groups, ICMR institutes, and other stakeholders to enhance the nation's capacity for research, training, and health development. In 2023, 25 centers were selected under this program following a call for expressions of interest issued in July. These centers will play a vital role in advancing evidence-based research and addressing national health priorities over the next five years.

1.4.2. ICMR-DHR Centers of Excellence (CoE) at IITs: The CoE program at IITs/IIT-like institutes is a flagship program of ICMR-DHR which aims to foster Strategic Make-in-India product development in synergy with the requirement of the National Health Missions, Ayushman Bharat Health and Wellness Centres and Public Health programs of the Government of India for major public health impact. The program focuses on product and technology development in line with the objectives of the Start-up India and Make-in-India initiatives of the Government of India.

1.4.3. AYUSH-ICMR Advanced Centre for Integrated Health Research in AIIMS: The AYUSH-ICMR Advanced Centre for Integrative Research at AIIMS Delhi, Jodhpur, Nagpur, Rishikesh aims to identify priority areas where the approach of integrative medicine may have potential. The centres conduct integrative research in these priority areas to generate robust evidence, develop guidelines, and establish pathways to facilitate cross-referrals utilizing the integrative medicine approach.

1.4.4. Indian Clinical Trial and Education Network (INTENT): INTENT is an initiative to build a network of research institutes with the overarching goal of providing evidence-based, robust and culturally sensitive solutions to urgent health problems, in a reasonable time frame, by conducting large multi-centric clinical trials.

1.5 ICMR Infrastructure Development (2023-24)

In 2023-24, several laboratories, facilities, and research units were developed and upgraded across India, with some within the ICMR network and others supported by ICMR. A key milestone was the initiation of BSL-3 construction at ICMR-NARI, Pune. Additionally, Phase-II laboratory centres for the "Surveillance of Foodborne Pathogens in North East India" were established at the Institute of Bioresources and Sustainable Development (IBSD) in Imphal, the North Eastern Indira Gandhi Regional Institute of Health and Medical Sciences in Meghalaya, Zoram Medical College in Falkawn, the Veterinary Sciences & Animal Husbandry at the Central Agricultural University in Imphal, the Christian Institute of Health Sciences and Research in Nagaland, and CoVSc&AH, CAU(I) in Jalukie, Peren district, Nagaland.

ICMR-DHR supported the establishment of a Metal Additive Manufacturing Facility under the mPRAGATI initiative at IIT Delhi, aligning with the

Make-in-India and Atmanirbhar Bharat visions. An ICMR Center for Excellence in Neurosurgery Medical Devices was inaugurated at AIIMS Delhi to develop advanced surgical instrumentation, intra-operative neurophysiological monitoring systems, and computer-assisted neurosurgery navigation systems. A Surgical Innovation Laboratory (SIL) was also established at the AIIMS Trauma Centre, New Delhi, to advance patient care, education, and research through simulation models for immersive training.

In the field of medical device innovation, six ICMR-CAR centres were developed to support pre-compliance gap analysis, testing, and evaluation of advanced medical devices and diagnostic technologies. These centres include Andhra Pradesh MedTech Zone (AMTZ) in Vizag, the Dental Technology Innovation Hub at Maulana Azad Institute of Dental Sciences in New Delhi, and specialized centres at AIIMS New Delhi, Vardhman Mahavir Medical College & Safdarjung Hospital, Sree Chitra Tirunal Institute in Kerala, and St. John's Research Institute in Bengaluru.

Specialized facilities were developed at various ICMR institutes. At ICMR-NIRT, a composite TB research facility was set up at the Tiruvallur campus. ICMR-NIRTH established facilities for trophoblast stem cell culture, central instrumentation, and next-generation sequencing. Model Rural Health Research Units (MRHRUs) were established at ICMR-NIN in Mahbubnagar, Telangana, and ICMR-RMRC Sri Vijaya Puram in South Andaman. At ICMR-NICPR, the Central Instrumentation Facility and HPV DNA diagnostic lab were expanded. Regional centres of ICMR-NIV were inaugurated for One Health in Nagpur, Bengaluru, Dibrugarh, Jabalpur, and Jammu, while ICMR-RMRC Gorakhpur established a state-level Viral Research and Diagnostic Laboratory.

Enhancements in patient care were made at ICMR-BMHRC, including the expansion of the Emergency Medicine Unit, the establishment of a new molecular lab for the National Viral Hepatitis Control Programme, and the initiation of a 24/7 blood bank and integrated holistic health consultation centre. Notable inaugurations include five new facilities at the ICMR National Institute of Malaria Research (ICMR-NIMR): a 300-seat Auditorium, Preclinical Testing Research Laboratory, an Innovation Complex, a Conference Hall Complex and a Guest House. Additionally, the new Building of ICMR-National Institute of Traditional Medicine (ICMR-NITM), Belagavi houses the Rekhi Centre of Excellence for the Science of Happiness at ICMR-BMHRC, promoting stress reduction and well-being.

CHAPTER 2
BUDGET

This chapter outlines ICMR's financial heads, budget allocations, funding sources, and expenditure patterns.

2.1 Budget Allocation

The primary funding source for ICMR is the Government of India, through the Department of Health Research (DHR), which provides approximately 97% of ICMR's budget[1]. Additional funding comes from internal sources, accounting for about 2%, which includes training fees, royalties, and testing charges. Furthermore, around 1% of the budget comes from Corporate Social Responsibility (CSR) contributions.

Expenditures

There were three major heads where expenditure was incurred:

i. **Grant-in-Aid (Salaries)** – It consists of the pay and allowances of the regular/ permanent employees of ICMR and its institutes/centers.

ii. **Grant-in-Aid (General)** – This encompasses ICMR's research activities, which are dicided into two heads: Extramural Research and Intramural Research(see detail in chapter 1).

iii. **Grant-In-Aid (Capital)** – This head consists of two sub-heads: Major Works and Machinery and Equipment. It includes capital expenditure related to activities such as the construction of building, procurement of equipment for research work etc.

2.2 Overview of Budget and Funding Sources (2023-24)

In the fiscal year 2023-24, ICMR efficiently utilized 99.71% of its total allocated budget of ₹2,350.12 crore, reflecting strong financial management. The strategic allocation of funds were instrumental in advancing critical research projects, capacity building, establishing state-of-the-art infrastructure, and enabling high-impact collaborations. The funding supported both intramural and extramural research initiatives. The expenditure for intramural grants stood at ₹698.94 crore, while extramural grants accounted for ₹896.18 crore, reflecting the high demand for research funding in medical institutions across India. Additionally, ₹615 crore was allocated for Grant-in-Aid salaries, and ₹140 crore was dedicated to the creation of capital assets.

2.3 Additional Funding Highlights

ICMR institutes also received substantial financial support from national and international organizations, government bodies, private entities, and philanthropic foundations. These funds were utilized to enhance research, develop innovative solutions, and address pressing public health challenges, including tuberculosis (TB), HIV, vector-borne diseases (VBDs), antimicrobial resistance (AMR), nutrition, and non-communicable diseases (NCDs).

[1] Details of ICMR annual accounts available on www.icmr.gov.in

CHAPTER 3
Human Resources and Capacity Building

ICMR's success is driven by the collective expertise, dedication, and innovation of our talented workforce. In 2023-2024, significant progress was made in building a robust human resource ecosystem, aligning with ICMR's mission to excel in research, capacity building, and policy development.

3.1 Human Resource at ICMR

ICMR, comprising 27 institutes, employs a workforce that includes scientific, technical, and administrative personnel. This diverse staffing structure ensures the efficient functioning of its institutes and research programs, as well as effective research management at ICMR Headquarters. The workforce is categorized into regular and project staff. Regular staff serves as the backbone of ICMR's operations, with a significant representation in technical roles (2,491), followed by scientific roles (803) and administrative roles (689). Complementing this is the project staff, primarily in technical roles (1,630), who play a critical role in supporting the execution of specialized and time-bound research projects.

3.2 Mission Mode Recruitment in the Year 2023-24:

The year 2023-24 marked a landmark achievement for recruitment at ICMR, with mission mode recruitment efforts closely aligning with the Government of India's recent push for Mission Mode Recruitment. This initiative was designed to fill vacancies in key public sector institutions in an expedited and structured manner(Figure 02).

A majority of the positions filled were in technical and supporting roles, with

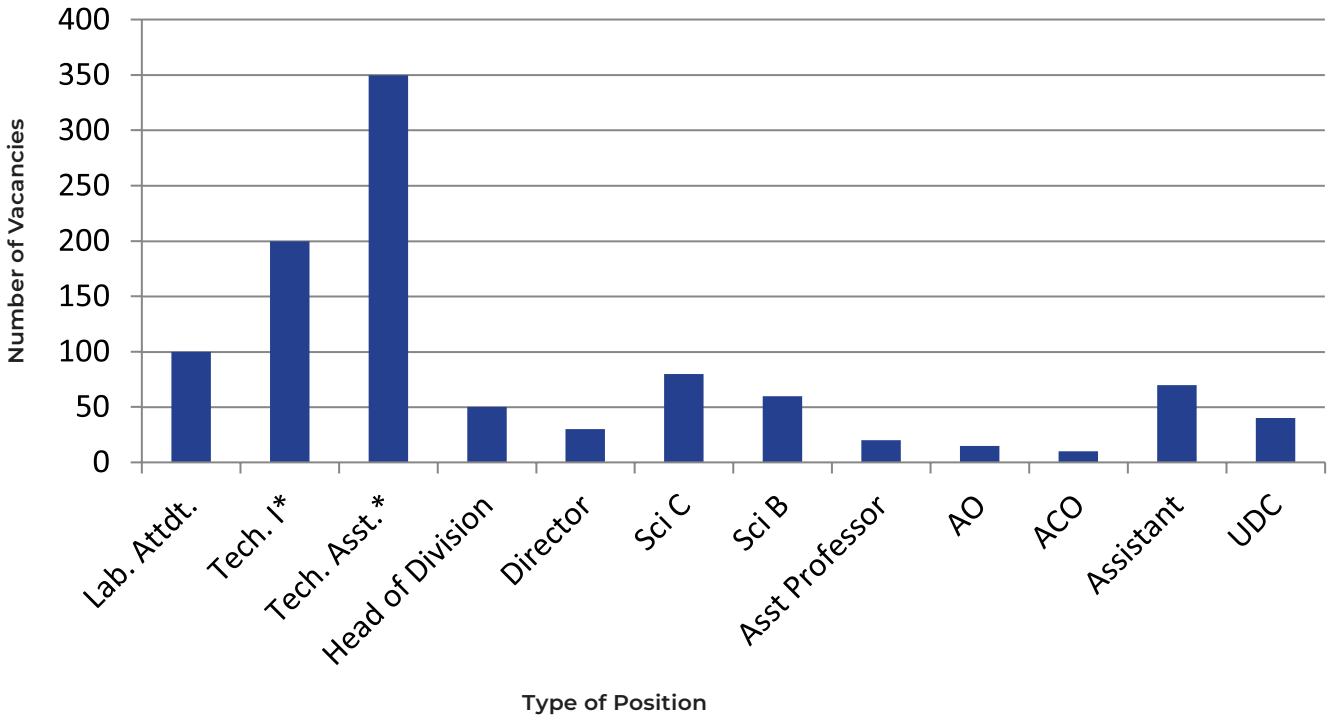


Figure 02: Mission Mode Recruitment 2023-24

Technical Assistants accounting for 381 recruits, followed by 279 Technical Level I staff, and 169 Laboratory Attendants. On the administrative side, 62 Assistants and 16 Upper Division Clerks (UDC) were recruited, emphasizing the importance of administrative support.

Among scientific positions, Scientist C positions were most prominently filled, with 69 new hires, followed by Scientist B positions specializing in bioinformatics, entomology, and medical technology developments. Leadership roles, including Head of Division and Directors positions were also filled. A total of 1012 offer letters were issued.

3.3 Contribution to National Human Resource Development

Beyond its institutional workforce, ICMR demonstrates a commitment to building the next generation of medical and research professionals across India. ICMR has been at the forefront of advancing biomedical research and fostering scientific talent through a range of fellowships programs, and financial support initiatives. Established schemes such as the Short-Term Studentship (STS) and Junior Research Fellowship (JRF) continue to encourage young students and researchers, with recent enhancements in stipends and increased opportunities. Senior retired scientists are supported through specialized programs like the ICMR Chairs and the Emeritus Scientist Program. Further, the newly established ICMR Faculty of Medical Research (FMR) marks a significant step towards trans-disciplinary education and research (Table No. 01).

3.4 Capacity Building in year 2023-24

Category	Details
FELLOWSHIPS	
Short-Term Studentship (STS)	Established in 1979 to promote research among medical/dental undergraduates. Stipend: ₹10,000/month (₹20,000 total) increased to ₹25,000/month (₹50,000 total) from STS 2023 onwards. Details for 2023: 15,364 registrations, 8353 proposals submitted, 1550 selected, 1304 reports submitted.
Junior Research Fellowship (JRF)	National-level exam conducted on July 8, 2023, at 23 centers across India. Seats increased from 150 to 300 in 2023 and 290 candidates selected. Program renamed as DHR-ICMR Biomedical Research Eligibility Test (BRET) from 2024. Exam now conducted by NTA under DHR-HRD scheme.
Grant for PG thesis support MD/MS/DM/ MCh/DNB/DrNB/MDS	In 2023, 946 applications received; 101 fellowships awarded after scientific review.
MD-MS/Ph.D. Fellowship	Total 18 fellows ongoing at KGMU Lucknow, NIMHANS Bengaluru, and SRIHER Chennai.

Nurturing Clinical Scientists (NCS)	Merged with the MBBS/MD-Ph.D. program of DHR. No new calls advertised; sunset program. There are 16 fellows ongoing.
ICMR Centenary Post-Doctoral Fellowship	In 2023, 20 PDFs selected from 37 applicants.
FINANCIAL SUPPORT	
International Travel Grant	In 2023, 914 applications received; 332 grants awarded to scientists/researchers from recognized universities/medical colleges/INIs in India.
DHR-ICMR Workshop funding support	In 2023, 243 applications received; 58 workshops recommended after scientific review.
ICMR Chairs	Two Chairs ongoing as in 2023.
ICMR Emeritus Scientist	Eight (08) new Emeritus Scientists were selected for the year 2023 and therefore all 30 seats were filled up.

Table No. 01: Capacity Building in year 2023-24

3.5 New Initiative: ICMR FMR

ICMR Faculty of Medical Research (ICMR FMR): On December 13, 2023, the ICMR-FMR was established in collaboration with the Academy of Scientific and Innovative Research (AcSIR), under CSIR, marking a pivotal milestone for ICMR in its mission to nurture talent and advance biomedical research. This strategic partnership combines ICMR's expertise in medical research with AcSIR's academic excellence, providing students and researchers with a unique platform for cutting-edge studies and translational research. The initiative underscores ICMR's commitment to fostering innovation, encouraging multidisciplinary approaches, and strengthening India's scientific ecosystem. Through this collaboration, both medical and non-medical students at ICMR institutes will have the opportunity to enrol in AcSIR's existing faculties, promoting a culture of transdisciplinary research/innovation. It will also encourage the ICMR medical scientists to pursue Ph.D. under FMR, thus creating a pool of physician scientists in the country. The first call for Ph.D. enrolment under the newly established ICMR-FMR will be advertised by AcSIR, marking the beginning of a new era in academic and research excellence.

INTRAMURAL RESEARCH HIGHLIGHTS FOR THE YEAR 2023-2024

Intramural Projects

Communicable Diseases

New Projects

36 Multisite Projects

6 National Health Research Projects (NHRPs)

Ongoing Projects

129 Single-Centre Projects

Publications

>850 publications

Non-Communicable Diseases

New Projects

34 Intramural Projects

3 National Health Research Projects (NHRPs)

Ongoing Projects

52 Multisite Research Projects (National Task Force)

14 Centre for Advanced Research and Excellence (CARE)

65 Single-Centre Projects

720 Ad hoc Projects

387 Fellowships

Publications

>500 publications

Reproductive, Child Health & Nutrition (RCN)

New Projects

7 Multicentric Projects

3 National Health Research Projects (NHRPs)

Ongoing Projects

150

Publications

>150 publications

Capacity Building

Workshops

>120 workshops conducted

6,000 scientists, researchers

Workshops

200 training sessions

42,000 personnel

Initiatives of National Importance

1. **National One Health Mission:** Programme for strengthening Research and Development towards integrated disease control and pandemic preparedness for the National One Health mission" established in collaboration with Principal Scientific Advisor's Office, Department of Health research and 18 other ministries. ICMR National Institute of One Health Nagpur became 28th ICMR institute.
2. **Syndromic Diagnostic Algorithms for surveillance:** Developed for acute respiratory syndrome, diarrhoea, fever, and encephalitis.
3. **KFD Vaccine Initiative:** Collaborated with industry through CSR to develop an indigenous KFD vaccine.
4. **Anaemia Mukt Bharat (AMB):** Developed AMB 2.0 roadmap and revised anaemia treatment algorithms.
5. **Medical Innovations:**

- Developed protocol for validation of non-invasive and minimally invasive haemoglobin devices.
- Developed powders for oral suspension (PFOS) of 6-mercaptopurine (6-MP).
- Developed Pediatric isotretinoin formulation for high-risk neuroblastoma
- Therapeutic drug monitoring and personalized anticancer strategies
- Validated the Indian Diabetic Risk Score (IDRS) for cost-effective screening for diabetes.
- Recommended age-specific HbA1C cut-offs and dietary strategies for Type 2 diabetes remission and prevention.

Support for National Programs

- Supported 20+ national/state-level programs.
- Conducted 7 disease outbreak investigations.
- Evidence Synthesis: For Anaemia Mukt Bharat and anaemia treatment.
- Combat Medical Research: Support for Armed Forces on priority research needs.
- STEMI ACT Program: Heart attack management protocols.

CHAPTER 4
COMMUNICABLE DISEASES

ICMR has been at the forefront of addressing India's pressing communicable disease challenges, ensuring a robust and coordinated national response. The Communicable Diseases Division at ICMR drives health resilience by leading and supporting groundbreaking research and initiatives that combat public health emergencies, strengthen disease surveillance, and contribute to key national initiatives, including the National TB Elimination Program (NTEP) and the National Malaria Elimination Program (NMEP) and emerging threats through strategic foresight, rapid diagnostics, and targeted interventions. Research outputs such as advanced diagnostic tools, therapeutic interventions, and disease surveillance systems are directly integrated into these programs, ensuring that evidence-based interventions reach communities.

In 2023-24, ICMR's initiatives in communicable diseases achieved notable milestones in diagnostics, vaccines, therapeutics, and surveillance. Portable diagnostic kits for TB and leprosy, along with genomic surveillance frameworks for emerging viral infections, exemplify the organization's commitment to scientific excellence and public health advancement.

Through its Communicable Disease Intramural Research program, ICMR has supported multi-centric research projects, single-centre studies, and National Health Research Program (NHRP) initiatives in areas such as vaccine development, drug discovery, and disease surveillance. These projects reflect a multidisciplinary approach to addressing complex public health challenges, contributing to a deeper understanding of disease dynamics and potential solutions.

Moving forward, ICMR is focused on bridging regional disparities in research, integrating artificial intelligence into disease modeling and prediction, and expanding surveillance networks. These priorities aim to reinforce India's health infrastructure and enhance its capacity to address both persistent and emerging communicable disease threats.

4.1 RESEARCH ACTIVITIES

4.1.1 New Multisite Research Projects:

During the year, the Division launched 36 new initiatives in communicable diseases, driving advancements in vaccine development, drug discovery, surveillance, public health, climate health, regional health, and One Health. These include six projects in vaccine development targeting both prevalent and emerging infectious diseases, and five projects in drug discovery, aimed at identifying and optimizing novel therapeutic agents. Eight projects in surveillance and epidemiology were initiated for enhancing the capacity to monitor disease trends and inform strategic interventions, while four initiatives in public health infrastructure aim to fortify healthcare systems for effective disease control. Additionally, six projects under tribal and regional health initiatives address the unique vulnerabilities of underserved populations, and two projects on climate and environmental health investigate the interplay of environmental factors in disease transmission. Lastly, three projects in One Health and zoonotic diseases emphasize the interconnected health of humans, animals, and ecosystems, targeting zoonotic pathogens. Collectively, these efforts exemplify a comprehensive, multidisciplinary approach to improving disease prevention, treatment, and health outcomes on both regional and global scales. Two more projects come under other areas of communicable diseases (Figure 03).

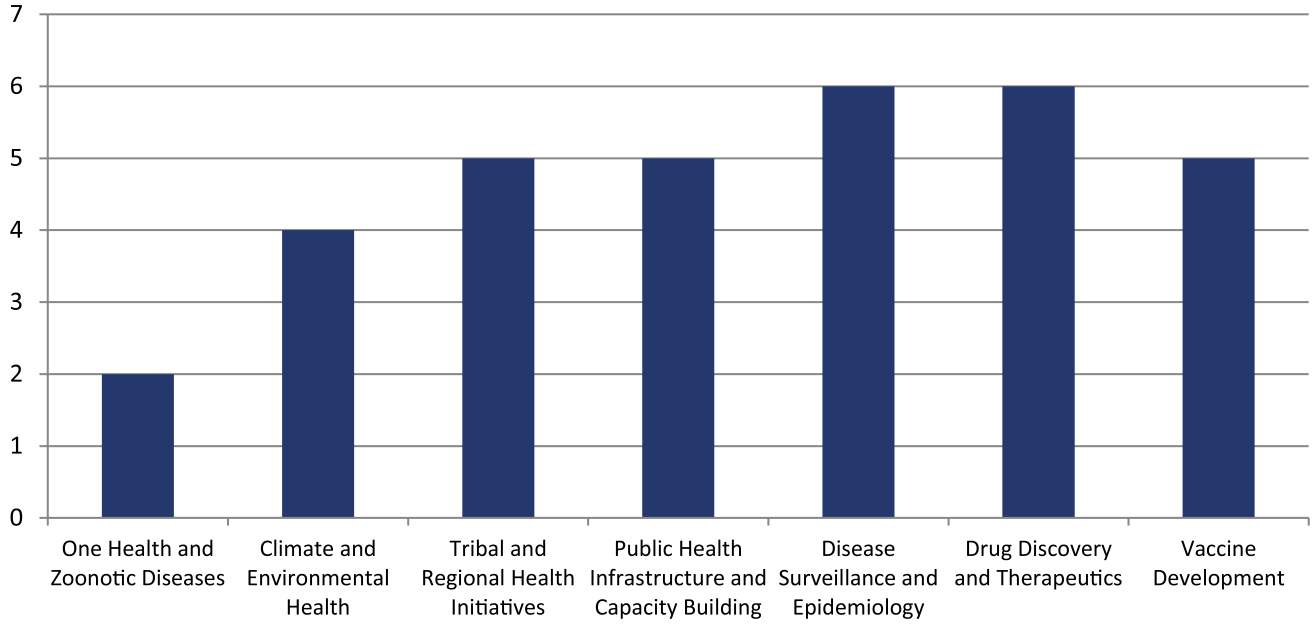


Figure 03: Multicentric Projects by Category in Communicable Disease Research Division

4.1.2 Ongoing Projects:

In 2023-24, the Division continued 129 ongoing projects in communicable diseases across eight critical research areas, reflecting sustained efforts to advance national health priorities. Building on past efforts, research initiatives on tuberculosis and respiratory disease focused on better diagnostics and elimination strategies, while COVID-19 and SARS-CoV-2 projects continued work on vaccine research, therapeutics, and epidemiology. The Division advanced innovative strategies for malaria and leishmaniasis prevention, treatment, and control, while vector biology research explored methods to mitigate disease transmission. Anthropological and tribal health studies addressed socio-cultural determinants to improve tribal health outcomes Studies on emerging and neglected diseases aimed to bridge critical knowledge gaps, while other projects advanced diagnostics and biomarkers for improved disease detection and monitoring. These ongoing projects represent sustained efforts to combat communicable diseases through impactful and targeted research.

4.1.1 Initiatives of National Importance:

i. **National One Health Mission (NOHM)** – The National One Health Mission, aimed at strengthening Research and Development for integrated disease control and pandemic preparedness, was approved by the Standing Finance Committee (SFC) with support of Principal Scientific Advisor's Office, Department of Health research and 18 other ministries. As part of this program, the ICMR-National Institute of One Health (NIOH), Nagpur became the 28th ICMR institute. The approval of a One Health Mission Director and the elevation of the ICMR Centre for One Health to a national institute highlight the mission's strategic focus on zoonotic threats.

A key initiative under this Mission is the launch of a collaborative study with the Indian Council of Agricultural Research (ICAR), the Department of Animal Husbandry & Dairying (DAHD), and other key stakeholders, titled "Building a Surveillance Model for Detecting Zoonotic Spillover in Increased Animal-Human Interaction Settings Using a One Health Approach." This initiative focuses on select slaughterhouses in Punjab, Assam, and Telangana to establish a pioneering zoonotic surveillance system.

ii. **Rapid Response to the Nipah Virus Outbreak** – During the September 2023 Nipah virus outbreak in Kerala, ICMR deployed a mobile BSL-3 lab, significantly

reducing testing turnaround time, enabling rapid diagnosis, effective containment, and streamlined outbreak management.

iii. **Syndromic Diagnostic Algorithms** – ICMR developed Syndromic Diagnostic Algorithms for acute respiratory syndrome, acute diarrhea, acute fever and acute encephalitis to enhance One Health surveillance in India.

iv. **New Vaccine Initiative for Kyasanur Forest Disease (KFD)** – Kyasanur Forest Disease (KFD), a viral illness transmitted by infected ticks, currently lacks definitive treatment. Addressing challenges with the existing formalin-inactivated KFD vaccine, ICMR initiated the development of a vaccine candidate with enhanced efficacy and safety. In a notable first, CSR funds were utilized to support this initiative in collaboration with industry partners, marking a significant milestone in public-private partnerships for vaccine development.

v. **Malaria Control Intervention in Tripura** – In malaria-prone tribal areas of Tripura, a study on customized intervention packages in Jhum cultivation areas identified key gaps and implemented measures that reduced malaria incidence. The study uncovered a significant hidden burden of P. vivax and mixed infections, provided valuable vector-related insights, and detected additional vector-borne diseases. To enhance real-time surveillance, the "FeverTracker" app was developed, with a patent filed and copyright obtained, representing a significant advancement in malaria monitoring and control.

vi. **Identification of Non-Malarial Fever Pathogens in the Northeast** – In the Northeast, research identified non-malarial fever pathogens and established sero-prevalence for diseases such as leptospirosis. These findings provide crucial insights for strengthening disease surveillance and tailoring public health interventions in the region.

vii. **Contribution to Tuberculosis Elimination** – ICMR supported the RATIONS trial in four districts of Jharkhand to assess the impact of nutritional supplementation in preventing TB among household contacts of TB patients. Over a period of 18 months, a total of 10,345 household contacts of 2800 microbiologically confirmed TB patients were enrolled in the study and provided nutritional interventions. A relative reduction of tuberculosis incidence of 39% (all forms) to 48% (microbiologically confirmed pulmonary tuberculosis) was observed. The study was published in Lancet Global Health.

Additionally, handheld X-ray devices were validated for early TB detection and found to be portable and user-friendly. The CyTB test for latent TB detection was also validated and recommended for inclusion in the TB program, showing improved performance over the traditional Mantoux test.

4.2 SIGNIFICANT RESEARCH ACTIVITIES AND ACHIEVEMENTS ACROSS ICMR INSTITUTES: DRIVING INNOVATION IN COMMUNICABLE DISEASE

ICMR continues to spearhead impactful research and innovation across its nationwide network of institutes, addressing pressing challenges in communicable diseases and advancing public health priorities. Highlights of research conducted by the Institutes coordinating with the Communicable Diseases Division are noted below:

4.2.1 ICMR-National Institute of Virology (ICMR-NIV), Pune

i. Studies conducted with the help of VRDL network in samples collected from 24 states suggested the circulation of multiple (all four) serotypes of Dengue virus in India.

ii. Studies in patients suffering from long COVID, 2-3 years post COVID-19 infection, showed increased frequency of Th cells/B cells and significantly decreased frequency of NK cells, compared to individuals who

recovered completely.

iii. Combination of repurposed drug 2-fluoroadenine with metyrapone, emetine or enalaprilat showed potential inhibitory activity against the Chikungunya virus.

iv. The RdRp inhibitor Favipiravir demonstrated antiviral activity against Rhabdovirus. Notably, a rare case of survival from clinical rabies infection was reported in Maharashtra, with the patient followed for over 18 months after hospitalization.

v. Confirmed the first laboratory paediatric Japanese encephalitis case which was identified in the Pune district. Estimates of Japanese encephalitis vaccination among children in central India was reported to be 86.7%.

vi. Identified Recombinant Enterovirus G carrying a Torovirus Papain-like cysteine protease gene for the first time in India. The whole genome sequence analysis revealed it as a porcine-human reassortant.

vii. Metagenomic analysis of mosquitoes from diverse geographical regions of India revealed the presence of Phasi Charoen-like virus (PCLV), Choristoneura fumiferana granulovirus (CfGV), in Aedes aegypti mosquitoes and Wenzhou sobemo-like virus 4 (WSLV4) in Aedes albopictus mosquitoes.

viii. Genetic characterization of HAV sampled from different outbreaks investigated during 2009-2020 from 18 different states confirmed association of single IIIA genotype suggesting its predominant circulation in different parts of India.

ix. Assessment of liposome-complexed DNA-corresponding combination proteins of HEV and HBV, as combined vaccine candidates in rhesus monkeys through immunization with Lipo-NE-DP and Lipo-NES-DP exhibited a sterilizing immunity, indicating complete protection through humoral immune responses.

x. SARS CoV-2 omicron and its sub-lineages XBB, XBB1.16, XBB2.3 and JN.1 strains found to be in co-circulation along with influenza, Adenoviruses and respiratory viruses. Influenza A/H3N2, Influenza B, Influenza A/H1N1pdm09, SARS CoV-2 and RSV B contributing to 8.70%, 5.88% 4.93%, 4.75% and 11.8% respectively, were predominantly circulating in Pune.

xi. Enhanced surveillance along the Western Ghats detected KFDV cases in newer areas of Shimoga and North Goa. Total of 245 positive cases and 13 deaths [CFR-5.3%] reported from Karnataka and 5 cases with no fatality from North Goa. KFDV isolated during last two decades are grouped in lineage 2 while older isolates in lineage 1.

xii. Deployed and utilized the Mobile BSL-3 facility for on-site diagnostics during outbreaks of high-risk pathogens.

xiii. Observed Nipah virus positivity in Pteropus medius bats in Kerala, Bihar and West Bengal and seropositivity in 9 states and 1 union territory of the country.

xiv. Developed a designated poliovirus-essential facility (dPEF) for India and standardized assays for seroprevalence studies. S19 poliovirus strains were obtained from NIBSC, UK in 2023, for conducting seroprevalence studies in India. The microneutralization assay has been standardized and validated using S19 strains, which could be used for seroprevalence studies of poliovirus in India. The India Expert Advisory Group (IEAG) and the Ministry of Health and Family Welfare, GOI have advised to conduct seroprevalence studies in India as soon as possible.

xv. Developed a point-of-care assay for early detection of silicosis/Silico-TB, aiding control efforts under the National Health Mission.

xvi. Developed a HEK293T cell line by CRISPR/Cas9-mediated genome editing for production of high titred EV A71 to aid the vaccine development.

xvii. Study showed that incomplete age-appropriate vaccination emerged to be major risk factors of B. pertussis infection

in infants, highlighting the need to strengthen vaccination in susceptible population.

4.2.2 ICMR-National Institute of Translational Virology and AIDS Research (ICMR-NITVAR) (Formerly known as ICMR-National AIDS Research Institute), Pune

i. The endTB trial, completed in August 2023, demonstrated the safety and efficacy of three shorter oral regimens, with findings presented at the UNION Conference in Paris. In the TB vaccine trial, 1,592 participants were enrolled in a phase III, randomized, double-blind, three arm placebo controlled trial to evaluate the efficacy and safety of two vaccines VPM1002 and Immuvac(Mw) in preventing TB in healthy household contacts of newly diagnosed sputum positive pulmonary TB patients.

ii. The Dengue vaccine trial entered its preparatory phase after receiving DCG (I) approval and CTRI registration, with activities progressing at full speed.

iii. A study assessing the feasibility of using the Gene-Xpert platform and dried blood spots for HIV viral load testing among PLHIV attending ART centres in India was initiated at two sites identified. A demonstration project on daily oral TDF-containing PrEP among Men Who Have Sex with Men (MSM) and Transgender Women (TGW) enrolled 650 participants. Implemented in Jalandhar, Punjab, and Pune, Maharashtra, the study showed high acceptability of PrEP delivery through community- and clinic-based models. Additionally, a serosurvey for MPOX conducted among MSM and TG at seven community-based organizations across India revealed an IgG seropositivity rate of <1%. Only six cases suggestive of MPOX like disease were identified of whom only one was IgG sero-reactive.

iv. Study of host-pathogen interactions of HIV and associated common opportunistic infections for identification of important therapeutic targets and their modulators was conducted. Some host targets and their modulators through bioinformatic analysis were identified and are now being validated.

v. Study on air borne infection control assessed 95 HIV care settings to measure the TB cross transmission to healthcare workers and other people living with HIV and provided critical recommendations to mitigate transmission. This intern will review the risk of transmission of airborne infection predominantly TB in the HIV care settings.

vi. Validation of the dried blood spots (DBS) samples for detection of Treponemal anti-bodies was conducted for the National AIDS Control Program. Validation of all three laboratory assays (TPHA- Biorad, EIAs-Biorad and Transasia Biomedicals) showed satisfactory results as per the CDSCO criteria and the report has been submitted to NACO.

vii. Under HIV cure research, HIV-specific memory-like NK cells were generated from both HIV-infected and uninfected individuals and are being assessed for functionality to advance immunotherapy approaches for HIV cure. Additionally, the efficacy of TLR-7 and TLR-8 in enhancing NK cell-mediated killing of autologous target cells was tested, with TLR-7 showing promising results when combined with other latency-reversing agents.

viii. A multi-centric study on network dynamics among People who Inject Drugs (PWID) in context of HIV demonstrated the use of the RDS strategy in reaching hidden/ new PWIDs. The qualitative interviews conducted with the PWIDs provide deep insights into their fears, helplessness, and inability to go back to life without drugs, their call for help, and their need for ambient accessible services to relax them and relieve them without any fear.

ix. Preliminary findings from demonstration task force project for reduction of Tuberculosis in Saharia Tribe dominated region in India has highlighted an urgent

need for refresher training about the NTEP program and simplified guidelines for the extra-pulmonary TB detection and treatment among grassroot level health functionaries.

x. Comprehensive Tribal TB Management Program for Decentralized TB Care Services revealed delays in diagnosis occurring due to limited diagnostic services and inadequate healthcare staff. Community mobilization gets adversely affected by stigma, lack of awareness about TB within the community, and patient fear. Addictions, long treatment durations, side effects of medicines, and lack of motivation led to treatment interruption. Initial content analysis shows potential solutions such as collaborations with various NGOs that are already working in the tribal community, raising awareness among traditional healers, providing trainings to healthcare staff, counselling to patients before and during treatment, and enhancing community participation.

4.2.3 ICMR-National Institute for Research in Bacterial Infections (ICMR-NIRBI) (Formerly known as ICMR-National Institute of Cholera and Enteric Diseases), Kolkata

i. Validated a Point of Care Rapid UTI Antibiogram kit (Rapidogram) in peripheral health facilities of West Bengal. Based on recommendations, the kit was improved by the manufacturer and taken up by National Health System Resource Centre for implementation in the NHM.

ii. Estimated the Typhoid burden across India as part of a multi-centric study across India, showing high burden of Typhoid in urban India, thus addressing the issue of introduction of typhoid vaccine in the public health care delivery system.

iii. Participated in the first ever multi-centric study that looked at the burden of influenza among older adults above 60 years in India. The study demonstrated a high burden of influenza and highlighted the cost-effectiveness of vaccinating older adults through facility-based or outreach-based programs.

iv. A comparative immunogenicity and safety study of Oral Cholera Vaccines (OCV) Euvichol-Plus with Shanchol demonstrated the non-inferiority of Euvichol-Plus, contributing to its licensure for use in India.

v. A large-scale multicentre randomized controlled trial showed that a package of PoCTs, an electronic diagnostic algorithm and training and communication had the potential to reduce antibiotic prescriptions in patients presenting with acute febrile illnesses and respiratory symptoms.

vi. Developed a low-cost nested PCR assay directly from the biopsy samples for the rapid detection of clarithromycin-resistant Helicobacter pylori strains, providing rapid initiation of effective antibiotic treatment, avoiding empirical therapy.

vii. A tetravalent Shigella outer membrane vesicles-based candidate vaccine offered cross-protection against all the serogroups of Shigella in adult mice.

viii. Pentavalent outer membrane vesicles immunized mice sera conferred passive protection against five prevalent pathotypes of diarrhoeagenic Escherichia coli in neonatal mice.

ix. Reported that one herbal compound, Asiatic acid showed anti-bacterial effect against Shigella flexneri by inducing antimicrobial peptide expression in both in-vitro and in-vivo conditions.

x. Vibrio cholerae hemagglutinin protease was shown to kill colon cancer cells by triggering multiple cellular proteases and proteasomal cascades and induced apoptosis in explant culture of human clinical samples.

4.2.4 ICMR-National Institute of Malaria Research (ICMR-NIMR), Delhi

i. Continued maintenance of the national repository for Plasmodium species to support research and diagnostics.

ii. Conducted comprehensive characterization of field isolates of Plasmodium falciparum and P.vivax.

iii. Performed transcriptomics analysis to distinguish between lethal and nonlethal malaria infection.

iv. Developed an RDT kit for species-specific identification of *P. vivax* and *P. falciparum* in malaria infections.

v. Initiated the development of a mobile application for identifying malaria infections.

vi. Analyzed blood brain barrier and endothelial dysfunction in P. berghei ANKA infection.

vii. Identified three cyclic constrained immunoreactive peptides (C6, B7, and A8) from P. falciparum secretory/ surface proteins and further validated for diagnostic potential of 2 peptides (C6; EXP-1 and B7; Glurp) with field-collected P. falciparum-infected sera samples.

viii. Determined the CSPs/SAPs interaction with insecticides such as pyrethroid, organophosphates, organochlorines and carbamates through binding affinity (Kd) values ranging between 0.7μM to 1.0 μM via MicroScale Thermophoresis.

ix. Demonstrated that RNAi-mediated gene knockdown of the CSDIR gene caused >60% mortality after one hour of exposure to deltamethrin and malathion insecticides compared to the control group of An. stephensi mosquitoes.

4.2.5 ICMR-Vector Control Research Centre (ICMR-VCRC), Puducherry

i. Assessed the impact of MDA-IDA in two areas Simdega district, Jharkhand and Yadgir Taluk, Karnataka. Significant reduction in Circulating Filarial Antigen prevalence in children in both random and sentinel sites was indicative of suppression of transmission following MDA. Molecular xenomonitoring of vector infection proved more sensitive than human infection indicators, detecting vector infection in more sites.

ii. Conducted field validation field validation of a new rapid diagnostic test to detect Wuchereria bancrofti filarial antigen as a support to WHO and NCVBDC. The STANDARDTM Q Filariasis Antigen Test (QFAT), developed by SD Biosensor (South Korea) was compared with the currently used AlereTM Filariasis Test Strip (FTS) among 1227 individuals in two blocks in Bidar, an LF endemic district in Karnataka. The new QFAT test had a high sensitivity (>95%), specificity (>99%) and predictive values (>97%) when compared with FTS results and were in perfect agreement ($k > 0.96$, $p < 0.001$), and could be a promising alternative to the existing FTS test.

iii. Conducted a study to develop potential surveillance diagnostic tools for lymphatic filariasis assessment surveys, aimed at supporting decisions to stop MDA and conduct post-MDA validation surveillance. Of the 12 proteins identified for the development of diagnostic assays, four antibody detection assays (ELISAs) were optimized and tested for their diagnostic potential. Of these, two were identified as potential antibody markers for the detection of IgG4 antibodies specific to W. bancrofti. The specificity and sensitivity of the ELISA assays developed using gp15/400 recombinant antigen were 90% and 100% respectively, while those of another antibody marker, mif-2, were found to be 87.7% and 100%, respectively.

iv. Developed sampling strategies for non-MDA/unsurveyed districts to identify the high-risk sites based on listed LF disease cases and blocks bordering endemic districts. Blood and molecular xenomonitoring surveys were conducted to assess ongoing transmission. If the human or vector infection levels are above the provisional LF elimination threshold of 2% or 0.25%, those blocks in which these sites were situated alone can be brought under IDA-MDA (1 or 2 rounds) to clear the foci of transmission and be followed up by surveillance.

v. Identified *Rickettsia roulti*, multiple genotypes of *Orientia tsutsugamushi*, new entomo-pathogenic nematode parasite in wild-caught sandflies

vi. Identified two new vector species: Sergentomyia ashwanii sp. nov. and Phlebotomus ajithii sp. nov.

vii. Documented *Culex flavivirus* in *Culex quinquefasciatus* for the first time.

viii. Developed an artificial diet for female mosquitoes to replace blood, alongside a low-cost ANM feeder to facilitate the feeding of the artificial diet to mosquitoes.

ix. Developed an ecofriendly novel trap for surveillance of Aedes vectors and a cost-effective protein gel electrophoresis device.

x. Piloted wastewater surveillance for soil transmitted helminths (STH) infections at four different geographical locations – Gorakhpur, Aurangabad Bhubaneshwar, and Puducherry. Hookworm eggs were predominantly detected, alongside whipworm and roundworm eggs in some samples, establishing wastewater analysis as a viable surveillance method.

4.2.6 ICMR-Rajendra Memorial Research Institute of Medical Sciences (ICMR-RMRIMS), Patna

i. Successfully developed diagnostic kit for co-infected visceral leishmaniasis (VL) and post-kala-azar dermal leishmaniasis (PKDL), enhancing disease detection accuracy in affected populations.

ii. The Leish-LAMP detection kit exhibited high sensitivity and specificity in diagnosing visceral leishmaniasis (VL) and post-kala-azar dermal leishmaniasis (PKDL) in endemic regions, showcasing a validation success rate of 96.61% and 93.88%, respectively. This robust performance positions the kit for potential regulatory approval, enhancing clinical diagnosis and surveillance efforts against these diseases.

iii. Identified 187 consensus epitopes for SARS-CoV-2, with 23 epitopes demonstrating broad global coverage across diverse populations. Computational analyses confirm the potential of a chimeric vaccine construct to elicit a robust immune response, offering valuable insights for vaccine development.

iv. Arsenic exposure on visceral leishmaniasis (VL), reveals its association with heightened parasite load, hepatonephric toxicity, and dysregulated immune responses favoring parasite survival. Through preclinical models, it highlights the modulation of MAPK signaling, T cell proliferation, and cytokine balance, offering insights into the pathophysiological mechanisms underlying arsenic-mediated drug resistance in VL.

v. The transcriptome analysis delineates distinct gene expression profiles between Post-Kala-Azar Dermal Leishmaniasis (PKDL) and Visceral Leishmaniasis (VL), revealing key genes associated with immune responses and disease pathogenesis. It suggests potential mechanisms underlying the contrasting immune responses and clinical manifestations observed in PKDL and VL, offering insights for targeted interventions and therapeutic strategies.

vi. A study conducted among male participants in Patna's OST centre highlights a 28% prevalence of HCV seropositivity, positively associated with prolonged injection use, unemployment, and lower educational attainment. The findings emphasize the importance of integrating HCV care into OST or de-addiction centres to address the needs of the high-risk population.

vii. A study elucidates the interaction between LdCfd1 and LdNbp35 proteins in Leishmania donovani, shedding light on their role in cytosolic FeS cluster biogenesis essential for parasite survival. Their upregulation of these proteins in amphotericin B-resistant parasites suggests a potential mechanism

contributing to increased tolerance towards reactive oxygen species (ROS) levels and drug resistance.

viii. Whole exome sequencing identified candidate driver germline mutations associated with visceral leishmaniasis (VL) relapse susceptibility, highlighting EP300 as a principal pathogenic mutation and suggesting MTTP and NANOG variants as biologically relevant targets for combating VL.

ix. Assessed the insecticide susceptibility of *Phlebotomus argentipes* in Vaishali and Saran districts, revealing complete susceptibility to alpha-cypermethrin and malathion, while confirming resistance to DDT. Notably, the application of alpha-cypermethrin 5% WP at 25 mg a.i./m2 exhibited promising residual activity against laboratory strains of the insect. These findings contribute crucial insights into effective vector control strategies against visceral leishmaniasis in endemic regions.

x. Assessed the role of Mevalonate kinase (MVK) in facilitating *Leishmania donovani* entry into macrophages and modulating host cell functions through actin reorganization and signaling pathway activation was assessed, which shed light on crucial host-parasite interactions in leishmaniasis. Furthermore, it highlights the potential of LdMVK as a virulent factor in Leishmania, suggesting its significance in disease progression and potential as a target for therapeutic intervention.

xi. Determined predominant rotavirus genotypes G1P [8] and G2P [4] among children in Patna, Bihar. This data sheds light on the epidemiology of rotavirus infections in the region and is crucial for guiding vaccination strategies and healthcare interventions to reduce the burden of rotavirus-associated gastroenteritis, particularly in pediatric populations.

4.2.7 ICMR-National Institute for Research in Tuberculosis (ICMR-NIRT), Chennai

i. The interim analysis of the multicentric pragmatic trial evaluating the effectiveness, safety and tolerability of various doses of Linezolid in combination with Bedaquiline and Pretomanid in Adults with Pre-Extensively Drug-Resistant (Pre-XDR), Or Treatment Intolerant/Non-responsive Multidrug-Resistant (MDRTI/NR) Pulmonary tuberculosis had shown that structured dose reduction of Linezolid gives the same treatment outcome as the regular 6-month dosing of 600mg given throughout for 6 months ,the latter being seemingly intolerant in the Indian population. , but with a lower incidence of toxicity.

ii. A district-wise prevalence study in Tamil Nadu showed that the prevalence of microbiologically confirmed pulmonary tuberculosis in ≥ 15 years age is 212 per lakh population (95% Confidence Interval: 184-293) and the prevalence to notification ratio for the State of Tamil Nadu is 2.05 (1.8-2.29).

iii. Facilitated publication of two studies by Regional Resource Centre for HTA: “Smoking cessation strategies at primary health care settings in Tamil Nadu” and “Assessing the cost-effectiveness of the new treatment BPaLM/BPaL for Multi-drug resistant, rifampicin resistant, tuberculosis as compared to the shorter oral Bedaquiline containing regimen under the National Tuberculosis Elimination Program (NTEP)”

iv. Developed a comprehensive psychosocial intervention module to improve the self-efficacy and treatment outcomes in patients with drug sensitive and drug-resistant tuberculosis is being implemented as part of the NTEP program in Kancheepuram District.

v. An integrated database of chest X-rays with clinical data has been established on the ICMR-NIRT website. This resource supports research for developing indigenous AI-

based diagnostic tools for TB interpretation and point-of-care applications.

vi. A validation study using evaluating AI modelling performance in for LPA for first-line and second-line reporting and a feasibility study of utilizing Trueprep-extracted DNA for line probe assay were as done and adopted by the NTEP for implementation.

vii. A self-forming functional Nano delivery system for aerosol-mediated delivery of the anti-tubercular drugs for effective prevention of residual lung injury (novel delivery vehicle) was developed and filed for patenting.

viii. An indigenous CRISPR-Cas13 molecular diagnostic tool for M. tuberculosis detection was developed and evaluated in clinical isolates and biological samples.

ix. A new simple HPLC-UV detection method was developed to simultaneously quantify first-line drugs in fixed-dose combination tablets.

x. A standardized droplet digital PCR (ddPCR) assay was developed for detecting circulating cell-free M. tuberculosis DNA (cfDNA), demonstrating superior diagnostic capacity in extrapulmonary tuberculosis cases and diagnostically difficult cohorts.

4.2.8 ICMR-National Institute of Epidemiology (ICMR-NIE), Chennai

i. Implemented the first statewide differentiated TB care model (called Tamil Nadu Kasanoi Erapilla Thittam), aimed at reducing TB deaths. The model generated real-world evidence demonstrating its feasibility and effectiveness, reducing TB deaths by 10-20% within two quarters of its implementation. This model serves as a promising approach to differentiated TB care, especially in resource-constrained settings.

ii. Evaluated Direct Benefit Transfer for TB patients implemented by the national TB program, providing the first ever national level estimates on coverage, delay in receipt of DBT, and utilization of DBT money for nutrition during TB care.

iii. Conducted an evaluation of the Active Case Finding (ACF) initiative under the National TB program. The findings from the project are the first ever national level estimates on the frequency, scale, quality and benefits of ACF for TB.

iv. Conducted a multicentric matched case–control study across 47 tertiary hospitals in India to identify factors associated with unexplained sudden deaths in young adults. The study demonstrated the protective effect of COVID-19 vaccination.

v. Conducted annual HIV sentinel surveillance and Integrated Behavioral and Biological Surveys (IBBS) across Tamil Nadu, Andhra Pradesh, Telangana, Karnataka, Odisha, Kerala, Pondicherry and Lakshadweep. The HIV disease burden estimates derived from the surveillance data is being used to calculate the HIV disease burden in the country as well as to measure the impacts of intervention in different population groups (ANC and other High-Risk Groups such as FSW, MSM, IDU, etc.).

4.2.9 ICMR-National JALMA Institute for Leprosy & Other Mycobacterial Diseases (ICMR-NJILOMD), Agra

i. Conducted a which assessed a comprehensive intervention package to reduce TB incidence, promote early case detection, treatment adherence, contact tracing, and preventive therapy. Active case detection in high-risk groups and households uncovered hidden cases, while community awareness camps improved diagnostic reporting and drug compliance, supporting NTEP in advancing TB elimination at the district level.

ii. Implemented a mission-mode project to accelerate leprosy eradication in 10 high-burden states/UTs, aiming to estimate new cases, assess leprosy-related disabilities, and evaluate NLEP implementation through surveys and gap analysis. The

study aims at providing evidence for refining intervention strategies.

iii. A preclinical study aimed to evaluate the efficacy of a hydroalcoholic extract of Mesua ferrea combined with anti-TB drugs (ATT) during two to four months of therapy in a chronic Mycobacterium tuberculosis (Mtb) infection model using BALB/c mice. Combining anti-TB drugs (ATT) with a hydroalcoholic extract of Mesua ferrea significantly enhanced bactericidal activity, reduced lung bacillary load, and inhibited Mtb dissemination to the spleen in mice. Lowest tested dose (125 mg/kg body weight) produced better anti-TB efficacy with ATT in lung of mice by reducing additional bacillary load in lung than ATT four-month post treatment. The extract with ATT significantly inhibited dissemination of Mtb bacilli from lung to spleen during the intensive phase of combination therapy.

iv. A study evaluated the efficacy of high-dose (HD) and low-dose (LD) DPI formulations of mycobacteriophages (D29 & TM4) prepared using spray freeze-drying (SFD) against M. tuberculosis in a mouse model of tuberculosis. The HD formulation (10^10 Plaque Forming Units PFU/dose) was non-inferior to human-equivalent doses (HED) of oral anti-tuberculosis therapy (ATT) and showed a non-significant additive effect on bactericidal activity, whereas the LD formulation (10^6 PFU/dose) was inferior to ATT. The findings suggest that the HD DPI formulation could be a promising adjunct to oral ATT, warranting further preclinical safety and dose optimization studies.

v. A study utilized advanced proteomics tools to identify differentially expressed serum proteins in contacts verses leprosy cases that could serve as potential early diagnostic markers. A total of 46 serum proteins were identified by iTRAQ based Liquid Chromatography-Mass Spectrometry analysis. On analysing the results, it was found that 17 proteins need to be upregulated in the serum of contact as compared to healthy control. Out of these seventeen, 8 proteins were found to be upregulated in the serum of contact and either downregulated or constant in confirmed/other related cases.

vi. A multi-centric interventional study investigated the prevalence and association of silicosis and tuberculosis among 2,652 silica dust-exposed workers in the glass industry of Firozabad district. The study found 3.8% of workers had silicosis and 15.5% tested positive for TB, with a sixfold higher TB positivity rate in silicotic workers compared to non-silicotic workers. Additionally, rifampin resistance was recorded in 28 (6.8%) workers. Of these 10 (9.8%) were in silicotic cases and 18 (5.4%) were in non-silicotic cases. These findings underscore the strong link between silica exposure, silicosis, and TB, emphasizing the need for targeted interventions to prevent and manage these conditions.

vii. A study investigated the allelic/ genotypic frequencies of TLR1 and TLR2 polymorphism among the MDR, XDR PTB cases and their healthy controls; through an immunogenetic case-control analysis of 101 pulmonary TB patients, 104 MDR-TB patients, 48 XDR-TB patients, and 130 healthy controls. Findings revealed that the heterozygous (Ins/Del) genotype and deletion allele of TLR2 (−196 to −174) polymorphism are associated with an increased risk of developing drug-resistant TB. Furthermore, for TLR1 743 A>G gene polymorphism, A/G genotype, and G allele are found to be associated with healthy controls, suggesting the protective role against TB.

viii. A study demonstrated the superiority of intranasal delivery of clofazimine-nanoclusters (CLF-NCLs) in augmenting bactericidal activity within brain tissues, compared to oral administration. Formulations incorporating the anti-TB drugs isoniazid and rifampicin also exhibited comparable efficacy in terms of CFU reduction within the brain, with ATD-NiMs (Anti-TB Drug-loaded nano-in-microparticles) insufflations driving an additional ~1 log CFU reduction compared

to oral treatment. Analysis divulged a significant decline in mycobacterial survival within the lungs of treated mice across all groups, relative to the infected and untreated groups ($p<0.05$). Findings underscore the efficacy of intranasally delivered formulations in reinstating the Th1/Th2 ratio and curbing mycobacterial burdens in CNS-TB. This promising outcome, evident in both cytokine data and colony-forming unit (CFU) counts, underscores the potential of intranasal administration as a formidable therapeutic strategy for CNS-TB.

ix. A study identified key markers and risk factors associated with nerve function impairment (NFI) in new leprosy cases. Neuropathy was assessed through clinical examination, nerve conduction studies, and antibody profiling against M. leprae antigens (PGL and LAM) and nerve components (S100 and ceramide). Leprosy cases that developed Nerve Function Impairment (NFI) showed initial impairments in nerve conduction parameters and sensory functions, including vibration, warmth, and cold sensation, which worsened with the progression of NFI. Sensory and motor nerve conduction amplitudes were impaired in 48% of cases prior to NFI but improved with clinical treatment. Among clinically non-enlarged nerves with sensory and conduction impairments, 23% progressed to NFI, primarily affecting the ulnar (35%), median (20%), and radial (14%) nerves. Follow-up with sensory motor nerve conduction studies is being done following which final analysis will be done.

x. A study assessed age-specific immunity to measles and rubella viruses within three age strata (children 9 months to less than 60 months and 5 to less than 15 years of age, and women 15 to less than 50 years of age) through serological surveys. The findings showed that and Supplementary Immunization Activities (SIAs) significantly increased measles and rubella seroprevalence, reducing virus transmission, though immunity levels remain insufficient for India's measles elimination goals. Variability in immunity across districts highlights gaps in routine and SIA coverage, emphasizing the need for targeted vaccination strategies to reach zero-dose and under-vaccinated children. Sustained high MR vaccination coverage through routine immunization and robust case-based surveillance are critical to achieving elimination goals.

4.2.10 ICMR-National Institute for Research in Tribal Health (ICMR-NIRTH), Jabalpur

i. Developed a point-of-care device for the diagnosis of leprosy, which is currently in the validation phase.

4.2.11 ICMR-National Institute of Research in Digital Health and Data Sciences (ICMR-NIRDHDS) (Formerly known as ICMR-National Institute of Medical Statistics), Delhi

i. In collaboration with NACO, led the development of the India HIV Estimates 2022 report, released on World AIDS Day 2023, to inform the National AIDS Control Program (NACP). The report highlights significant progress in reducing HIV infections and AIDS-related deaths while identifying critical areas requiring targeted action to achieve India's HIV/AIDS eradication goals.

ii. Conducted a study on COVID-19 vaccine equity, identifying vaccine hesitancy fuelled by negative attitudes and conspiracy beliefs, and recommended targeted awareness campaigns. Another study on child vulnerability revealed significant regional and gender disparities, highlighting the need for focused interventions in high-risk districts and policies to address vulnerabilities among girls and reduce the gender gap.

iii. Undertook the impactful "ICMR MYCONET Inpatient Clinical Registry" to establish a pan-India analytics platform for invasive fungal infections, enhancing disease surveillance and empowering

policymakers to target high-burden areas and optimize resource allocation. This registry is poised to improve treatment outcomes by enabling early detection of drug resistance, and refining diagnostic and therapeutic strategies.

4.2.12 ICMR-National Animal Resource Facility for Biomedical Research (ICMR-NARFBR), Telangana

i. Acquired a resource of several transgenic mice models, hamsters, rabbits, pigs, and NHP primates to support biomedical research, particularly during health emergencies like the COVID-19 pandemic.

4.2.13 ICMR-Regional Medical Research Centre (ICMR-RMRC), Bhubaneswar

i. Developed a One Health intervention strategy for elimination of Anthrax and Scrub typhus in endemic districts of Odisha.

ii. Documented the health status of particularly vulnerable tribal groups (PVTGs) in Odisha and currently undertaking “Odisha Tribal Family Health Survey”.

iii. AFI surveillance is being carried out using the population cohort (16,500 households, ~1 lakh people) at its MRHRU, Tigiria to understand disease transmission dynamics and establish a conducive platform for future clinical trials.

iv. The Health Technology Assessment (HTA) Resource Hub under DHR has successfully conducted HTA for the telemedicine-enabled Otoscope for diagnosis at primary healthcare level and cost-effectiveness of DAMaN malaria intervention program of Government of Odisha. The report was approved by the HTAIn Board.

v. Established a state-of-the-art facility for cost-effective recombinant protein production platforms for vaccine and diagnostic purposes.

vi. Initiated a mega TB elimination project to accelerate health system response for TB elimination at Bhubaneswar in collaboration with Central TB Division (CTD) and Health & Family Welfare Department, Government of Odisha.

4.2.14 ICMR-Regional Medical Research Centre, NE (ICMR-RMRCNE), Dibrugarh

i. Established the presence of Rickettsial diseases among Acute febrile illness (AFI) cases in all the eight north-eastern states. Presence of Lyme disease was reported in the states of Assam, Meghalaya and Mizoram.

ii. Developed point-of care diagnostic technologies for malaria and TB based on CRISPR-CAS technology.

iii. The study on non-malarial aetiologies in Tripura identified Dengue, Chikungunya, Japanese encephalitis, West Nile and Rickettsial diseases (Scrub typhus, Spotted Fever Group Rickettsia and Typhus Group Rickettsia) as contributing to non-malarial fevers in the region. Entomological surveys were conducted in areas where positive cases had been reported. Exclusive presence of Ae. Albopictus in the dengue reporting areas is noteworthy. Among rickettsial disease vectors, the most abundant tick belonged to the genus Haemaphysalis.

iv. A study was conducted on the prevalence, distribution and biology of An. culicifacies in relation to malaria transmission and control in three states of North-east India. The presence of An. culicifacies in Sonitpur and Goalpara districts of Assam was recorded. Immatures of An. culicifacies were collected from slow-flowing streams from Sonitpur district of Assam.

v. The seroprevalence of Leptospirosis was determined in the hilly and plain region of Assam. In Dibrugarh, the sero-prevalence was 7.14%, and in Dima Hasao, it was 3.54% in the community.

vi. A multicentric project in the form of a One Health consortium to address the Zoonotic and Transboundary Diseases in India, including the Northeast Region in collaboration with NIAB, Hyderabad

developed diagnostic facilities for zoonotic diseases in ICMR-RMRC, Dibrugarh and found the presence of Brucellosis, Q fever, Leptospirosis, Lyme disease and Cysticercosis in the states of Assam, Meghalaya, Mizoram and Arunachal Pradesh.

vii. The expression patterns of SARS-CoV-2 genes in clinical samples among 500 Whole Genome Sequencing (performed at Regional VRDL), normalized based on Transcript per kilobase million (TPM) showed the highest expression of the M gene followed by E and ORF6 gene. The expression of the M gene was found to be higher in Omicron JN.1 as compared to previous variants of SARS-CoV-2. The significance of this finding may be used for the design of new qRT-PCR assays targeting the M-gene.

4.2.15 ICMR-Regional Medical Research Centre (ICMR-RMRC), Gorakhpur

i. Developed a point-of-care (POC) kit for scrub typhus with high sensitivity and specificity. Its results are comparable to gold standard for molecular diagnostic tests such as PCR. This kit has the potential to diagnose scrub typhus in low resource setting labs in rural areas.

ii. Developed isothermal PCR based molecular diagnostic kits for Chikungunya with very high sensitivity and specificity, which has potential to be used in remote areas.

iii. The studies on immunogenicity and safety of a heterologous prime-boost COVID-19 vaccine schedule: ChAdOx1 vaccine Covishield followed by BBV152 Covaxin provided evidence that immunization with a combination of Covishield and Covaxin was not only safe but also elicited better immunogenicity. These findings have an important implication for the COVID-19 vaccination program wherein heterologous immunization will pave the way for induction of improved and better protection against the variant strains of SARS-CoV-2. Such mixed regimens will also help to overcome the challenges of shortfall of particular vaccines and remove hesitancy around vaccines in people's mind that could have genesis in programmatic 'errors' especially in settings where multiple COVID-19 vaccines are being used.

iv. Molecular detection of spotted fever group of Rickettsiae in acute encephalitis syndrome cases as well as in mite and flea vectors from eastern Uttar Pradesh region of India has provided the baseline data for molecular surveillance of rickettsial infection in this region.

v. The immunogenicity of live attenuated SA-14-14-2 JE vaccine in terms of persistence of the humoral response after two doses was evaluated. The study showed that after the second dose of vaccination, there was decreasing trend of anti-JEV specific IgG antibody titers with time. The results emphasize the significance of booster doses of vaccine for children living in endemic areas.

vi. Co-circulation of all the four Dengue virus serotypes were reported in eastern Uttar Pradesh for the first time. This study emphasizes the requirement of continuous molecular surveillance for monitoring circulating DENV serotypes.

vii. Developed basic guidelines for rapid response team of MBSL-3 in handling outbreak investigations and management.

viii. The insecticide susceptibility of Phlebotomus argentipes was assessed in Deoria and Kushinagar districts of Uttar Pradesh revealing complete susceptibility to alpha-cypermethrin and malathion, while confirming resistance to DDT. These findings contribute crucial insights for effective vector control strategies against visceral leishmaniasis in endemic regions.

ix. Conducted a survey to find out the point prevalence of TB and its associated risk factor in 10 districts of eastern Uttar Pradesh. The finding will aid in designing

the elimination protocol for TB in selected district of India.

4.2.16 ICMR-Regional Medical Research Centre (ICMR-RMRC), Sri Vijaya Puram (Formerly Port Blair)

i. As part of the malaria elimination demonstration project, malaria survey in Nancowry group of islands revealed that more cases occurred in Teressa and Chowra Islands, and hence stringent control operations were targeted in these areas.

ii. A survey identified almost 15 different types of HPVs circulating among women of Andaman and Nicobar Islands. It was observed that HR-HP16 is the most prevalent genotype circulating in these Islands.

iii. Among 110 Nicobarese tribal individuals screened for respiratory viruses, Influenza A (H3N2) virus was found more prevalent (29.7%) than other etiologies.

iv. Blood samples from suspected patients were screened for dengue infection. Of 4,469 samples screened, 10.4% were found positive in the Andaman group of Islands. In 645 suspected patients, 32 (4.89%) were found positive for chikungunya infection.

v. In a hospital-based survey in south Andaman, among 552 samples tested for Leptospirosis, 59 (10.7%) were found positive, indicating declining trend of leptospirosis

vi. After three doses of the COVID-19 vaccine, protective immunity against the SARS-CoV-2 antigen persisted for up to 18 months.

vii. A study identified 3,146 leptospiral proteins (86% of those listed in the NCBI database), which is the highest number of proteins identified globally.

CHAPTER 5
NON-COMMUNICABLE DISEASES

In the year 2023-24, the Non-Communicable Diseases (NCD) Division of ICMR demonstrated a steadfast commitment to addressing the growing burden of NCDs through impactful research, innovative strategies, and effective program implementations. This year marked significant advancements in strengthening health systems for better prevention, management, and control of NCDs such as diabetes, cardiovascular diseases, cancer, and respiratory disorders. Key highlights include implementation research projects to reinforce national health programs, pioneering studies on disease-specific biomarkers, and the development of AI-driven diagnostic tools. The section's collaborative efforts have underscored the importance of multi-disciplinary approaches, integrating technological innovation with public health strategies to ensure equitable healthcare delivery across diverse population groups.

The Division's initiatives also gained global and national recognition for their contributions to cancer surveillance, diabetes burden assessments, and population health management. Institutes under the NCD framework implemented groundbreaking studies in the areas of Oncology, Diabetes, Cardiovascular Diseases, Trauma and Mental Health. Through intramural research, these Institutes also contributed to national programs in NCD epidemiology, molecular diagnostics, and health informatics. These efforts were complemented by capacity-building initiatives, engaging healthcare professionals and community health workers to enhance skills for tackling NCD challenges.

5.1 RESEARCH ACTIVITIES

5.1.1 New Single Centric Research Projects:

In the past year, 34 new research initiatives were launched in the field of non-communicable diseases. These projects focus on Cardiovascular Diseases, Hypertension Management and related interventions, Hematology, Autoimmune and Inflammatory Disorders, Occupational Health, Public Health systems and tools, Cancer, Diabetes, Respiratory Diseases, Neurological Disorders, Musculoskeletal Disorders, Infectious Diseases, NCD Prevention, Obesity and Nutrition, and other NCDs.

5.1.2 Ongoing Projects:

Ongoing intramural research in NCD continued to expand and strengthen its diverse portfolio, addressing critical and contemporary health challenges. The primary focus remains on the prevention, diagnosis, and management of chronic conditions, including Oncology, Cardiovascular Diseases, Mental Health, Neurological Sciences, Diabetes, Obesity and Metabolic Syndrome, Chronic Obstructive Pulmonary Diseases, Gastroenterology, Geriatrics, Oral Health, Orthopedics, and Nephrology & Urology, with efforts directed toward the prevention, diagnosis, and management of chronic health conditions.

Additionally, research activities have continued in the fields of Ophthalmic Sciences, Otorhinolaryngology, Hematology, Anesthesiology, and Disability, Rehabilitation, and Assistive Technology. Other key areas of focus included Trauma, Accidents and Injuries, Environmental and Occupational Health, Climate Change, Tobacco, and Chronic Disease Health Research. Multidisciplinary studies in Toxicology, Anatomy, Anthropology, Nanomedicine, and Traditional Medicine also highlighted ICMR' commitment to advancing innovation in healthcare and biomedical sciences.

Ad-hoc projects, representing a total of 720 projects, formed the cornerstone of ongoing research efforts. Additionally, the Division

supported 584 fellowships, reflecting a strong emphasis on capacity building and human resource development, nurturing the next generation of researchers and enhancing the overall research ecosystem.

Other project categories included National Task Force Projects (53), Single Centre Projects (65), and CARE Projects (14), which provide focused and impactful contributions to specialized research areas. These initiatives reinforce the importance of collaborative, institution-centric, and advanced research endeavors. Below are some of ICMR's ongoing projects on national importance.

Initiatives of National Importance:

Cancer care

CARE-Clinical Pharmacology –ICMR's CARE-Clinical Pharmacology initiative focused on therapeutic monitoring of anti-cancer drugs such as sunitinib and docetaxel, showing that drug monitoring improved patients' quality of life (QOL) and reduced treatment costs.

PFOS (PREVALL): ICMR, in collaboration with Tata Memorial Center-ACTREC, developed a powder for oral suspension (PFOS) of 6-mercaptopurine (PREVALL), which helps in accurate dosing for children undergoing treatment for Acute Lymphoblastic Leukaemia (ALL). Since children aged 1–10 often face difficulties swallowing tablets, this liquid formulation of 6-MP helps in overcoming this issue and ensures better treatment outcomes. The product, expected to benefit approximately 10,000 children annually, was patented and launched on November 25, 2023.

Cardiovascular Disease

a. **PACT-HF Trial** – This trial, aimed at preventing repeat hospital admissions and death in Heart Failure patients, recruited 1,693 patients, with a 97% follow-up rate and a 9% mortality rate at six months.

b. **The India Hypertension Control Initiative (IHCI)** – IHCI has successfully expanded to 154 districts, enrolling over 5.1 million hypertensive patients across 22,000 health facilities, including 16,000 Health & Wellness Centers. Nearly half (47%) of the registered patients have achieved BP control.

c. **STEMI Care Pathway:** Implemented in districts of Himachal Pradesh, Punjab, Uttar Pradesh and Andhra Pradesh, this initiative demonstrated that STEMI patients can be diagnosed at CHC level via tele-ECG and receive lifesaving thrombolytic therapy. The model has since been upscaled to entire state of Himachal Pradesh, Punjab and 4 districts of Andhra Pradesh.

Stroke and Neurological Research

a. **INSTRuCT Clinical Trials** – The Indian Stroke Clinical Trial Network (INSTRuCT) was established to create a cutting-edge stroke clinical trial infrastructure in India. Initially, INSTRuCT Phase I undertook two clinical trials across 30 centers. The network expanded in Phase II, encompassing 58 centers. Currently, four clinical trials are ongoing under this network, each addressing distinct aspects of stroke care and treatment.

b. **FeSSH Trial** – (Fever, hyperglycemia, swallowing and hypertension management in acute stroke: Stepped wedged cluster randomized trial with cross-sectional data collection): Baseline data were collected across 20 centers, with 12 centers transitioning to the intervention phase. A total of 3,022 eligible patients were identified from a screened population of 4,818.

c. **SMRUTHI India** – The Strategic Multimodal Intervention in At-Risk Elderly Indians for the Prevention of Dementia (SMRUTHI India) aims to establish a prospective longitudinal cohort of elderly individuals with multiple risk factors (CAIDE ≥ 6) and develop a validated multimodal "care bundle" intervention in four MRHRU field areas.

Ophthalmology:

ICMR's task force on "Rapid Diagnosis of Keratitis in India-Newer and challenging approaches" study indicated that both genus-specific

PCR and ddPCR serve as rapid and improved techniques that present an advantage over conventional methods for diagnosing for Fungal Keratitis (FK).

Environment & Occupational Health

CRISPI Initiative – ICMR's Task Force study CRISPI (Epidemiology of Chronic Respiratory Illness in Select Populations in India) examined the prevalence, determinants, and progression of chronic respiratory illnesses and the impact of ambient and indoor air pollution across nine sites in urban and rural India.

Rehabilitation and Assistive Technology

National List of Essential Assistive Products (NLEAP) – ICMR initiated the process of preparing a NLEAP, modeled after the WHO's Priority Assistive Products List (WHO-APL). This initiative aimed to identify essential, cost-effective assistive products necessary for maintaining or improving individual functioning.

Virtual Autopsy Program:

ICMR-CARE Virtual Autopsy – The study demonstrated that PMCT (post mortem CT scanning) of the dead body was useful in two key areas of research i.e. age estimation and analysis of internal neck findings. Virtual Autopsy program utilized post-mortem CT scanning (PMCT) to enhance forensic investigations, particularly for age estimation and analysis of neck injuries related to strangulation, hanging, or throttling.

5.1.3 Achievements of Completed Research Activities

Cancer Care

a. **Consensus Documents:** To date, ICMR has published 26 consensus documents on the management of different cancer sites, addressing the burden, improving diagnosis, and optimizing treatment and palliative care. In 2023 – 24, three on Retinobastoma, Prostate and Urinary Bladder Cancer were published.

b. **Cancer Screening Pilot:** ICMR's pilot project on screening and early detection of cervical, breast, and oral cancers in Cachar, Assam demonstrated the effectiveness of frontline health workers, such as ASHAs, in promoting home-based screening. The study found high compliance rates for self-sampling for HPV among trained women, indicating the potential for scaling such initiatives across the country.

c. In Jodhpur, ICMR worked with the State and developed a model for setting up referral chains for diagnosing and treating suspected cases of breast cancer. The model was successfully handed over to the state government for wider implementation, helping improve the diagnosis and management in the region.

Diabetes Research

a. **Indian Diabetic Risk Score:** The Indian Diabetic Risk Score was evaluated and found to be a cost-effective tool for screening diabetes in Asian Indians.

b. **INDIAB Study:** The INDIAB study provided state-specific obesity prevalence data for better policy planning of the national program and suggested age-specific HbA1c cut-offs to minimize over-diagnosis of diabetes, especially in elderly individuals. The survey was completed in 30 states/UTs, with follow-up studies completed in Arunachal Pradesh and Tamil Nadu and the data is being analyzed. The study in the Union Territories has also been completed.

c. **Dietary Recommendations:** ICMR's research also highlighted the importance of dietary changes for diabetes management. The data recommended reducing carbohydrates and increasing protein intake for Type 2 diabetes (T2D) remission and preventing progression from pre-diabetes to T2D.

d. **Young Diabetes Registry:** ICMR's Young Diabetes Registry reported critical data on the prevalence of Type 1 and Type 2 diabetes, along with complications such as retinopathy, neuropathy, and nephropathy. This registry also documented a high incidence of co-morbidities such as

autoimmune thyroid disease and hypertension in diabetic patients.

Cardiovascular Disease

Trivandrum Heart Failure Cohort: Over nine years, this study tracked 1,205 HF patients (with a mean age of 61 years), revealing a five-year mortality rate of 59%, higher than rates observed in Western countries. Notably, one in six patients had chronic kidney disease (stage III or greater), further emphasizing the unique burden of heart failure in India.

Gastroenterology

a. **Centre for Advanced Research:** Under this project, 14 Randomized Controlled Trials (RCTs) were completed. One notable study, featured on the cover of Gut International Journal (IF: 33), demonstrated that a combination of fecal microbiota transplantation with anti-inflammatory diet (FMT-AID) followed by anti-inflammatory diet effectively maintained remission in mild-to-moderate ulcerative colitis patients over one year.

b. **IBD NutriCare App:** The IBD NutriCare App was developed and validated for tele-nutrition in patients with Inflammatory Bowel Disease (IBD), marking a transformation in India's approach to intestinal disease research and clinical practices, with a focus on pan-India IBD research.

Non-putrifying Properties of River Ganga:

A comprehensive study, conducted across AIIMS, BHU, and NEERI, investigated the unique non-putrifying properties of the Ganga's water and sediment. The findings, accepted by the National Mission for Clean Ganga (NMCG), provide valuable microbiological and virological insights for river conservation.

5.2 SIGNIFICANT RESEARCH ACTIVITIES AND ACHIEVEMENTS ACROSS ICMR INSTITUTES: DRIVING INNOVATION IN NON-COMMUNICABLE DISEASE

Coordinating with the Division, ICMR Institutes achieved significant milestones during FY 2023-24 across diverse research areas and public health interventions.

5.2.1 ICMR-National Institute for Occupational Health (ICMR-NIOH), Ahmedabad

i. Secured patents titled "A non- invasive system for detection of analytes and applications thereof" and "A diagnostic device and method for differentiating Asthma- COPD Overlap Syndrome (ACO) from Asthma and COPD".

ii. Identified the negative impact of various bisphenol analogues exposure for its sexual dimorphic effects on behavioral despair, potentially linked to altered gut microbial profiles in mice.

iii. Catalogued a relatively high number of antibiotic resistance genes presence in soil and sludge samples collected from various industrial sites in Ahmedabad, Baroda, Bharuch, Ankleshwar and Vapi-Valsad in Gujarat.

iv. Demonstrated significantly higher heavy metal concentration (Cd, Cr, Mn, Ni and Pb) in the blood of e-waste workers and supportive staff. DNA damage was observed to be significantly correlated with blood levels of heavy metals, emphasizing the need for regular monitoring of body burdens among e-waste workers.

v. Found significantly increased bile acids and their receptors in painters as compared to controls. Dose response relationship was noted between bile acid concentration and fibrogenic and inflammatory mediators. Suitable preventive measures were suggested to minimize bile acid-induced fibrogenic and inflammation.

vi. Reported decreased DNA methylation (5mC) and methylation index (SAM/SAH) among Pb-exposed and B-vitamin-deficient workers. Hypomethylation promoted oncogene expression, leading to hormonal imbalance, infertility, and cognitive decline. The supplementation of B vitamins and avoidance of Pb exposure was recommended to mitigate the

methylation loss among these workers.

vii. Observed significantly lower serum calcium and higher bone remodeling markers (osteocalcin and alkaline phosphatase) in occupationally exposed individuals compared to controls. The serum 25-hydroxy vitamin-D3 and calcitriol levels did not differ significantly between the two groups. Lastly, blood lead and osteocalcin were weakly but significantly associated with serum calcium levels after controlling for variations in total protein, diet, 25-hydroxy vitamin-D3, calcitriol, and alkaline phosphatase among the study participants. These findings reinforced the adverse impact of lead exposure on calcium metabolism.

viii. Performed a systematic review of literature demonstrating the various health hazards of heavy metal exposure (Pb, Cd) and biomass fuel smoke that are instrumental in developing guidelines.

ix. A mixed-methods study investigating latent tuberculosis infection (LTBI) among agate-stone workers in Khambhat found 58% LTBI prevalence, almost twice that of the general population. The study identified key predictors, including extended exposure duration and type of work, advocating for policy changes to recognize silica-dust-exposed populations as high-risk for LTBI testing

5.2.2 ICMR-National Institute of Cancer Prevention and Research (ICMR-NICPR), Noida

i. Provided the first national-level evidence on the types and quantity of waste potentially generated by use of smoked and smokeless tobacco products in India. A total of 170,331 (±29,332) tonnes of waste is estimated to be generated annually, out of which 43.2% was plastic, 3.6% was foil and 0.8% was filter. The novel method of estimating potential tobacco product waste can be used in any low-and-middle income countries.

ii. Assessed the impact of alcohol prohibition policy on the extent and pattern of self-reported alcohol use in the state of Bihar comparing data from the fourth and fifth rounds of the National Family Health Survey (NFHS). Found a 41.8% reduction in the proportion of men reporting alcohol use and a 69.6% reduction among women. Despite this decline, alcohol use continued with men reporting use of tadi madi and country liquor.

iii. Highlighted poor cognitive outcomes among older adults who smoked or consumed smokeless tobacco compared to tobacco non-users, underscoring the need to accelerate programmes related to tobacco-free generation in low-and-middle income countries to reach a higher quality of life and healthy aging. This will also be instrumental in achieving the Sustainable Development Goal of “good health and well-being.”

iv. Anlayzed 37 SLT samples, including khaini, snus, moist snuff, gul, pan masala, zarda, Mainpuri kapoori and qiwam. Their pH, moisture, nicotine and alkaloid content were collected and measured, reporting a positive correlation between pH and free nicotine levels, with the highest free nicotine found in snus samples.

v. Developed a novel computational protocol of protein structure selection for computer-aided drug discovery. This workflow allows identification of true active molecules more efficiently during virtual screening, a routinely used method for lead identification. The developed approach can be implemented for identifying crystal structures of important therapeutic drug targets.

vi. A prospective cross-sectional study provided evidence of higher specificity and accuracy of p16/Ki67 dual staining compared to HPV16/18 genotyping in triaging women with cytologically-detected low-grade cervical intraepithelial lesions. Women with positive dual staining were more likely to demonstrate high-grade lesions on a concurrent or

subsequent cervical biopsy.

vii. Demonstrated a comprehensive view of the novel as well as reported single nucleotide variants (SNVs) in the PIK3CA gene associated with Indian breast cancer cases. The mutation status of H1047R/L could serve as a prognostic value in terms of selecting targeted therapy in breast cancer.

viii. Conducted HPV screening of 5,593 hospital-based adult females across eight Northeastern states, reporting the highest prevalence in Mizoram (15.5%) followed by Tripura (15.4%; 138/892), Arunachal Pradesh (13.8%, 69/497) and Assam (12.8%, 116/905). High concordance of HPV DNA detection i.e. 18.6% (56/300) vs 17.6% (53/300) respectively, among paired cervical smears and urine samples showed that urine samples can be used as a viable alternative for HPV screening.

ix. The Genome sequencing of SARS-CoV-2 Omicron variants in Delhi revealed alterations in immunogenic regions in spike glycoprotein. This paper describes the sequence feature of Indian origin isolate. Spike protein mutations are important to examine immune evasion of SARS Cov-2, and this paper reveals some novel mutations (Y505 reversion, G339H, and R346T/N) in genomes from Delhi, and their probable implications for altering the immune response and binding affinity for ACE-2. Various in-silico structural analysis have shown that such mutation may alter the antibody binding affinity in spike protein, so the immunity provided by cells are not recognized well. This NGS based genome sequencing of SARS-CoV-2 Omicron variants in Delhi reveals alterations in immunogenic regions in spike proteins associated with immune evasion following immune pressure due to vaccination or re-infection.

5.2.3 ICMR-National Institute for Implementation Research in Non-Communicable Disease (ICMR-NIIRNCD), Jodhpur

i. Highlighted challenges in mental healthcare delivery, from patient resistance to limited resources, hindering effective treatment and management. Overcoming these barriers demands comprehensive interventions, including specialized training for healthcare providers and community engagement initiatives to combat stigma and enhance support. This study included imparting capacity-building training with updated guidelines and practical approaches like counselling therapy to district health care providers. The manuals of Ayushman Bharat were used for this purpose.

ii. Conducted Jodhpur Urban Air Quality Monitoring Project (JUMP), which revealed substantial insights into the spatial and temporal variations of air pollution within Jodhpur's different micro-environments. Found higher PM2.5 levels indoors compared to outdoor environments, emphasizing the need for targeted policies to improve air quality.

iii. Promoted Sickle Cell Anemia Screening in Rajasthan's tribal regions, screening 94,000 tribal individuals and determining an overall 4.3% prevalence rate. This marked a critical step towards managing sickle cell disease (SCD) and trait (SCT) within this vulnerable population. The provision of genetic counseling is an innovative strategy that helps educate the community about the potential health implications of this condition. This initiative significantly enhances early diagnosis and management, which is crucial for improving life quality and reducing mortality associated with SCD.

iv. Screened 9079 newborns for sickle cell disease, recording 43 homozygous SCD babies and 1035 babies with the trait. Among the study participants, 35 were given antibiotics and folic acid. During the reporting period following, the incidence of clinical events in SS cases occurred, including anaemia. Events per 100 person year of Acute Febrile Illness (AFI) and Acute Respiratory Infection (ARI) were 117 and 170, respectively. The variation of the Hb, HbS, and HbF are also correlated with the

participants' follow-up visits. Treatment of Hydroxyurea and antibiotics were prescribed to 4 patients with SCD. Events per 100 people a year of blood transfusion, painful events, and hospitalization were 3.66, 10.96, and 5.55, respectively.

v. Evaluated the competence of healthcare workers to screen infants and adult populations through POC. Healthcare workers included in the study were auxiliary nurse midwives (ANM), laboratory technicians (LT), and medical officers (MO) of a few blocks of Udaipur district of Rajasthan. ANMs were found to be more adept at dealing with people, whereas the LTs were more competent in conducting the test procedures in Phase I (pre-analytical phase). In Phase II (analytical phase), both the ANMs and LTs were found to be equally competent.

vi. A study on implementation of screening for TB among school students in Rashtriya Bal Swasthya Karyakram (RBSK) demonstrated that integration of screening for presumptive cases of TB among school students within the existing infrastructure of RBSK is feasible and would aid in detection of hidden cases of TB.

vii. Active screening and motivation of presumptive cases of TB among the community is acceptable among stakeholders of Nehru Yuva Kendra Sangathan, the Public Health system and the community at large.. The study identified challenges in treatment adherence and proposed improvements to tuberculosis preventive treatment uptake.

viii. Assessed COVID-19 mortality by exploring innovative methods such as capture-recapture and network scale-up analysis. A study in Mumbai's M/East ward showed that network scale-up can estimate deaths effectively but needs suitable replication methods and visibility rates. Field data collection was found to be impractical, suggesting the need for online methods like Google Forms or mobile apps with higher response rates among younger demographics.

ix. Developed and validated an Artificial Intelligence tool for screening/detection of Pulmonary TB and other lung diseases using Chest X-Rays..

5.2.4 ICMR- National Centre for Disease Informatics & Research (ICMR – NCDIR), Bengaluru

i. Described the variation in survival rates for population-based cancer survival studies on breast and cervical cancer across Wardha, Ahmedabad urban, Manipur, Mizoram, Tripura, and Pasighat. The 5-year survival rate of cervical cancer ranged from 31.6% (Tripura) to 61.5% (Ahmedabad urban), with cancer stage as a significant predictor of survival. The 5-year breast cancer survival rate ranged from 41.9% (Pasighat) to 74.9% (Mizoram). Patients diagnosed with local-stage breast cancer had a 4.4 times higher 5-year survival rate than those diagnosed with distant-stage cancer. Disparities in survival rates highlighted significant variations across different regions of India, emphasizing the importance of awareness, early detection, and healthcare improvements.

ii. Examined Patterns of Care and Survival Studies (POCSS) on Gall Bladder Cancer (GBC) in Indian Hospital Based Cancer Registries. Reported that a majority of the Gallbladder cancer cases presented at Stage IV (53.3%) followed by Stage III (22.3%), while early-stage detection was as less as 13.8%. The pattern of treatment patients received were chemotherapy (83.8%), surgery (19.3%) and radiotherapy (8.3 %). Among GBC patients, 24.0% of male patients and 15.1% of female patients were reported as dead after 3 years follow up. Survival rates were lowest in Stage IV (3.5%) and Stage III (21.9%) after three years, emphasizing the need for early detection and timely treatment through public health interventions, including screening programs.

iii. Investigated Incidental Gall Bladder Cancer (IGBC) and Other Pre-malignant Gall Bladder Condition in India to aid early detection, describe risk factors and clinical correlates

for IGBC and other preneoplastic lesions. Among IGBC-diagnosed participants, 86.8% were unemployed, 78% followed a mixed diet, and 13.2% had diabetes or hypertension. Pathological findings included wall thickening (38%), cholelithiasis (96%), and extrahepatic biliary radical dilatation (5.9%). Multiple gallstones were observed in 30.9% of cases, while 2.9% had porcelain gall bladder. Other findings included chronic cholecystitis (70.86%), high-grade dysplasia (48.5%), pyloric metaplasia (41.2%), lymphocytic infiltration (42.6%), and Rokitansky-Aschoff sinuses (44.1%).

iv. Conducted a health facility assessment for NCD services to evaluate the current status and scope for improving continuum of care for diabetes and hypertension in India. Cross-sectional survey of health facilities and patient exit interviews were conducted in 9 districts of 4 states in India and key recommendation was to improve case detection through opportunistic screening services at secondary level care and ensure availability of essential medicines at sub-centre level. Community workers under the supervision of medical officers can ensure continuum of care at community level. State NCD officers can plan and implement integrated health promotion strategy, by using mass media and other channels for communications to promote healthy lifestyle in the communities.

v. Highlighted the association of air pollution with cancer incidence and mortality through a meta-analysis of observational studies. Found significant association between exposure to pollutants such as PM2.5 and nitrogen dioxide (NO2) and mortality from lung, breast and liver cancer.

vi. Assessed India's progress in reducing premature mortality from four major non-communicable diseases (NCDs) to achieve WHO's 25x25 goal and Sustainable Development Goals (SDGs), By analyzing data from 2001 to 2030, the research revealed a 13.9% reduction in combined premature mortality from cancer, diabetes, cardiovascular disease (CVD), and chronic respiratory disease (CRD) between 2010 and 2025, and a 15.6% reduction from 2015 to 2030. Notably, CRD showed the most significant reduction, with an average annual percent change (APC) of 5.2%, reflecting effective interventions. The detailed disease-specific trends indicated that while there has been substantial progress, achieving the WHO's 25% reduction target by 2025 or the SDGs' one-third reduction by 2030 will require intensified and sustained efforts.

5.2.5 ICMR-National Institute for Research in Environmental Health (ICMR–NIREH), Bhopal

i. Developed an optical nanobiosensor using advanced quantum sensing technology to accurately detect circulating triad grid of miRNAs, LncRNAs, and mRNAs with unparalleled precision, even at extremely low concentrations of just one femtogram. The most remarkable feature of this sensor is its potential to identify and analyze disease-specific cell-free circulating miRNAs, lncRNAs, and mRNAs in rural women who have been exposed to biomass fumes and are at high risk of developing breast cancer.

ii. Developed a novel method for identifying and measuring circulating cell-free miRNAs (ccf-miRs). This innovative approach, utilizing nanocytometry, involves a unique nano-hybrid composite technique that combines an oligonucleotide-nano-polystyrene (ONPS) hybrid and a highly specific fluorophore-labeled locked nucleic acid (LNA) to capture ccf-miRs.. This strategy can potentially be highly effective in detecting lung cancer linked to environmental factors, as it uses targeted and amplification-free quantitative detection.

iii. Observed that inorganic arsenic (a trivalent form, As3+) induced cell death in lung epithelial cells through inducing the expression of microRNA-195-5p. microRNA-195-5p mediated arsenic

induced cytotoxicity. Specific inhibition of microRNA-195-5p protected cells from arsenic-induced cell death. Dietary polyphenol tannic acid protected lung epithelial cells from arsenic induced cell death through suppressing microRNA-195-5p expression.

iv. Detected micro plastics, one of the emerging environmental contaminants of concern, in soil and aquatic matrices of Bhopal and Indore in Madhya Pradesh, with concentrations higher in soil. Risk assessments indicated 'very-low' to 'low' environmental risk under current conditions scenario (limitations in experimental conditions need not to be neglected).. Identified microplastic shapes as fibers, beads, and particles with varying colors, attributing their presence to anthropogenic activities, atmospheric fallout, and wind dispersion.

v. Found that population density of dengue vector Aedes aegypti were significantly associated with microclimatic variables such as diurnal temperature range (DTR) (negative association), RH and rainfall (positive association) within Bhopal, indicating the importance of micro-climatic conditions on the density of the dengue vector in local scale.

vi. Anlayzed time-series dengue incidence data with historical meteorological data, revealing higher risk (RR >1.1) at both lower (<50mm) and higher (>100mm) rainfall with 5 week-lag and an extended 10-15 week-lag, respectively. A higher RR (~1.2) was also observed at >30°C mean temperature with a 5-15 week-lag (peak at 10 weeks). Absolute humidity >60 g/m3 with 5-15 week-lag was also found to be a major risk factor (RR ~2.0) for dengue virus transmission.

vii. Confirmed the circulation of a new lineage of dengue virus serotype 2 (non-Indian, cosmopolitan genotype 4a) in field collected Aedes aegypti mosquitoes from Bhopal city.

5.2.6 ICMR-National Institute of Child Health and Development Research (ICMR-NICHDR) (Formerly known as ICMR-National Institute of Pathology), New Delhi

i. Detected 2-hydroxyglutarate in biofluids of glioma patients, identifying it as a potential circulatory biomarker. Found that quantification of 2HG in IDH1 mutant gliomas could facilitate the diagnosis, prognosis, monitoring of treatment responses and disease recurrence.

ii. Docking studies using the IBS library identified potential targets for KIFC1, KIF4a, KIF15, and KIF20a, and molecular dynamics simulations identified stable inhibitory molecules that will be validated for anticancer activity in breast cancer cells.

iii. Identified potential biomarkers for early-stage gallbladder cancer (GBC) as well as 58 proteins associated with lymph node metastasis, including KRT7 and SRI, which were over-expressed in LN-positive GBC compared to LN-negative GBC. Knockdown studies of SRI suggested its potential as a therapeutic target. Also identified 94 differentially expressed miRNAs in early stage GBC, some previously reported in other cancers, validating their potential as biomarkers.

iv. Demonstrated Post-Kala-azar Dermal Leishmaniasis (PKDL) patients are a key source of Leishmania donovani parasites that impede the eradication of visceral-leishmaniasis. Our research demonstrates that recent isolates of Leishmania donovani of PKDL origin have regained susceptibility to antimonials in vitro, making it possible to use antimonials in combination with other medications to effectively treat PKDL..

5.2.7 ICMR-National Institute of Traditional Medicine (ICMR – NITM), Belagavi

i. Established potent antimalarial activity of Anacardium occidentale (cashew nut) leaf extracts through its action against Plasmodium falciparum Transketolase (PfTK).

ii. Developed a topical formulation for diabetic wound healing based on traditional practices, leading to a clinical trial.

iii. Established potential anti-Cholera toxin activities of selected polyphenols from Punica granatum (Pomegranate) peel and Psidium guajava (Guava) leaves based on their traditional use.

iv. Established the efficacy of Theobroma cacao (Cocoa) seeds against doxorubicin-induced organ toxicity in Ehrlich ascites carcinoma (EAC)-mediated solid tumor in induced mice model.

v. Identified Iodine Deficiency Disorders (goiter) as a major public health challenge among rural school-age children in several districts of North Karnataka through Model Rural Health Research Unit (MRHRU).

vi. MRHRU also documented the burden of malnutrition in school-going children in Raichur, an aspirational district in Karnataka.

5.2.8 ICMR-National Institute of Immunohaematology (ICMR-NIIH), Mumbai

i. Conducted the first large study on newborn screening of sickle cell disease (SCD) from seven centres across six different states, screening 68,723 newborn children. Of these 7834 (11.39%) were identified as sickle cell traits and 529 (0.76%) were SCD. Amongst SCD newborn, 504 (0.73%) were sickle homozygous (SS). The study is important in understanding the morbidity and mortality of the SCD.

ii. Conducted a prospective non-inferiority randomized controlled trial across six centers in India to determine the efficacy of 10 mg/kg/day [arm-1] v/s 20 mg/kg/day [arm 2] Hydroxyurea for the treatment of Sickle Cell Disease (SCD) patients. A total of 347 SCD patients with a mean age of 7.51 ± SD 3.47 years at baseline were enrolled in this study. The participants were followed up for a period of 12 months to evaluate the efficacy and safety of hydroxyurea. This study will help in clearly to develop guidelines for the treatment of SCD patients.

iii. Phenotyped regular 4000 'O' blood donors form four different regions for 22 common antigens to prepare a database of antigen typed donors and 2000 donors genotyped using targeted and cost effective Next Generation Sequencing (NGS) for more than 360 blood group antigens.

iv. Identified and registered over 300 novel and very rare donors in the ICMR-Rare Donor Registry of India (RDRI). The web-based portal for RDRI is ready for launch and will be integrated with e-Raktkosh. A proposal for the expansion of the current RDRI has been sent to DGHS for developing fifteen more molecular immunohematology centres to increase the inventory.

v. Determined the molecular bases of RhD negativity in Indians, leading to development of a diagnostic genotyping strategy for correct RhD typing. Two kits developed: a non-invasive fetal RHD genotyping assay for the Indian RhD negative woman and a multiplex PCR-based for genotyping 14 common and clinically important BG antigens, and submitted for Expression of Interest (EOI).

vi. Standardized methods for detecting human neutrophil antigens and associated antibodies for the first time in India.

vii. Contributed to drafting and finalizing WHO guidelines for implementing Poliovirus surveillance among patients with Primary Immunodeficiency Disorders (PIDs). Genomic signatures were analysed in large cohort of primary immune disorders using next generation technology, identifying severe combined immunodeficiencies (24.9%), phagocyte functional defects (19.3%) and immune dysregulation diseases (15%), which are important for the diagnosis and treatment of PIDs.

viii. Conducted the first study on large cohort (n=300) of Fanconi Anemia (FA) genotyping, revealing major FA

complementation groups (FANCA, FANG, and FANCL) important for genetic counselling and disease management. Founder mutation c.1092G>A of FANCL gene Indian population was established. It was also identified that epigenetic markers in FA to predict the cancer for the better management of the disease as FA has a high risk of developing cancers.

ix. Conducted a multicentric study on Systemic Lupus Erythematosus (SLE) in 5 North Eastern (NE) Region of India to establish laboratories and train the faculties for early diagnosis of SLE patients. The data collected on large cohort of tribal and non-tribal groups of SLE patients from NE is important to understand the geographical and epidemiological variations.

x. Established cost effective technologies for the diagnosis and management of various autoimmune diseases in 9 participating MRUs of Govt. Medical Colleges across the country under the strengthening of ICMR-MRUs program.

xi. Developed a simple, rapid and cost-effective diagnostic kit for the diagnosis of Haemophilia A and vWD for first time in the world. This kit is a lateral flow immune assay (LFIA) based test which can be performed at PHC without technical expertise. The technology was transferred to Bhat Bio-Tech India (P) ltd. (BBI), Bangalore for commercialization of these kits. The manufacturing license by DCGI has been given and the kit is ready for marketing.

5.2.9 **ICMR-Regional Medical Research Centre** (ICMR-RMRC), Sri Vijaya Puram

i. Found that almost 1.3% of Nicobarese screened (77 total) had the sickle cell anemia trait (AS).

ii. Conducted a community-based health survey in rural areas of South Andaman, revealing that 28.8% were hypertensive, 21.7% were diabetic, and 54.3% of men and 29.8% of women consumed smokeless tobacco.

iii. Conducted a Diabetes survey in the whole of Andaman & Nicobar Islands, surveying 1094 households and identifying 85 (7.8%) individuals with Newly Diagnosed Diabetes (NDD).

5.2.10 ICMR-National Institute of Epidemiology (ICMR-NIE), Chennai

The STEPS (round 2) study in Tamil Nadu revealed higher gaps in the detection, treatment, and control of diabetes and hypertension among men and individuals under the age of 45 yrs. Recommendations led to expanding NCD screenings to worksites, extending screenings to private and government sector factories.

5.2.11 ICMR-National Institute for Research in Tribal Health (ICMR-NIRTH), Jabalpur

i. Contributed to the preparation of operational guidelines for national sickle cell anemia elimination mission. The mission was launched by the Hon'ble Prime-Minister of India on 1 July 2024 at Shadol District of Madhya Pradesh.

ii. Contributed tow the development of training modules for training of master trainers on sickle cell disease (SCD).

iii. Contributed to the preparation of six different counselling and awareness modules on SCD for the mission.

iv. Provided training on SCD to 17,105 healthcare workers from 18 districts in Madhya Pradesh.

5.2.12 ICMR-National Institute for Research in Digital Health and Data Science (ICMR-NIRDHDS) (Formerly ICMR-National Institute of Medical Statistics), Delhi

i. Undertook a project to assess the household financial burden of non-communicable diseases in Southeast Asian countries through a review of available evidence The findings revealed a substantial economic burden from conditions like cardiovascular diseases, diabetes, cancer, chronic kidney disease, and chronic obstructive pulmonary disease, driven by high out-of-pocket expenditures (OOPE),

catastrophic health costs, and distress financing. These costs, including direct medical expenses and indirect costs like productivity losses, underscore significant disparities in healthcare access and insurance coverage across SEAR countries. The study emphasized the urgent need for governments to prioritize healthcare financing and expand insurance coverage, particularly in countries like Bhutan and Maldives, where universal health coverage remains limited.

ii. Conducted a study entitled," Benefit Incidence of Public Health Expenditure in India: Does Socioeconomic Equity Matter for Universal Health Coverage" that revealed significant disparities in healthcare access and resource distribution across socioeconomic and geographic segments in India. Wealthier quintiles displayed a marked preference for private healthcare, while public facilities served as the primary option for economically disadvantaged groups in both rural and urban areas. Public health spending disproportionately benefits wealthier urban segments, with the richest quintile receiving a substantial share of outpatient (37.6%) and inpatient (34.2%) services. These findings underscored the urgent need for equitable resource allocation and targeted policy interventions to bridge gaps and achieve universal health coverage.

iii. Conducted a study titled "Socio-economic, Demographic, and Regional Convergence in Obesity and Overweight among Adult Population in India during 1998-2021: A Study Based on Four Rounds of National Family and Health Survey" . The study revealed that women had more increase in the prevalence than men, especially among the 40 years and above age group. A rise in the prevalence of overweight/ obesity was found in the Southern (Tamil Nadu, Karnataka, Andhra Pradesh) and Northern (Delhi, Punjab, Chandigarh) regions. The study highlighted the need for health policymakers and other stakeholders to primordial preventive measures through a targeted intervention-based approach among women and men in their late thirties, of the urban and well-off economic group, to achieve the Sustainable Development Goals (SDGs) target 3.4.1, by the end of 2030.

CHAPTER 6
Reproductive, Child Health, and Nutrition

The Reproductive, Child Health, and Nutrition (RCN) Division coordinates intramural research activities in the areas of maternal, reproductive, child health, and nutrition. It plays a pivotal role in addressing critical health, nutritional, and reproductive challenges in India through a multifaceted approach combining research, capacity building, policy contributions, and community engagement.

In 2023-24, significant strides were made in the domain of nutrition to address malnutrition, micronutrient deficiencies, and non-communicable diseases. Initiatives included developing dietary guidelines and advancing research on nutrient metabolism and environmental safety. A nationwide study was launched to assess dietary and biomarker patterns across all states and union territories, covering individuals across all age groups. Additionally, an implementation research study on anemia is in the planning stages to develop an effective model for reducing its prevalence among vulnerable populations. A study evaluating the impact of fortified rice distribution on anemia reduction has also commenced. These efforts are complemented by community awareness programs and international collaborations, which have significantly amplified the reach and impact of these initiatives.

In the fields of reproductive health and maternal health, research has advanced understanding in key areas such as infertility, maternal and child health, reproductive cancers, and genetic disorders. These studies have driven innovations in diagnostics, treatment strategies, and the development of policy frameworks. Rural health research units and community-driven interventions have extended these benefits to underserved regions. Comprehensive research and collaborative efforts have also focused on addressing anemia, childhood malnutrition, maternal mortality and menstrual health. Large-scale studies on Polycystic Ovary Syndrome (PCOS), gestational diabetes mellitus (GDM), and stillbirth prevention have contributed to the formulation of guidelines, validation of technologies, and strengthening of community health initiatives. Efforts to strengthen maternal health research in tribal and Northeast populations are also underway.

By integrating research, policy, and community engagement, these efforts aim to create sustainable solutions for improving nutrition, reproductive health, and overall well-being.

6.1 RESEARCH ACTIVITIES

6.1.1 New Multi-site Research Projects:

The RCN Division initiated seven new multisite research projects, which demonstrate a strategic and diversified approach to addressing pressing health challenges with a strong focus on women's health, maternal and child outcomes, and disease prevention. These initiatives were designed to combine innovative approaches with targeted interventions to ensure meaningful and sustainable public health advancements.

One of the key priorities was advancing women's health through tailored interventions and long-term observational studies centered on Polycystic Ovary Syndrome (PCOS) and Gestational Diabetes Mellitus (GDM). The ICMR-PCOS Cohort Study Phase II, spanning 18 sites, represents a significant investment in understanding and addressing this widespread condition among Indian women. This is complemented by the Lifestyle Intervention for PCOS Women project, affirms the Division's commitment to women's health through innovative and personalized interventions. Similarly, the Maternal and Fetal Outcomes in GDM project, covering eight sites, underscores the commitment to deriving actionable insights for managing GDM effectively.

Maternal and child health remained at the forefront, with projects addressing critical

gaps in care systems. For the first time in India, a large-scale collaborative secondary data analysis is pooling pregnancy cohort data from diverse regions. This initiative aims to provide critical evidence on the burden of stillbirth and develop robust risk prediction models. Complementing this effort are the development of Bereavement Care Guidelines and the formulation of stillbirth prevention strategies, which reflect a holistic approach to maternal care.

Another significant area of focus was public health innovation and disease prevention. The task force study on menstrual hygiene examines potential health risks associated with commonly used products, aiming to enhance safety standards and improve health outcomes for women. The OMNIVEC-India initiative exemplifies an innovative approach to tackling vector-borne diseases by integrating digital tools and community engagement to create cost-effective and scalable solutions.

Through these projects, the RCN Division has effectively balanced large-scale initiatives with targeted interventions, prioritizing evidence-based solutions, inter-sectoral collaborations, and scalability.

6.1.2 Ongoing Research Studies:

The RCN Division supports diverse research, including approximately 150 small grant studies across the country and intramural projects conducted ICMR-NIN, Hyderabad, and ICMR-NIRRCH, Mumbai. These initiatives span a wide spectrum of research projects aimed at advancing maternal and child health, reproductive health, and disease prevention. Key focus areas include the development of biomarker-based diagnostics for conditions like preterm delivery and PCOS, studies on the health impacts of environmental exposures, and the creation of fortified foods to combat micronutrient deficiencies such as anemia.

The Division also prioritized innovative approaches to addressing chronic conditions like sarcopenia and non-communicable diseases while exploring the dietary influences on gut microbiota, cognitive function, and bone health. Additional efforts involve optimizing locally sourced food systems, designing nutrition interventions tailored to community needs, and developing surveillance systems for monitoring nutritional and lifestyle risks. By integrating evidence-based strategies and behavioural interventions such as menu labelling, these projects aim to promote holistic public health improvements across diverse populations.

6.2 INITIATIVES OF NATIONAL IMPORTANCE

Through the RCN Division, ICMR has made significant contributions to several national programs focused on nutrition, reproductive health, and maternal and child health, driving evidence-based policy and programmatic advancements.

i. Women's Health Innovation Opportunity Map 2023: ICMR Contributed to the Women's Health Innovation Opportunity Map 2023, coordinated by Bill & Melinda Gates Foundation (BMGF). This collaboration evaluated and identified key opportunities for advancing women's health, resulting in in actionable solutions outlined in the final report.

ii. Haemoglobin Device Validation Protocol: Developed a protocol for the validation of non-invasive and minimally invasive haemoglobin devices. The RCN Division supported the CAR center at Safdarjung in its implementation.

iii. Maternal Mortality Research: Coordinated with the Registrar General of India (RGI) in response to a request from the Ministry of Health & Family Welfare to analyze data on the causes of maternal mortality in India and promptly shared the findings with the Ministry.

iv. Armed Forces Research Support: Supported the Armed Forces in identifying key research priorities related to combat medical care and other specific issues. This includes spearheading efforts to advance these priorities and ensure their successful implementation.

v. Multi-Micronutrient Supplement for

Pregnancy: Conducted extensive evidence synthesis and convened expert consultations to reach a consensus on the optimal composition of an India-specific multi-micronutrient supplement for pregnancy. This formulation is designed for testing in research settings nationwide.

vi. Rising Cesarean Section Rates: Organized expert group meetings involving state government representatives, the Ministry of Health and Family Welfare (MOHFW), and domain experts to review the factors contributing to the rising rates of cesarean sections in India. This was followed by a research priority-setting exercise to guide future investigations in this critical area

vii. Fertility Research in Sikkim: Collaborated with the Govt. of Sikkim in identifying possible solutions for the declining fertility rates in Sikkim and deciding research priorities

viii. Nutritional Guidance for Gaganyaan Mission: Provided nutritional guidance to astronaut designates for India's Gaganyaan Mission space mission.

6.3 SIGNIFICANT RESEARCH CTIVITIES AND ACHIEVEMENTS ACROSS ICMR INSTITUTES

The ICMR institutes coordinating with the RCN Division have made remarkable advancements across various domains of health research. Below is a detailed narrative of the significant contributions made by the institutes:

6.3.1 ICMR-National Institute for Research in Reproductive and Child Health (ICMR-NIRRCH), Mumbai

Women's Health

i. Study identified 305 rare variants associated with PCOS, found across 253 genes. These are associated with ovarian steroidogenesis, insulin resistance and insulin secretion, and the PI3K-AkT pathway. Several functional rare variants were revealed to be associated with increased PCOS risk, thus expanding the genetic susceptibility landscape of Indian women to PCOS.

ii. A database on POI has been developed by manual curation of literature. It includes information on 166 genes associated with POI. Pathway enrichment of these genes indicates a major role of pathways associated with the immune system, cell proliferation and steroidogenesis in POI.

iii. The early growth response 1 (ECGRI) study, the largest in India with standardized recruitment (WERF-EPHect), revealed significant geographic differences in endometriosis lesion types, with endometrioma (55.4%) being the most common in Indian women, in contrast to superficial peritoneal endometriosis (SUP) in European populations. This study highlights the need for multidisciplinary endometriosis care centers across India and emphasizes the importance of addressing diagnostic delays through capacity building for healthcare professionals and community awareness initiatives for early symptom recognition and referral.

iv. A research project titled three dimensions of Mycoplasma genitalium infection-detection, cure rate and co-infections revealed a significant prevalence (7.3%) among women attending STI clinics. This emerging STI is a notable contributor to lower genital tract infections.

v. A gene from arginine metabolism has been identified as a semi-essential target protein affecting Candida growth. A knockout mutant of this gene in C. albicans was developed, showing attenuated virulence in terms of hyphal growth, aspartyl protease activity, and phospholipase B activity. A provisional patent has been filed for this mutant strain.

vi. A drug has been repurposed as a potential inhibitor of Candida type II topoisomerase. It demonstrated effectiveness in reducing Candida load in murine systemic candidiasis model and a provisional patent has been filed in this regard.

vii. The drug retapamulin was repurposed as a potential inhibitor of Candida ribosomal protein YmL9. Topical treatment using retapamulin showed a significant decrease in vaginal Candida burden from day 2 to day 8 compared to vehicle control and control groups.

viii. Analysis of the Trop2 expression in the ascites of ovarian cancer cells demonstrated that Trop2 transcript levels in ascites correlate with the frequency of the malignant cells present in the ascites. Trop2 was identified as specific marker to detect malignant cells of the ascites in ovarian cancer patients.

Maternal Health

i. The use of IV Ferric Carboxymaltose among pregnant women was found to be clinically effective and cost efficient at price of Rs. 3039 per 1000mg IV FCM, with no adverse pregnancy outcomes when compared to IV Iron Sucrose. The cost-saving potential was identified at Rs. 354 per 1000mg of the drug. The use of this drug at sub district hospitals was feasible and acceptable to both healthcare providers and pregnant anemic women.

ii. A study identified two novel HLA-G alleles (HLA-G*101:01:01:01v2var and HLA-G*101var) among Warli tribal population using next-generation sequencing. This marks the first report on identification of new HLA-G alleles in the Indian population.

Child Health

i. A non-invasive diagnostic method for mitochondrial disorder was developed using buccal swab samples.

ii. A rapid HTA on Gazelle POC in Sickle Cell diagnosis found that kit procurement costs under Rs. 50 and machine costs below Rs. 95000 would make facility-based screening cost-effective for all adults and infants above 6 weeks of age. Confirmation of all positives by HPLC (the gold standard) remains essential.

iii. A population-based study conducted through ASHAs in public healthcare facilities and communities in association with RBSK program demonstrated a birth defect prevalence of 8.39 per 1000 live births in seven blocks of Palghar, Maharashtra.

iv. A study conducted to distinguish Premature Thelarche (PT) and Idiopathic Central Precocious Puberty (ICPP) revealed that Kisspeptin levels are higher in both groups as compared to controls.

Infertility

i. An animal model of male hypertension using Wistar rat was developed. Fertility assessment showed a significant reduction in the sperm count and an increase in abnormal sperm morphology in hypertensive animals.

ii. An AI-based tool was developed to predict the outcomes of assisted reproduction in men with Y chromosome microdeletion. The technology was transferred by Amity University.

iii. Genome wide epigenetic studies in male partners of idiopathic recurrent pregnancy loss cases (iRPL) highlighted the differentially methylated landscape of sperm genome compared to the fertile group.

Infections

i. HIV-infected individuals with both latent and active TB display a unique gut microbiome composition. Anti-HIV and anti-TB treatment leads to the restoration of alpha diversity in HIV infected individuals with latent TB, alongside normalization of the CD4:CD8 ratio. This highlights the potential for gut microbiome modulation strategies to enhance conventional treatments for better health outcomes.

ii. Robust humoral immune responses against SARS-CoV-2 were observed in cord blood, peripheral blood, and breast milk following childbirth in women vaccinated at least 2

years ago. This suggests the possibility of passing protective immunity to newborns, shielding them from SARS-CoV-2 infection despite no direct exposure to the virus. These findings have implications for future vaccination strategies for pregnant women and their newborns.

Cancers

i. Administration of G1, a GPER1 agonist in TRAMP (Transgenic adenocarcinoma of mouse prostate) mice, a model for prostate cancer, prevented the progression of HGPIN (High grade prostatic epithelial neoplasia) to carcinoma stage. GPER1 appears to play a protective role in prostate cancer.

6.3.2 ICMR-National Institute of Nutrition (ICMR-NIN), Hyderabad

i. Point-of-care digital hemoglobin analyzers were found to underestimate hemoglobin levels compared to autoanalyzer in pooled capillary blood samples. The bias was found to be age and gender specific.

ii. A simple Zinquin-based fluorometric method was developed to estimate serum zinc and zinc dialyzability, a surrogate marker of iron bioavailability from foods. This method is highly sensitive and requires lower sample volume.

iii. Exposure to Aflatoxin B1 was identified to decrease hepatic iron intake. This could have a major implication in understanding the anemia prevalence in India.

iv. A study has demonstrated that elevated expression of transcription factor WT1 in kidney cells (podocytes) in obesity settings leads to obesity-related CKD by employing two rodent models of obesity.

v. Aging and any age-related disorders (such as diabetes and obesity) were found to alter the composition and structure of the extracellular matrix (ECM) due to post-translational modifications such as advanced glycation end-products (AGEs) which can disrupt cell–matrix interactions. A novel and pathogenic role for AGEs was provided, particularly carboxymethyllysine (CML) modification of ECM leads to activation of fibroblasts and excessive production of the ECM, which opens new avenues for therapeutic interventions.

vi. Investigated dietary Zinc (Zn) deficiency on neurotrophic factors and proteostasis in the rat brain and found that it altered the ubiquitin-proteasome system and autophagy, increased gliosis, ER stress, and apoptosis in Zn-deficient rats. Zinc repletion for three weeks partially restored these alterations, indicating a decline in Zn concentrations below a critical threshold may trigger multiple mechanisms, leading to brain-cell apoptosis.

vii. Vitamin B12 supplementation in high fat high sucrose (HFHS)-fed mice attenuated the hyper homocysteinemia, alleviated ER stress and astrogliosis, and enhanced the neurotrophic factors expression. It also reduced neuronal cell death and age-associated anxiety-like behaviour.

viii. An ICSSR-funded study in urban Telangana found that college-going women perceive millets as healthy but few consume them due to reasons like family habits, unavailability, and taste preferences. Despite limited exposure to the International Year of Millets 2023 campaign, they noted increased awareness through social media and peer discussions, highlighting social media, peers, and educational institutions as key information sources.

ix. Data analyzed from preterm cord blood suggest that altered methylation of the leptin (LEP) gene may serve as an early biomarker for the risk of obesity for preterm neonates

x. In vivo data suggest a crucial link between early exposure to bisphenol and the possible long-term risks of the male reproductive system.

xi. In response to Aflatoxin B1 exposure, there is a clear difference in cellular energy production and the rate of glycolysis. Research found the role of UCP1 in AflatoxinB1 mediated Energy expenditure and the rate of glycolysis, happening in the human hepatoma cells. The role of UCP1 in such energy imbalance was identified.

EXTRAMURAL RESEARCH HIGHLIGHTS FOR THE YEAR 2023-2024

EXTRAMURAL RESEARCH HIGHLIGHTS FOR THE YEAR 2023-2024

Division	Grant Type	Number of Projects
Descriptive Research	Centers for Advanced Research (CAR)	3
	Mission Mode	1
	Intermediate Grant	5
	Small Grant and STI	141
Discovery Research	Small Grants	180
	Intermediate Grants	31
	Centers for Advanced Research (CAR)	7
Delivery Research	Small Grants	34
	Intermediate Grants	13
	Centers for Advanced Research (CAR)	5
Development Division	Small Grants	234
	Intermediate Grants	46
	Centers for Advanced Research (CAR)	26

Table 02: Extramural Research projects

Distribution of projects funded through Extramural Program (2023-24)

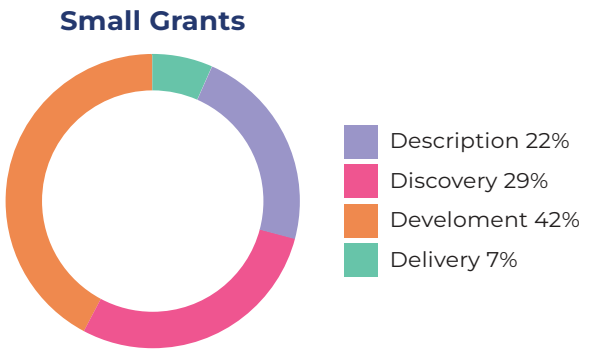


Figure 04: Distribution of small grant projects by extramural research types

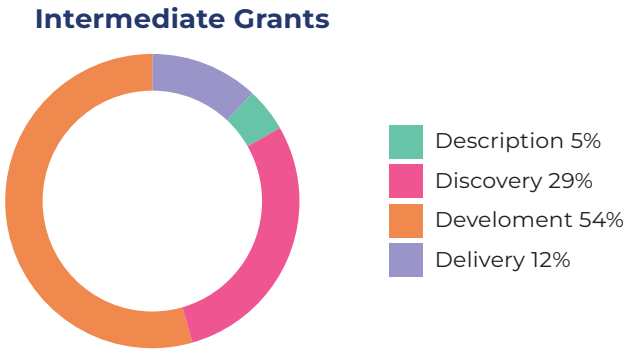


Figure 05: Distribution of intermediate projects by extramural research types

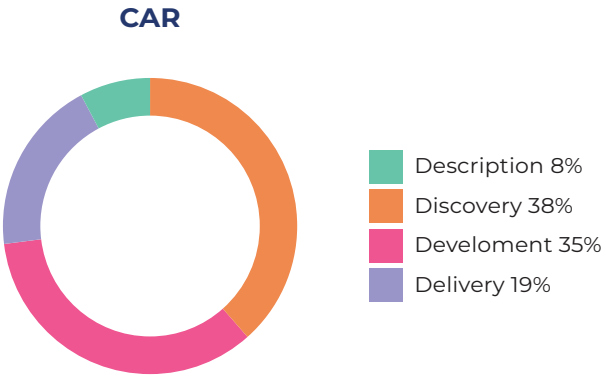


Figure 06: Distribution of CAR projects by extramural research types

1 Publications

A total of 1,809 publications resulted from the extramural research **with more than 50 articles published in journals with more than Impact Factor of 12**.

2 Patent and Technologies

Applications Filed

18 Indian patents | 3 Design | 5 Copyright

Patents Granted

10 Indian patents | 1 Foreign patent

2.1 Technologies:

- **Newborn Screening for Sickle Cell Disease (SCD):** Newborn Sickle Cell Screening Portal (NBSP); copyright registered.
- **Gastroenterology:** NutriCARE app developed under ICMR CAR project
- **ICMR-MDMS CLiMB Program:** Under this program, 13 technologies were developed.

2.2 Policies/Guidelines:

i. **ICMR-Guidelines for Technology Development Collaboration - 2024:**

- Revised and renamed from the Technology Transfer and Revenue Sharing Guideline (2021).
- Focus on royalty determination during strategic collaborations, including validation by ICMR, material transfer, grant-in-aid, extramural funding, and licensing.
- Approved by the EC and GC of ICMR

ii. **ICMR Guidelines for Utilization of Corporate Social Responsibility (CSR) Funds:** Aimed at utilizing industry donations for diagnostics, therapeutics, vaccines, and device development.

iii. **ICMR-Intellectual Property (IP) Policy:** Inventorship, ownership, licensing, collaboration, and revenue sharing have been standardized across ICMR institutes. Approved by the Governing Council (GC) and Executive Council (EC) of ICMR.

iv. **Addition of Assistive Products to the National List of Essential Medical Devices.**

v. **National Viral Hepatitis Control Program:** Contributions include finalizing technical specifications for equipment, kits, and drugs for the program.

vi. **Assessment of Cost-effectiveness of Mass Testing and Treatment (MTaT) for Malaria in Inaccessible Areas:** Operational feasibility and cost-effectiveness studies have been conducted and communicated for national adoption.

vii. **Protocol for Clinical Management of Febrile Illness Among Evacuees from Sudan:** Developed by an ICMR mission-mode group for managing febrile illnesses.

viii. **DHR Recommendation on PathoDetectTM:** Integration into the national TB diagnostic system approved

due to comparable performance with Truenat® for molecular detection.

ix. **The NLEAP initiative** supports the ADIP and RVY programs under the Ministry of Social Justice, scientifically shortlisting assistive products for national and hospital use.

x. Inputs for Integrative Health Research Chapter in the National Health Research Policy, 2020-23.

2.3 Expert Participation in National Policies/ Meetings:

i. Scientists have contributed to areas like National Oral Health Policy, National Mental Health Survey, Phase 2 Megacity Survey, and Technical Expert Groups on Cancer Disease Biology

ii. National Tobacco Control Program (NTTLs): Strengthening initiatives undertaken under NTTL labs

iii. Support for Ayushman Bharat Programs: Development of standard treatment workflows for Ayushman Arogya Mandirs and contributions to patient consent forms for medical photography

iv. Integrated Health Research for TB: Active and intensified case-finding strategies under the National Tuberculosis Elimination Program (NTEP)

v. Support to NLEAP: Assistance to ADIP and RVY schemes through scientific shortlisting of assistive products

vi. Development of Educational and Outreach Guidelines: IEC materials for community engagement developed under programs like Anant Muskaan

vii. Revised SOP for Foodborne Pathogen Surveillance: SOP updates to improve the surveillance network, particularly in North-East India

viii. Policy on Assistive Technology: Collaboration with MoHFW and stakeholders to develop and distribute assistive technology awareness materials

ix. Cancer Genomics and Diagnostics: Contributions to the Indian Cancer Genomic Atlas (ICGA) and efforts in molecular diagnostics

x. COVID-19 Impact Programs: Studies on vaccine acceptance, health systems resilience, and effects of vaccination across diverse communities

xi. Ayurvedic Clinical Trials and Public Health Integration: Joint efforts with AYUSH to promote integrative health practice

xii. Emergency and Disaster Management: Evidence-based rapid response during outbreaks like diarrheal diseases and initiatives for TB case finding

xiii. Support to Health Screening Programs: Screening projects for STIs and reproductive health improvements in underserved populations

CHAPTER 7
DESCRIPTIVE RESEARCH

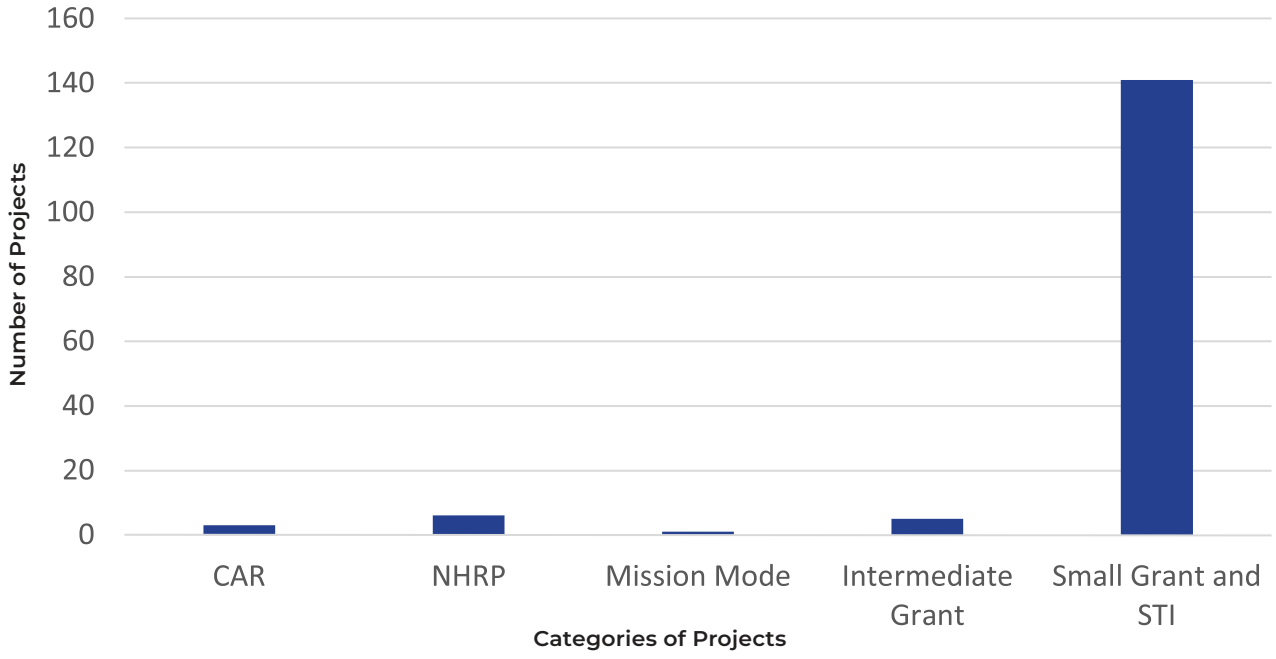
The Descriptive Division under ICMR Extramural Research plays a pivotal role in advancing scientific inquiry to address pressing public health challenges. The Division focuses on providing a deeper understanding of diseases, including their burden, risk factors, determinants, and pathogenesis. While research exploring disease mechanisms or pathogenesis is not a priority, funding is selectively extended to projects deemed critical by ICMR for driving practical solutions. This strategic approach ensures that resources are directed toward high-impact studies that align with national health priorities and contribute to addressing systemic gaps in healthcare access and equity.

To support its mission, the Division offers diverse funding opportunities through structured grants such as Investigator Initiated Research Proposals – Small and Intermediate Grants and Centers for Advanced Research (CAR). These grants empower researchers to innovate in areas including diagnostics, antimicrobial resistance, and public health interventions. The Division's efforts are further enhanced by multidisciplinary collaborations, ensuring that funded projects address critical issues with practical applications. By fostering research excellence and targeting solution-oriented outcomes, the Descriptive Division underscores its commitment to advancing healthcare through science and innovation.

RESEARCH ACTIVITIES

7.1 New Extramural Research Funding in FY 2023-24:

In 2023-24, new funding was approved for various categories of projects. The CAR category consisted of 3 projects, while the Mission Mode category had the smallest number, with 1 project. The Intermediate Grant category accounted for 5 projects and the largest category, Small Grant and STI, included 141 projects(F igure 07).



F igure 07: Number of Projects Across Categories

7.1.1 **Small Grants**: A total of 141 Small Grant projects spanned a diverse range of research areas, including Infectious Diseases (32 projects), Cancer Research (18 projects), Gut Microbiome and Metabolic Health (12 projects), and Neurological and Neurodegenerative Diseases (10 projects). The remaining projects were in other categories including diagnostics, chronic diseases, maternal and child health, public health, mental health, environmental health, and specialized research areas. The project distribution highlights significant investments in healthcare research, with a specific focus on antimicrobial resistance, cancer therapies, diagnostic innovations, and public health challenges(Figure 08).

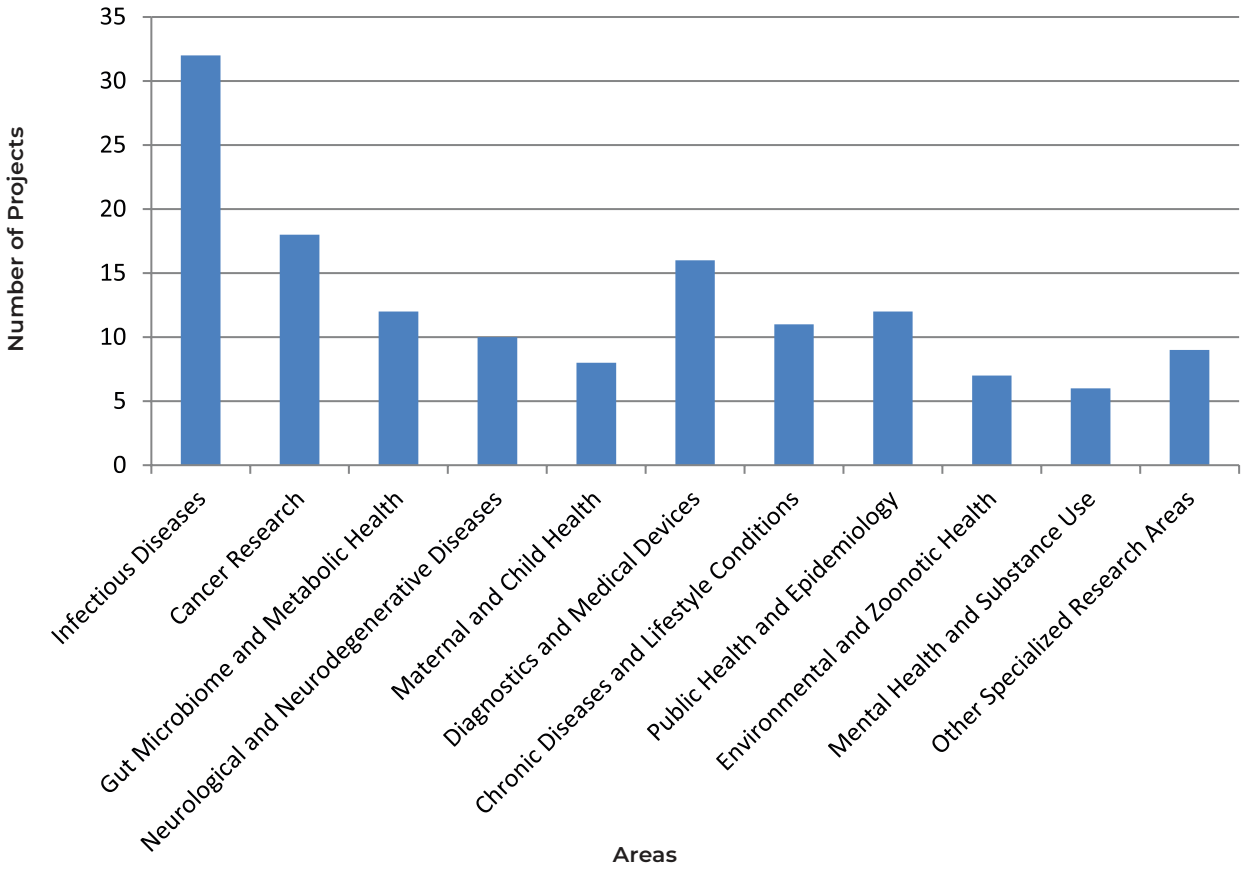


Figure 08: Number of projects across areas

7.1.2 **Intermediate Grants**: Five Intermediate Grant projects were funded in the year 2023-24. The grants covered diverse themes, including vaccination impact, air pollution effects, colorectal cancer screening, gestational diabetes, and gene-environment interactions

7.1.3 **Center for Advanced Research (CAR)**: Three projects were funded under the CAR initiative, namely, (a) CAR in Hospital acquired infection prevention and control, (b) CAR in Space Psychology for selection and training of Astronaut Designates and Astronauts, and (c) CAR in National Reference Centre for Rickettsial Diseases under the Centre for Advanced Research (CAR) initiative were funded in the year 2023-24.

7.2 Ongoing Research Funding from the previous year (FY 2022-23) and research activities:

During the year 2022-23, significant research funding was allocated to various projects

and initiatives across India. A total of 10 Task Force projects and 43 Ad Hoc projects were undertaken. In addition, funding was provided for 24 fellowships, 26 Ad Hoc projects, and 11 multi-centric Task Force projects. CAR initiatives were also supported in different parts of the country, emphasizing the widespread commitment to advancing research activities.

7.3 Initiatives of National Importance

7.3.1 Antimicrobial Resistance Initiative of ICMR

ICMR has an Anti Microbial Resistance Surveillance Network (AMRSN) to enable compilation of data of AMR from tertiary care hospitals, develop a detailed understanding of underlying mechanisms of resistance and conduct genetic molecular studies. Six nodal centres focus on six pathogenic groups:

- Diarrhoeagenic bacterial organisms: CMC, Vellore
- Enteric fever pathogens: AIIMS, New Delhi
- Enterobacteriaceae causing sepsis: PGIMER, Chandigarh
- Gram-negative Non-fermenters: CMC, Vellore
- Gram positives including MRSA: JIPMER, Pondicherry
- Fungal infections: PGIMER, Chandigarh.

There are 16 regional centres and all follow the same SOPs of bacteriology and mycology. Since 2018, ICMR has been publishing annual reports on AMR trends and patterns, including isolation and susceptibility information for various pathogenic groups. These reports highlight trends in resistance of key pathogens to critically important antimicrobials, providing guidance for prevention and treatment interventions for AMR in the country. Additionally, the interpretation of antibiograms from OPD/Ward/ICU is crucial for assessing the impact of AMR and its implications in clinical practice for empirical use of antibiotics.

ICMR's Antibiotic Stewardship Program (AMSP) is being implemented in network hospitals, where the impact of AMR interventions is being studied. All hospitals that are part of this network have developed antibiogram-based hospital antibiotic policy and monitor appropriateness of AMR prescriptions in their respective hospitals. This initiative also helps optimize antimicrobial selection (i.e. drug, dose and duration), monitor time to switch antibiotics from IV to oral, and reduce adverse drug events (i.e. morbidity and mortality). The AMSP data on length of stay and treatment costs for drug-resistant infections contribute to evaluating the success of AMS interventions, identifying areas for improvement in hospitals. This initiative is now being expanded to include secondary hospitals.

CMR has partnered with the Global Antibiotic Research and Development Partnership (GARDP) through a Memorandum of Understanding (MoU) to strengthen research in antimicrobial resistance especially collaborate on research and development opportunities, including clinical trials, epidemiological, observational and interventional studies, to facilitate the development of new treatments and their registration for use with priority populations. An observational study entitled "A site feasibility and prospective cohort study of hospitalized adults and children with serious bacterial infection caused by Carbapenem-Resistant Organisms, with focus on Enterobacterales and/or Pseudomonas aeruginosa: an Observational Study" was initiated in five hospitals in the country.

7.3.2 AMR Diagnostics

Diagnostics play a crucial role in promoting evidence-based antibiotic use and facilitating de-escalation, which is key to limiting the spread of antimicrobial resistance. To advance the research and development of indigenous rapid point-of-care tests (POCT), a dedicated task force project has been established to validate Indian diagnostic tools. Rapid POCTs are particularly important for conditions such as sepsis, urinary tract infections (UTIs), typhoid, and respiratory infections, where antibiotic misuse is prevalent.

The indigenous POCT for UTIs was evaluated

against conventional urine culture and sensitivity methods to assess its potential for use in peripheral healthcare settings. The Rapidogram test kit, which targets UTIs caused by Gram-negative bacteria, demonstrated high specificity, sensitivity, and accuracy, making it suitable for primary and secondary healthcare facilities. Conversely, the POCT for sepsis, validated with salivary samples from asymptomatic neonates at risk for early-onset sepsis (EOS), showed lower specificity and sensitivity.

Disease-specific Target Product Profiles (TPPs) for sepsis and typhoid have been developed to assist innovators and developers through this process. TPPs have helped develop effective diagnostics and can be adapted for similar contexts in other countries. Notably, the published TPP for sepsis has gained international adoption. Furthermore, cost-effectiveness studies have also been conducted for these diagnostics, confirming their feasibility before integration into national health programs.

7.3.3 ICMR's i-DRONE Initiative

ICMR launched the 'i-DRONE' initiative (ICMR's Drone Response and Outreach for North East) in 2021 to assess the feasibility of using drones to deliver vaccines and medical supplies in hard-to-reach areas of North East India (Manipur & Nagaland). This was carried out in various difficult geographical terrains including land, islands, foothills, and hills to explore different case scenarios. With the successful execution of the study, this initiative has now expanded the horizons in different health case scenarios and parts of India such as Himachal Pradesh (medical essentials delivery at 10000ft+ high altitude and sub-zero degree temperatures), Telangana (delivering the TB sputum samples from primary health care centres to district TU units), Karnataka (delivering the intra-operative pathological samples from peripheral hospitals to tertiary care hospitals), Delhi NCR (exploring the feasibility of using drones for transportation of Blood bags and its products), Delhi NCR (exploring the use of drones for cornea transportation) etc.

Under the i-DRONE initiative, drones have travelled for 130 hours, connecting 65 Healthcare centers, covering a distance of 7700 kms and delivering 22000 units of medical essentials. Furthermore, various guidance documents and training modules for drone operations have been released periodically for healthcare deliveries. With India's existing drone regulations, i-DRONE continues to explore how drones can bridge healthcare gaps, providing an efficient solution to access critical resources in remote areas.

7.3.4 ICMR's Mission Mode Initiative on Comprehensive Preconception Care Services to Young Couples

In 2023, ICMR initiated a mission mode project with an aim to assess the feasibility, acceptability, and cost of delivering Pre-Conception Care (PCC) in diverse settings, including tribal, rural, urban slum, and non-slum areas. The project functions under the "Vatsalya - Healthy Parent, Healthy Child" initiative in collaboration with Maharashtra's Department of Public Health and Family Welfare and the Ministry of Health and Family Welfare. The initiative focuses on delivering PCC as a preventive measure to improve maternal and infant health. These interventions are aimed to address various health risks — diabetes, anemia, STIs, genetic disorders, and lifestyle factors—critical for promoting safe motherhood and healthy births.

Initial studies in Nashik district demonstrated improved health outcomes, such as reductions in low birth weight and anemia. However, further evaluation is needed to evaluate PCC's broader impact on factors like contraceptive use, infertility, non-communicable diseases, and addictions. Despite its importance, PCC lacks dedicated services in the national health program. Therefore, this expanded study is aimed to inform a scalable service delivery model tailored to India's varied populations, offering insights into the challenges, benefits, and costs associated and finally, informing policy for implementing PCC measures.

CHAPTER 8
DISCOVERY RESEARCH

Discovery Research forms the foundation of scientific innovation, focusing on uncovering novel interventions and advancing basic research to address critical health challenges. In the past year, the Discovery Research Division of ICMR made significant progress in discovery research, particularly through projects that emphasize pre-clinical and phase-I studies, including phyto-pharmaceuticals and traditional medicines. Additionally, the research encompasses the development and application of genomic methods, algorithms, and tools tailored to personalized medicine.

By fostering investigator-initiated grants and collaborative efforts, ICMR aims to push the boundaries of translational and fundamental science. The focus spans diverse domains, such as therapeutic formulations derived from traditional knowledge, cutting-edge genomics, and tools for precision medicine. Through these initiatives, ICMR continues to pave the way for innovative and sustainable solutions that integrate modern science with India's rich heritage of traditional healthcare practices. This commitment is reflected in the range of small, intermediate, and advanced research grants that drive discovery across the biomedical landscape (Table no. 3).

8.1 New Projects in FY 2023-24:

Category	Priority Area	Number of Projects
Small Grants	Discovery Research	161
Small Grants	Rare Disease Therapeutics	19
Intermediate Grants	Discovery Research	28
Intermediate Grants	Omics in Health & Disease	3
Centers for Advanced Research (CAR)	Discovery Research	7

Table No. 3: New Projects in FY 2023-24

The Small Grants category dominated in both scope and quantity, with 161 projects focused on Discovery Research. These projects emphasized foundational and exploratory studies across a wide range of biomedical disciplines. Additionally, 19 projects under this category targeted Rare Disease Therapeutics, highlighting the growing attention to niche, underexplored conditions with significant therapeutic needs.

The Intermediate Grants category, though smaller in number, represents a more targeted approach. It included 28 projects in Discovery Research, indicating sustained interest in advancing basic biomedical research with intermediate funding. Furthermore, 3 projects under the Omics in Health & Disease highlighted the importance of applying high-throughput omics technologies to unravel complex biological processes and their implications for health and disease. Lastly, the Centers for Advanced Research (CAR) featured 7 projects dedicated to Discovery Research. These involved larger-scale, multidisciplinary collaborations aimed at tackling complex scientific questions or translational goals (Figure 09).

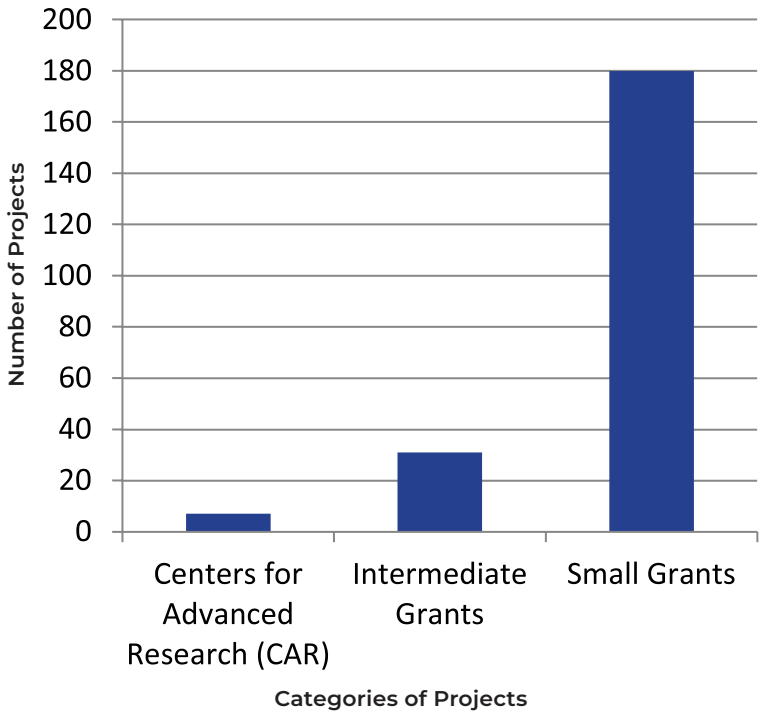


Figure 09: Funding for Projects in FY 2023-24

8.2 Small Grant Projects:

Small Grants comprise 161 projects spanning a wide range of biomedical research areas. Many of these projects focused on cancer research, with an emphasis on development of novel therapies such as photothermal nanoparticles for non-invasive tumour ablation in oral cancer, ERR-γ targeting and combined inhibitor therapies for lung cancer, and the exploration of docetaxel-loaded HSP70 peptide complexes in pre-clinical models. Additional studies investigated mechanisms like TGFß-1 in cervical cancer, DNA methylation regulation in breast cancer, and novel biomarkers for ß-hCG positive breast cancers.

Projects related to neurological and neurodegenerative disorders included investigations into hippocampal neuron inhibition for aging-related memory deficits, the therapeutic potential of natural small molecules for epilepsy, and innovative treatments for Alzheimer's disease, such as GSK3-ß inhibitors and mitochondrial pathway targeting. Other studies explored biomarkers and therapeutic targets for Parkinson's disease and the role of neurosteroids in cognitive function.

In the area of infectious diseases and antimicrobial resistance (AMR), research addressed the development of new antimicrobial agents, such as cyclic lipopeptides against Mucorales and beta-lactamase inhibitors for drug-resistant bacteria. Studies also included diagnostics, such as genome-based surveillance of Mycobacterium leprae, and drug design targeting tuberculosis and multidrug-resistant pathogens.

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Cardiovascular and metabolic disorders were another significant area of study. Studies explored natriuretic peptides in hypertensive heart disease, leptin signaling in macrophage

activity, and biomarkers for coronary artery disease. Research into diabetes investigates novel interventions for diabetic kidney disease, non-alcoholic fatty liver disease, and diabetic retinopathy.

In regenerative medicine and tissue engineering, projects included the development of bioactive nanofibrous conduits for spinal cord injury treatment, bone regeneration using Moringa Oleifera nanoparticles, and engineered chitosan sheets for burn injuries. Nanotechnology featured prominently, with applications in drug delivery, tissue engineering, and innovative therapies like 3D-printed sublingual patches for insulin delivery.

Genomics and epigenetics were central to projects investigating genome-wide association studies in tuberculosis and cancer, epigenetic aging in coronary artery disease, and the regulation of methylation in Alzheimer's disease. Multi-omics approaches were employed for biomarker discovery in non-small cell lung cancer and metabolic diseases.

Drug discovery and delivery projects included a virtual screening of inhibitors for Alzheimer's therapy, siRNA-loaded nanoparticles for epilepsy, and synthetic drug candidates for visceral leishmaniasis. Studies also explore the efficacy of nanomedicine, including aptamer-based nanoformulations for anemia and multifunctional hydrogels for antimicrobial resistance.

Research in immunology and inflammatory diseases focused on extracellular vesicle-based drug delivery, immune checkpoint blockade in cancer therapy, and targeting inflammatory pathways in neurodegenerative and autoimmune conditions. Pediatric and developmental studies focused on genetic markers for kidney disease and non-invasive diagnostic methods for neonatal disorders.

In addition, a special category in the Small Grants included 19 projects focused on Rare Disease Therapeutics. These focused on developing diagnostic markers, cost-effective indigenous therapies, and the promotion of in-house production of treatments like enzyme replacement therapies. Key research areas included drug repurposing, biosimilar development, and novel approaches such as synthetic molecules, stem cells, and gene therapies. These initiatives aimed to reduce treatment costs, improve accessibility, and drive innovation in rare disease diagnosis and management.

8.3 Intermediate Grants:

The Intermediate Grants projects encompassed a wide range of advanced research areas, with a strong emphasis on cancer, metabolic disorders, infectious diseases, and innovative therapeutic strategies. In cancer research, projects investigated targets like NUAK/MARK isoforms and nitric oxide signalling in oral and colon cancer, CDK7/Cyclin H/MAT1 inhibitors for triple-negative breast cancer, and squaramide-based IL-8R inhibitors for metastatic oral squamous cell carcinoma. Additional studies focused on cutting-edge therapies, including CAR T cells for CD20(+) malignancies and nanomedicine for precision drug delivery.

For metabolic disorders, novel approaches included TRPM8-mediated pharmacological cold mimicking for diabesity and neuropeptide Y1 receptor targeting for liver fibrosis. Infectious disease research includes host-directed therapies for tuberculosis, the development of anti-viral IRGM inhibitors, and multi-target antimalarials.

Projects also featured innovative diagnostics and drug delivery systems prominently, such as miRNA-based biosensors for oral cancer detection, rapid field-deployable diagnostics for meningitis and sepsis, and peptide-polymer hydrogels for cataract therapy. Research was conducted on natural product-based therapies for the treatment of Parkinson's disease, osteoporosis, and ulcerative colitis. Multi-omics analysis and advanced modelling, such as brain-specific studies for depression, enhanced precision in therapeutic targeting.

These projects underscored a focus on translational research, integrating innovative technologies and therapeutic approaches to address complex biomedical challenges.

8.4 Centers for Advanced Research (CAR) Grant

CAR projects were dedicated to the establishment of bone marrow transplantation for children and adults addressing haematological malignancies, relapsed/ refractory Acute Lymphoblastic Leukemia (ALL), and bone marrow failure syndrome. Other key areas of focus included gut microbiome manipulation therapies for intestinal disease, normative baseline characterization of body composition and metabolic parameters to assess growth and development in children. Projects also emphasized the rapid development of host-directed broad antivirals, mechanisms of resistance in leukemia and strategies to overcome. Further research concentrated on discovery and development of therapeutic interventions against multidrug-resistant bacterial pathogens and Consortia for vaccine candidates' development against arboviruses have been supported.

8.5 Initiatives of National Importance:

8.5.1 Collaboration with the Ministry of AYUSH

Collaborations between ICMR and the Ministry of AYUSH were formalized through an MoU signed on 11th May 2023, with the objective of promoting and developing cooperation in integrative health research. This partnership is leading to the establishment of the AYUSH-ICMR Advanced Centre for Integrative Health Research, which aims to advance integrative health care by combining the AYUSH system, conventional biomedicine, and modern technology.

The center focuses on improving patient outcomes through innovative diagnostics, prevention, health promotion, and treatment approaches. Its objectives include fostering collaboration between traditional and modern medical systems, identifying priority areas for integrative research, developing evidence-based management protocols, conducting mechanistic studies, and creating guidelines for cross-referrals in integrative medicine. The centers have been set up at AIIMS Delhi (focused on gastro-intestinal disorders and women and child health), AIIMS Jodhpur (geriatric health), AIIMS Nagpur (cancer care), and AIIMS Rishikesh (geriatric health).

8.5.2 National Task Force Projects on Medicinal Plants

The Division spearheaded several National Task Force projects, aimed at advancing research into medicinal plants. A National Task Force project was launched to develop a phytopharmaceutical formulation from trigonella-foenum graecum seeds (PDP-117), aimed at preventing or delaying the onset of type-2 diabetes in subjects with pre-diabetes. After completion of pre-clinical and regulatory toxicity study on the developed product (PDP-117 Tablets) and IND approval of Phytopharmaceutical drug from CDSCO, a Phase I randomized, double-blind, placebo-controlled trial was completed. This trial evaluated the safety, tolerability, pharmacokinetics, and pharmacodynamics of the formulation, marking an important step in its development.

Another National Task Force project focused on developing standardized medicinal plants formulation of Nardostachys jatamansi and Withania somnifera roots (Polyherbal SDA-217) for the treatment of sleep disorders. After preclinical studies confirmed the safety and efficacy of the polyherbal product (SDA-217 capsules) in animals, a multicenter, randomized, double-blind clinical trial was conducted in patients with chronic insomnia at 4 centers across the country.

Lastly, a National Task Force project was undertaken to compile a knowledge database on Indian medicinal plants. The program sought to consolidate scattered scientific research on these plants into a comprehensive, accessible resource. As part of this effort, two monographs titled Reviews on Indian Medicinal Plants were published covering 108 genera and 321 species. These volumes provide valuable multidisciplinary insights into the medicinal properties of plants.

1. Reviews on Indian Medicinal Plants. 2023. Vol 28 (Ta-Th). Indian Council of Medical

Research, New Delhi. pp. 1-1254.

2. Reviews on Indian Medicinal Plants. 2023. Vol 29 (Ti-Ty). Indian Council of Medical Research, New Delhi. pp. 1-1157.

   As part of this effort, two monographs titled Reviews on Indian Medicinal Plants were published covering 108 genera and 321 species. These volumes provide valuable multidisciplinary insights into the medicinal properties of plants.

8.5.3 Gene Therapy/Gene Editing

The Division supported gene therapy and gene editing through eight studies, each conducted at multiple centers. These studies aimed to evaluate gene therapy as a treatment option not only for inherited and rare diseases but also for multifactorial conditions like cancer. Key areas of focus included non-viral vectors for gene transfer and assessment of efficacy in cellular models, gene editing with CRISPR/Cas9 in rat hepatocytes, population-based screening of immunological memory related to Adeno-Associated Virus (AAV) vectors in an Indian cohort. These studies highlighted the direct clinical relevance for gene therapy applications, editing of Atoh1 for the regeneration of auditory cells and retargeting lentiviral integration into heterochromatin for safer gene therapy applications.

In the area, ICMR supported and funded a collaborative effort of IIT Bombay and TMC Mumbai for capacity building and a phase I multicentre clinical trial of Indigenous anti-CD19 CAR T cell therapy for adolescent and adult patients with relapsed/refractory B-cell malignancies. The resulting product, NexCAR19 CAR-T therapy, was launched by the Hon'ble President of India, Smt. Droupadi Murmu. Additionally, the Division supported the development of India's first decentralized manufacturing process for anti-CD19-CAR-T cells using a fully automated closed system (Miltenyi CliniMACS Prodigy®) that is feasible in an academic setting for the treatment of relapsed and refractory B cell acute leukemia and lymphoma.

8.5.4 Guidelines

The Division raised awareness about various aspects of umbilical cord blood collection and storage for therapeutic purposes. To support this effort, comprehensive guidelines were published, covering all aspects of collection, processing, testing, storage, banking, and release for clinical applications.

To further advance stem cell therapy, 26 systematic reviews were funded across a range of priority disease conditions, including Osteoarthritis, Tendinopathy, Avascular Necrosis, Cartilage defect, Meniscopathies, Nonunion of bone, Multiple Sclerosis, Spinal Cord Injury, Spinal Cord Injury, Amyotrophic Lateral Sclerosis, Stroke, Retinitis pigmentosa, Corneal surface defects, Macular Degeneration, Dilated Cardiomyopathy, Chronic Wounds, Critical Limb Ischemia, Cerebral Palsy, Autism Spectrum Disorder, Osteogenesis imperfect, Bronchopulmonary dysplasia, Hypoxic Ischemic Encephalopathy, Muscular Dystrophy, Spinal Muscular Atrophy, Acute Respiratory Distress Syndrome, Skin rejuvenation, Diabetes, Liver Cirrhosis. These evidence-based guidelines aimed to support the development of stem cell therapy protocols and provided critical insights into treatment for various human diseases.

CHAPTER 9
DEVELOPMENT RESEARCH

The Development Research Division for Extramural Grants focuses on advancing investigator- and innovator-initiated research to create innovative interventions for screening, diagnosis, prevention, and treatment of various diseases and conditions. This research aims to enhance the efficacy, safety, affordability, and accessibility of existing and new healthcare solutions. Core areas of this Division include developing point-of-care diagnostic tests, molecular diagnostics, disease-specific animal models, optimized dosages and formulations, as well as artificial intelligence, machine learning tools for predictive modeling. The Division also conducts regulation-compliant first in human safety trials and advanced clinical trials for vaccines and therapeutics. Through these initiatives, the Division seeks to bridge gaps in development of medical technology, improve public health outcomes, and make impactful contributions to the healthcare sector.

9.1 New Projects

9.1.1 Small Grants:

The Division awarded a total of 234 Small Grants, driving innovation across key health research domains such as Reproductive and Child Health, Nutrition, Mental Health, Communicable Diseases, Non-Communicable Diseases, Oncology and the Safe and Rational Use of Medicines.

9.1.2 Intermediate Grants

in the past year, the Division awarded 54 projects under Intermediate Grants to support innovation across critical health research domains, with a focus on cross-disciplinary collaboration and solutions to complex medical challenges. Key areas of emphasis included Medicine, Pediatrics, Pulmonology, Tuberculosis, Communicable Diseases, and Non-Communicable Diseases such as Diabetes, Cardiovascular Disease, and Gastrointestinal Disorders. Oncology and the integration of Artificial Intelligence further demonstrated a commitment to advancing healthcare and addressing pressing needs. Additionally, efforts also concentrated on Clinical Trials, Intervention Studies, Antimicrobial Resistance (AMR), One Health, and Reproductive, Child Health, and Nutrition highlighted efforts to enhance intervention effectiveness and tackle urgent public health issues. This strategic allocation of resources underscores a focus on fostering impactful and innovative solutions.

9.1.3 Centers for Advanced Research (CAR)

The CAR initiative supported 12 projects across critical health research, prioritizing key areas such as medical devices and diagnostics, and implementation of national health programmes, reflecting their significant impact on nationwide healthcare access and innovation. Specialized areas included oncology, neuromuscular genetic disorders, foundational and translational research in antimicrobial resistance (AMR) and TB, intestinal and pancreatic diseases, and early-phase clinical trials through a dedicated Phase I Clinical Trial Network(Figure 10).

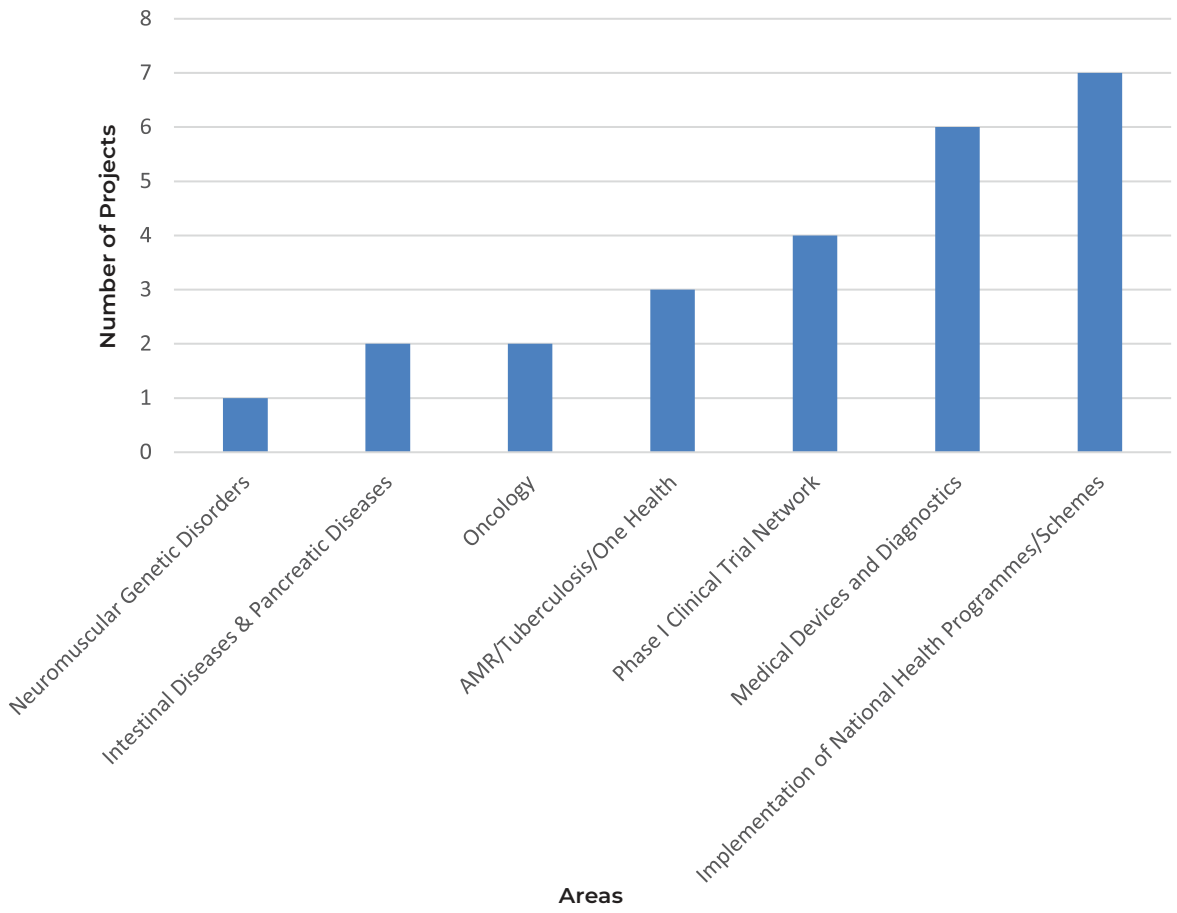


Figure 10: Distribution of Projects Across Centers for Advanced Research (CAR)

9.2 Ongoing Projects

There are currently 663 ongoing research projects (Adhoc and Task Force) and Fellowships focus on key priority areas, including Oral Health, Gastroenterology, Communicable and Non-Communicable Diseases, Foodborne Pathogens, Mycosis, Mycology, Health System-Based Interventions to improve access to medical devices and diagnostics, Covid-19, and Oncology.

9.3 Initiatives of National Importance in FY 2023-24:

i. Medtech Mitra Initiative: A joint initiative by NITI Aayog, ICMR, and CDSCO, the Medtech Mitra initiative provides regulatory, clinical, and market access support to Medtech innovators. Key activities included two workshops, twelve Technology Advisory Committee meetings, twenty-one mentoring sessions, the processing of 158 applications, addressing 182 queries, and providing support to 118 technologies across various areas.

ii. Strategic IP and Techno-Legal Management Systems Development: This initiative focused on technology transfer, policy drafting, and the creation of an online IP Management Portal. The division evaluated 22 technologies, processed Expressions of Interest (EOIs) for multiple diagnostic assays, and drafted standard agreements to facilitate innovation.

iii. ICMR-DHR-mPRAGATI under PM-ABHIM: A national facility was established at IIT Delhi for the design, fabrication, pilot batch manufacturing, and testing of medical devices and diagnostics. Key achievements include an ISO-certified fabrication facility, the installation of 25 pieces of equipment, the development of 9 medical technologies, and two training

sessions for 100 students.

iv. ICMR-CCRAS Clinical Trial on Nutritional anemia: ICMR and CCRAS developed a joint proposal for a clinical trial on nutritional anemia, which was initiated in March 2024.

v. ICMR-MDMS CLiMB Program: This collaborative initiative between medical and engineering institutes trains multidisciplinary teams to develop medical devices and diagnostics. Achievements include the development of 13 technologies, the training of 25 fellows, the organization of 22 workshops, filing of 3 intellectual property rights (IPs), and the formation of 7 start-ups.

vi. Product Ignition and Development Enabler (mPRiDE): The mPRiDE initiative accelerates medical device development and commercialization by providing funding up to Rs. 1.5 crores for 18 months per project. Six projects are currently being supported under this program.

vii. Indian Clinical Trial and Education Network (INTENT): he Indian Clinical Trial and Education Network (INTENT), a flagship program of ICMR coordinated by the Clinical Studies and Trials Unit (CSTU), aims to establish a robust ecosystem for high-quality, multicentric, and regulation-compliant clinical trials. Its research priorities align with India's National Health Agenda, focusing on Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCHA), communicable and non-communicable diseases, nutrition, mental health, environmental and occupational health, digital health, healthcare financing, and the health of vulnerable populations. The program accelerates the development of diagnostics, therapeutics, and preventive interventions tailored to India's healthcare needs. INTENT emphasizes capacity building through education and training for clinical researchers and trial managers, fostering collaboration among government agencies, academia, industry, and international organizations. The network currently includes 75 institutions, comprising public and private medical colleges, hospitals, research institutes, and ICMR centers. As part of the MedTech Mitra Initiative, INTENT plays a crucial role in supporting clinical trials and validating indigenous medical technologies. By January 2024, INTENT had received ₹30 crores in funding and had over eight clinical trials in advanced stages of development.

viii. ICMR Network for Phase I Clinical Trials: ICMR established the Phase I Clinical Trial Network to address the need for infrastructure supporting early-phase clinical trials, with two core objectives: strengthening Phase I clinical trial capabilities and funding priority leads aligned with national health priorities. To achieve this, four centers with advanced Phase I capabilities were identified: ACTREC in Navi Mumbai, KEMH and GSMC in Mumbai, PGIMER in Chandigarh, and SRM MCH and RC in Chennai. These centers play a key role in enhancing the network's capacity to conduct high-quality early-phase trials that align with national health priorities.

ix. ICMR National Task Force on Safe and Rational Use of Medicines (SRUM): ICMR initiated the SRUM network to develop and evaluate interventions aimed at improving medicine use and safety in India. The objectives of the network include the development of technology-based, educational, and policy interventions for the safe and rational use of drugs, conducting feasibility and scalability studies to facilitate adoption by Indian health systems, and building capacity for researchers through targeted training programs. Over 800 proposals were reviewed, resulting in 24 prioritized topics and 8 funded projects, which aim to address key challenges in ensuring the rational use of medicines across the country.

9.4 Achievements of completed/ongoing research works:

i. Development of a priority list of infectious diseases targeted for elimination, along

with their associated risk factors under C3-DESH component of PM-ABHIM at ICMR-NITVAR Pune. This list was approved by the Independent Verification Agency.

ii. Development of mouse monoclonal antibodies against Nipah virus.

iii. Conducted a multicentric task force project on "Surveillance of food borne pathogens in North-east India", identifying eight clinically significant, enteric pathogens, potential to cause food borne outbreak from environment, food, human and outbreak samples which is crucial evidence for food safety measures and to reduce risk of outbreaks. Notably, three new bacterial strains were identified for the first time in India, with the potential to cause outbreaks: i) new drug resistance strain of Salmonella serovars (Takoradi, Tananarive and Uganda) (which is resistant to Azithromycin, commonly prescribed in India for salmonella infection), ii) Shigella dysentery Type I, which had vanished 14 years ago globally, iii) Diarrheagenic strains of Proteous mirabelis, previously considered commensals.

iv. Investigated 15 acute diarrheal disease outbreaks, identifying the source and pathogens in seven cases. these findings helped to contain these outbreaks quickly. Reports were communicated to the IDSP and state health authority for corrective measures. An AMR report was sent to clinicians, ensuring the correct antibiotics were prescribed, which helped save lives, particularly among children who are more vulnerable during outbreaks.

v. The project "ICMR MycoNet Inpatient Clinical Registry: Establishment of an Analytics Platform" identified 659 hidden fatal cases of Invasive Fungal Infections (IFI) and 61 cases of eumycetoma and Chromoblastomycosis, rare fungal diseases. This finding provided strong evidence of the widespread nature of these deadly fungal infections in ICUs. Hotspots for rare fungal diseases were identified and are now targeted for elimination. Real-time data from the registry allowed for the timely introduction of appropriate antifungal treatment, saving lives from untimely death due to IFI and preventing disability or amputation in RFD cases.

vi. ICMR identified new drug-resistant fungal strains causing mycetoma (Madurella fahalii) and Chromoblastomycosis (Fonsecaea nubica and F. monophora), keratitis (Phaeoacremonium fuscum, Neodeightonia subglobosa, A. rasikaravidrae), and dermal infections (Phaeohyphomycosis, R. rufulum) — a first-time identification in Tamil Nadu.

vii. Through another task force project, "Risk Factors for Covid-Associated Mucormycosis in India: A Case-Control Investigation," key risk factors for post-Covid mucormycosis (CAM) were identified, including uncontrolled diabetes mellitus, prolonged dust exposure, use of ventilator support, and routine steroid administration. The findings were instrumental in quickly controlling the emergency situation, and the evidence gathered has been published.

CHAPTER 10
DELIVERY RESEARCH

The Delivery Research Division focuses on advancing health interventions by addressing critical barriers to their delivery. The Division's work prioritizes improving access, implementing national health programs effectively, and ensuring equitable healthcare distribution. It focuses on applying research in real-world settings to identify and resolve challenges in healthcare delivery systems. By supporting innovative, evidence-based strategies, the Division seeks to expand the reach and quality of healthcare services, reduce disparities, and integrate interventions into national and regional programs. Through its commitment to impactful research, the Division plays a pivotal role in strengthening public health outcomes and healthcare systems.

10.1 New Funding in 2023-24

In the past year, the Division awarded a total of 34 Small Grants, 13 Intermediate Grants, and 5 CAR. This reflects a commitment to advancing critical research areas through a range of research projects, from early-stage or pilot studies to cutting-edge, specialized investigations (Figure 11).

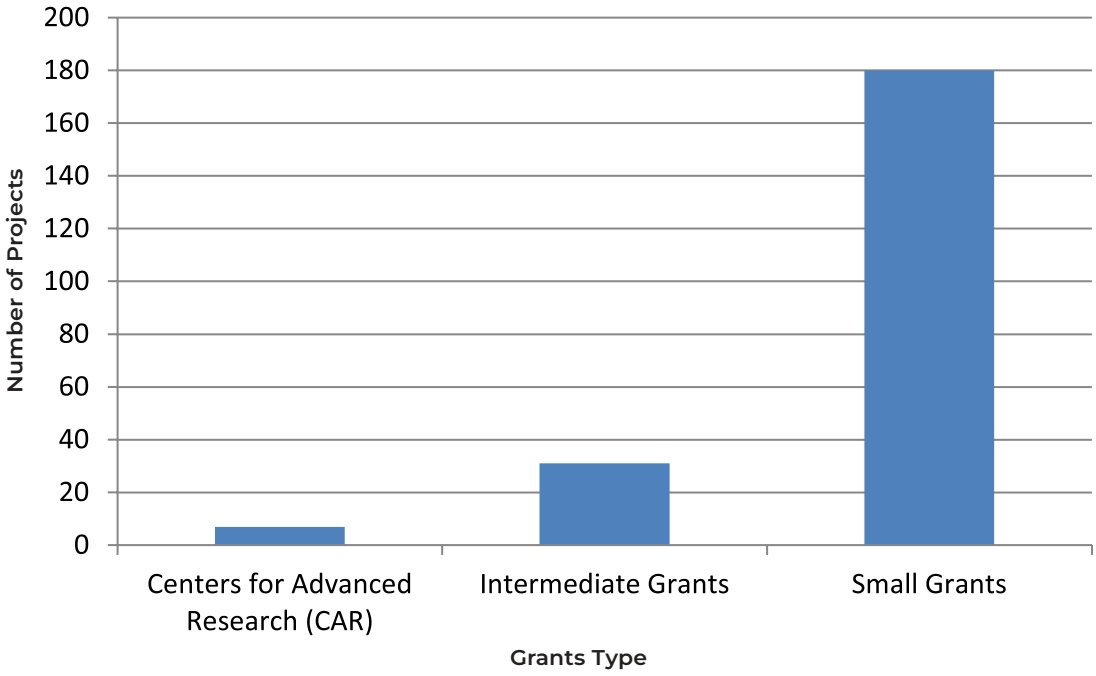


Figure 11: Distribution of Grants by Type

10.1.1 Small Grants

The Small Grants in the FY 2023-24 initiated 34 projects across 16 priority areas. Key focuses include Child and Maternal Health, Mental Health, and Nutrition. Additionally, it also includes other areas such as Cardiovascular Health, Diabetes, Tuberculosis (TB), Oncology, and Reproductive Health (Figure 12).

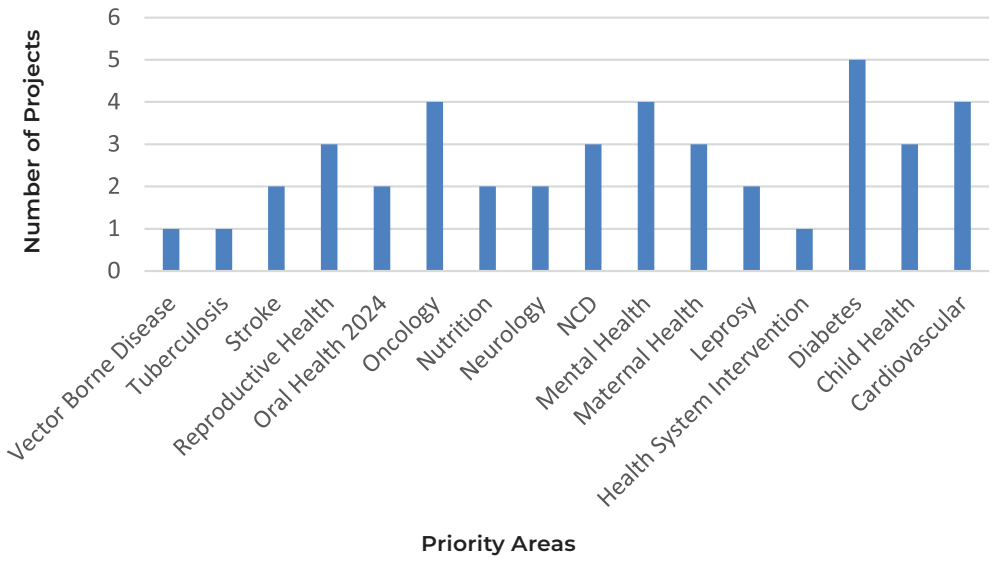


Figure 12: Number of Projects by Priority Areas

10.1.2 Intermediate Grants

The Intermediate Grants consisted of 11 projects that emphasized research in critical areas of healthcare to address diverse national health priorities. It supported advancements in oral health, oncology, obstetrics, infectious diseases, neurology, antimicrobial stewardship parasitology, and gerontology. This comprehensive approach promoted innovation and progress in healthcare delivery, addressing a wide range of health challenges.

10.1.3 Centers for Advanced Research (CAR)

Five high-impact projects were funded under the CAR program, focusing on neonatal mortality, ambulatory care, digital health solutions, and mental health. These centers are designed to serve as hubs of innovation, delivering cutting-edge research outputs and advanced training opportunities.

10.2 Ongoing Projects funding:

Ongoing funding for projects reflected a strategic commitment to advancing health research in critical and diverse areas. The Grantathon initiatives, comprising 21 projects, focused primarily on mental health, aiming to develop scalable and innovative solutions to address the rising mental health burden. Similarly, the National Task Force (NTF) supported 19 projects, with a major focus on mental health and nephrology, emphasizing targeted efforts to address chronic and pressing health concerns through structured nationwide research. The Mission Mode projects, though fewer in number (4), were designed to deliver transformative outcomes in high-priority areas like mental health, demonstrating an emphasis on swiftly and effectively addressing complex challenges (Figure 13).

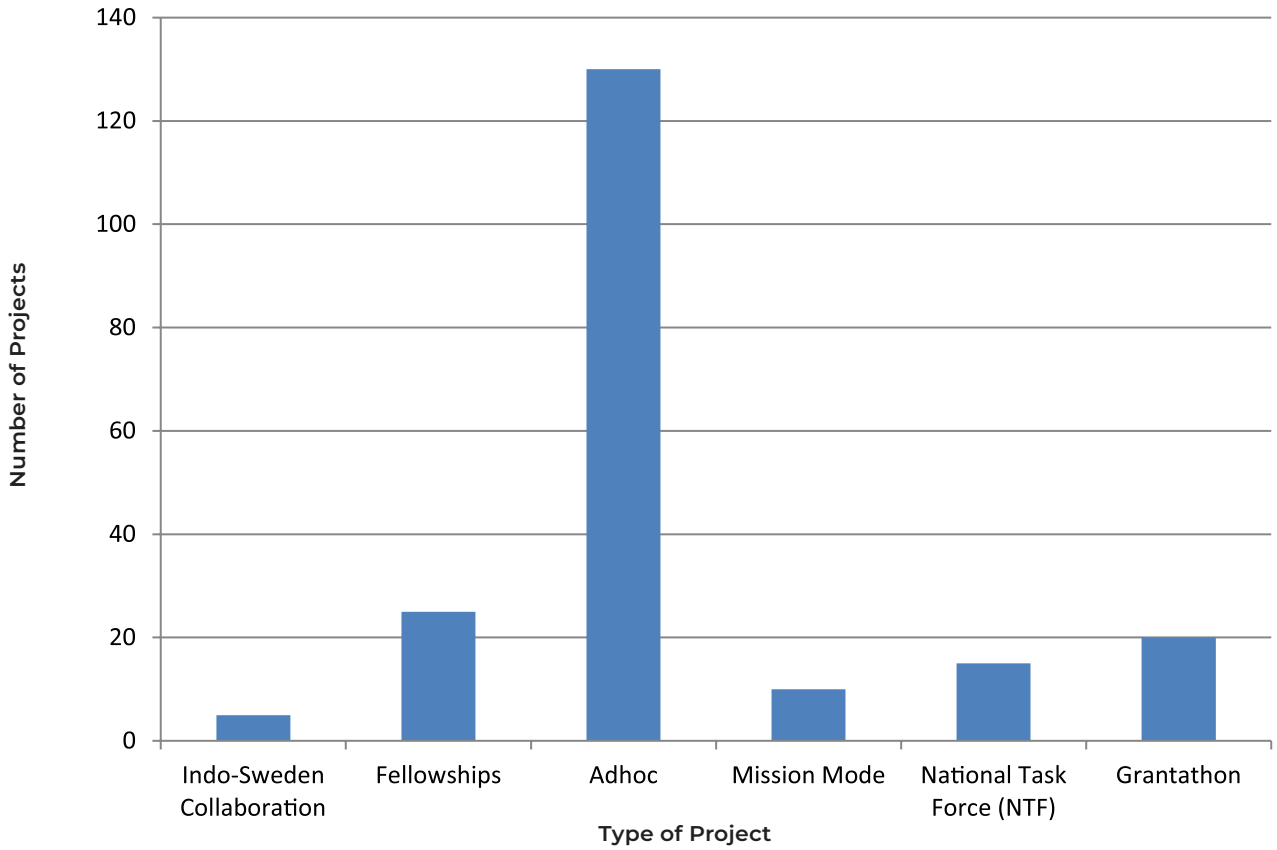


Figure 13: Number of Projects by Type

The Ad-hoc category, encompassing 135 projects, showcased flexibility and responsiveness to a wide range of emerging and localized health challenges, fostering exploratory research and innovative interventions. Fellowship programs, with 34 projects, played a crucial role in developing research capacity, empowering emerging scientists to contribute to critical health domains. Lastly, the Indo-Sweden collaboration, comprising 5 projects, underscored the importance of international partnerships in advancing mutual health objectives, with a focus on specialized areas such as aging and chronic diseases. The continued funding ensured sustained progress and the potential for transformative impact on national health outcomes.

10.3 Initiative of national Importance

10.3.1 Enhancing Patient Care with Standard Treatment Workflows:

The Division prepared 32 new Standard Treatment Workflows (STWs) for treating common and serious diseases across the five specialties listed below. These evidence-based workflows aim to ensure that patients receive the correct treatment and assist healthcare professionals in effectively following established guidelines:

- Cardiothoracic vascular surgery
- Pediatric cardiology
- Interventional radiology
- Neurosurgery
- Orthopedics

10.3.2 Strengthening Implementation Research in India

The Division, in collaboration with the ICMR-National Institute of Epidemiology and the Indian Institute of Science (IISc) Bangalore, launched a comprehensive webinar series titled

"Evidence to Action: Implementation Research Explained" to strengthen implementation research in India. This series, consisting of 11 informative sessions, was designed to build a strong foundation for impactful research initiatives within the field of implementation and delivery research.

10.4 Significant Achievements:

10.4.1 Ambulatory Care Research Priorities: The research priorities for non-communicable diseases (NCDs) were established, focusing on:

- Strategies to improve ambulatory care
- Integration of digital technologies for enhanced management
- Community engagement for sustainable care models

10.4.2 Innovations in Diagnostics

- PathDetect M.TB Rif. & INH was validated to detect resistance to Rifampicin and Isoniazid in TB/MDR-TB patients.
- Three diagnostic kits were developed under the National Tuberculosis Elimination Program (NTEP):

i. TB Detect (for improved smear microscopy)

ii. Sputum transportation kits for bio-safe sample movement

iii. DNA extraction kits for Line Probe Assays

- Cy-Tb, a new skin test for latent TB, was found effective for children and adults.
- A Quality Management System was established to enhance TB diagnosis in government and private laboratories.
- An AI tool for TB X-ray screening, with over 96% sensitivity and specificity, is ready for deployment

10.4.3 Therapeutic Advancements

- A clinical trial showed the efficacy of adding piperine to standard TB treatment, achieving early culture conversion.
- A 4-month clofazimine-based regimen for drug-sensitive TB (DS-TB) was evaluated as safe and effective, recommended for use under operational research

10.4.4 Vaccine Research:

Phase III trials of TB vaccines (VPM1002 and MIP) are nearing completion, with 12,717 participants enrolled across eight main sites.

10.4.5 Implementation Research for TB:

i. Two strategies under NTEP improved TB case detection:

- TB preventive therapy coverage increased from 35% to 98% through tailored interventions.
- Nutritional supplements for malnourished TB patients showed significant improvements in weight gain and cure rates

ii. Active case finding screened over 65,000 school children through intersectoral collaboration.

iii. Village-level screening with trained youth identified >400 TB-positive cases on treatment.

iv. A TB reduction project in a Saharia-dominated district demonstrated a 49–95% reduction in new TB cases through molecular diagnostics, hand-held X-rays, and telemedicine

CHAPTER 11

National Health Research Priorities (NHRP) Projects

In addition to Extramural and Intramural projects, a separate program has been established to fund projects addressing National Health Research Priorities, which are directly monitored by the Director General (DG) of ICMR. These priorities with relevant research questions, identified by the Scientific Advisory Board (SAB) and approved by the Governing Council (GC), are determined based on feedback from multiple stakeholders. Expressions of Interest (EoI) are invited based on priority research questions in each area. The projects are co-developed through collaboration between the applicants and ICMR, with a focus on multi-centric approaches guided by commonly agreed protocols. Multiple projects can be funded for each priority area, with an emphasis on achieving significant and impactful improvements in addressing priority health challenges.

In June 2023, the Governing Council of ICMR approved the following disease conditions for the current year: under communicable diseases – TB, Vector Borne Diseases, and Antimicrobial Resistance (AMR); under non-communicable diseases – Cancer, Mental Health, and Ambulatory Care; under reproductive, child health, and nutrition – Anemia, Childhood Malnutrition, and Neonatal Mortality; and other areas such as Acute Emergency Care and Oral Health. Additionally, Primary Health Care was included in this list based on a request from NITI Aayog, recognizing its importance in delivering care for all these conditions. The duration of these projects will be a maximum of four years, extendable by one year with the approval of the competent authority. However, learnings will be shared with central and state health departments every 6 months

11.1 New NHRP Projects in the FY 2023-24:

In the reporting year, 16 projects were funded across 12 national health research priority areas, contributing to a total of 27 projects developed under these priorities, with an average funding of ₹20 crores per project. The projects spanned 100 districts across the country, addressing critical health challenges. Among the funded projects, 3 focus on Cancer, 2 each on Mental Health, Emergency Care, and Primary Health Care, and 1 each on NCD Ambulatory Care, NCD Prevention, Tuberculosis (TB), Antimicrobial Resistance (AMR), Neonatal Mortality (NMR), Stillbirth, Anemia, and Dental Caries. These NHRP Projects are being implemented by the ICMR divisions in their respective areas as given below (Table No 4):

Division	Priorities		
RHC & Nutrition	Neonatal mortality	Stunting and wasting	Anemia
NCDs	Cancer	Ambulatory NCD care	Mental Health
Communicable Diseases	AMR & One Health	TB	Vector Borne Diseases
Oral Health	Oral Health		
Cross cutting	Primary Health Care, Acute emergency care		

Table No 4: Priority Areas by Division

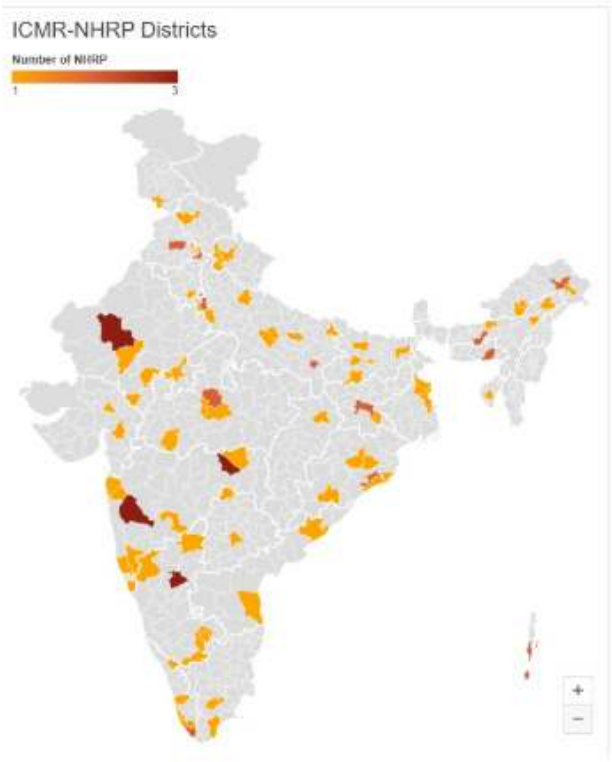


Figure 14: Map of India depicting ICMR-NHRP districts

Priority conditions (cross cutting)	Purpose of the research project	District
Primary Health Care	Develop model to deliver 12 quality CPHC services equality with high coverage through Ayushman Bharat – Health and Wellness Centres (AB-HWCs)	7
Primary Health Care	To leverage technology for delivery of equitable, hight – quality primary healthcare services through Health & Wellness Centres	6
Acute Emergency care	To strengthen facility-based emergency care for STEMI, Stroke, Trauma, Shock, Unconscious, Respiratory distress, Poisoning & snake bites, Burn, Paediatric emergency, Obstetrics-gynae emergencies	5
Acute Emergency care	To develop and scalable hight-quality, patient-centric integrated emergency care model	5
Oral Health	To develop and implement a school-based tooth brushing and oral health education scalable delivery model with high coverage (≥80%) for improving oral health amongst primary school children.	8

Priority Conditions (RNC)	Purpose of the research project	District
Neonatal Mortality	To strengthen program Implementation and Monitoring to Achieve Single-diet Neonatal Mortality	10
Still Birth	To develop a comprehensive package of interventions and effective delivery strategies to improve coverage and process indicators that will have the potential to reduce stillbirths	7
Anaemia	Clinical trial to compare effect of Punarnavadi Mandura alone and in combination with Drakshavaleha with IFA among non-pregnant women of reproductive age group with moderate anaemia	8

Priority Conditions (NCD)	Purpose of the research project	District
Cancer	To improve access, affordability and outcomes in cancer care (NCG & ICMR joint call)	9 RTCs
Cancer	To improve survival in patients with stage 2 breast cancer by making evidence-based quality care accessible to at least 80% patients	12 hospitals
Cancer	To facilitate implementation of ICICLe-1 protocol in selected public hospitals for managing paediatric acute lymphoblastic leukaemia to improve survival	28 hospitals
Ambulance care for NCD	To develop a model for improved delivery of NCD care at selected districts and iteratively implement the model and refine for scaling up	4
Mental health	To develop intervention package for schools and colleges to reduce risks of suicide behaviour and enhance help seeking in students	500 schools & Colleges
Mental health	To facilitate high coverage (at least 70%) of screening, linkage to care, and management of common mental disorders and substance use disorders among persons seeking care for NCDs at public health facilities.	7

Priority Conditions (CD)	Purpose of the research project	District
TB	To evaluate the effectiveness of a strategy to vaccinate vulnerable individuals older than 18 years with BCG vaccine under programmatic settings on the occurrence of notified TB cases up to a period of 36 months post-intervention	cRCT in 555 districts
TB	To support NTEP activities for accelerating TB elimination at district level and assess effectiveness of comprehensive intervention package in reducing the incidence of TB in selected districts	32
AMR	To develop of In Vitro Diagnostic (IVD) Kits against drug resistant salmonella enterica infections	4 research institutes

Table 5: Depicts the Priority Conditions, Purpose of the research projects and Districts/Hospitals for the NHRP

Among the 16 projects, significant focus areas included advanced diagnostics, public health interventions, nutritional studies, and disease surveillance. Projects like the CRISPR-based diagnostic kits and the LAMP assay for drug-resistant Salmonella detection utilized state-of-the-art technology to address the growing challenge of antimicrobial resistance. The “Barriers and Facilitators to STI Service Utilization” project, the largest in funding, sought to improve care accessibility and treatment-seeking behaviour in underserved populations, particularly in tribal regions. Similarly, the “Prevalence of STIs in Tribal Populations” project addressed specific vulnerabilities, ensuring inclusivity in healthcare strategies.

Nutritional studies formed another cornerstone of NHRP. The Diet and Biomarker Survey (DABS-I), a pan-India initiative, focused on understanding dietary patterns to inform national nutritional policies. The NECCTAR trial, a cluster-randomized controlled trial, evaluated the effectiveness of nutritional interventions in children. Disease surveillance projects like the Hospital-Based Surveillance of Acute Encephalitis Syndrome (AES) and the TB Eradication Initiative, spanning 12 and 32 sites

respectively, addressed urgent public health challenges with real-time data and targeted strategies. Other noteworthy initiatives included the Efficacy of Punarnavadi Mandura for Iron Deficiency Anemia, focusing on non-pregnant women of reproductive age, and the Anant Muskaan Project, which promoted oral health through school-based interventions.

Geographically, these projects spanned 177 sites across India, ensuring wide regional and demographic representation. The TB eradication program, with the highest number of participating sites, and multicentric studies such as the STI prevalence and nutritional intervention projects demonstrated a commitment to inclusivity and reaching underserved areas(Table 5).

The duration of these projects vary from 18 months to 5 years, balancing immediate outcomes with long-term impact. For instance, the Hospital-Based AES Surveillance is a one-year initiative targeting urgent health crises, while the DABS-I and diagnostic innovation projects lay a foundation for systemic healthcare improvementsThese projects provide significant opportunities for policy integration and impact. Advanced diagnostics, real-time surveillance data, and outcomes from nutrition studies can directly inform national health programs like Ayushman Bharat, Poshan Abhiyan, and Mission Indradhanush. It is recommended to accelerate fund utilization, expand successful projects, and establish robust monitoring frameworks. By addressing immediate health crises and preparing for future challenges, the NHRP projects embody the government's commitment to innovation, inclusivity, and evidence-based policymaking, aligning with India's Sustainable Development Goals (SDGs). Through these initiatives, India is well-positioned to achieve transformative improvements in public health outcomes.

CHAPTER 12
Scientific Support Units

In addition to its Intramural and Extramural Research Divisions, ICMR has dedicated scientific support units that assist its divisions and collaborate with ministries, Parliament, PMO, and other government bodies. The Policy and Communications Unit, Bioethics Unit, and International Health Unit coordinate scientific policy inputs, ethical research guidelines and international project collaborations respectively. Additionally, the Indian Journal of Medical Research (IJMR) Unit manages the peer review and publication of research articles submitted to IJMR.

12.1 INTERNATIONAL HEALTH UNIT

i International Collaboration & Partnerships

ICMR fosters international cooperation through bilateral, multilateral, and regional partnerships to strengthen ties between governments, academia, institutions, and industries in mutual areas of biomedical research. Currently, India has several bilateral Science & Technology (S&T) cooperation agreements with other countries to facilitate cooperation in the areas of biomedical research between India and foreign countries. ICMR operates in close cooperation with the Indian Ministry of Health & Family Welfare, Ministry of Science & Technology, Ministry of External Affairs, Indian missions abroad and foreign missions in India for the international collaborations. In addition to this, ICMR organizes a number of virtual meetings and delegation visits to discuss diverse agendas of importance pertaining to international collaborations. Additionally, the Unit also represents ICMR in various bilateral and multilateral Joint Committee Meetings coordinated by MEA, MoH&FW and DST Govt. of India for cooperation with various countries.

12.1.1 International Fellowship:

The ICMR-DHR International Fellowship Programme for Indian biomedical scientists aims to create a pool of talented health research personnel by facilitating advanced training and exposure to the latest advancements in knowledge through interaction with the international scientists in their respective field of work. In the past year, a total 206 applications were received (107 for Short Term Fellowships and 99 for Long Term Fellowships). A total of 25 Short Term (Senior) Fellows and 40 Long Term (Young) Fellows were selected to avail the fellowship in various international institutes across the globe.

12.1.2 Initiative:

Transfer of Human Biological Material (THBM) Portal – In compliance with the directive of the Cabinet Secretariat, ICMR developed an online portal in collaboration with the National Informatics Centre (NIC) for the submission of applications for the export of human biological material for commercial purposes and contract research. This initiative was driven by a series of meetings chaired by the Secretary DHR and DG ICMR, involving representatives from all relevant Government of India (GoI) Ministries and Departments. This portal is designed to curb the unauthorized export of human biological material and safeguard national security, to streamline the application process for obtaining No Objection Certificates (NOC) and ensures robust cyber security measures as advised by the National Security Council Secretariat (NSCS). The portal is fully operational and applications are being considered and granted NOC after scrutiny by all the relevant Departments/ Ministries of GoI.

12.1.3 Health Ministry's Screening Committee (HMSC) meetings:

ICMR facilitated 12 HMSC meetings throughout the year—one per month—to conduct technical reviews of international collaborative proposals. These reviews ensure scientific and ethical compliance before project approval and

implementation.

12.2 BIO-ETHICS UNIT

12.2.1 ICMR-Central Ethics Committee on Human Research (CECHR)

The ICMR-CECHR operates at the national level for the development and updating of National Ethical Guidelines, addressing emerging ethical aspects of biomedical and health research, guiding ICMR's Ethics Policy, and reviewing research of national importance with complex ethical issues led by ICMR or referred to it by government ministries and departments.

The ICMR-CECHR was reconstituted on June 2, 2023, to review ICMR-led research and policy. Over the past year, the committee played a key role in evaluating research proposals and ethical guideline documents developed by the ICMR Bioethics Unit, reviewing a total of 13 research proposals and guidelines.

The initial review form to be submitted by ICMR scientists to the Ethics Committee was modified to include a checklist. This checklist serves as a self-assessment tool for ICMR scientists to determine the suitability of their proposals for submission to the ICMR-CECHR, ensuring that only relevant and well-prepared proposals are submitted.

12.2.1 National Ethics Committee Registry for Biomedical and Health Research (NECRBHR) - NAITIK PORTAL

The New Drugs and Clinical Trial Rules, 2019 mandate that an Ethics Committees reviewing biomedical and health research shall be required to register with the authority designated by the Central Government. To facilitate this process, the National Ethics Committee Registry for Biomedical and Health Research (NECRBHR) was established under the Department of Health Research. The Head of the ICMR Bioethics Unit serves as the scientific advisor and nodal officer of the NECRBHR and is actively involved in reviewing EC applications, particularly those with complex issues related to the qualifications, affiliations, and roles of different EC members, as well as matters related to SOPs and training certificates. In the year 2023-24, a total of 394 Ethics Committee registration applications were submitted. During this period, 430 ethics committees were granted provisional registration and 199 received final registration.

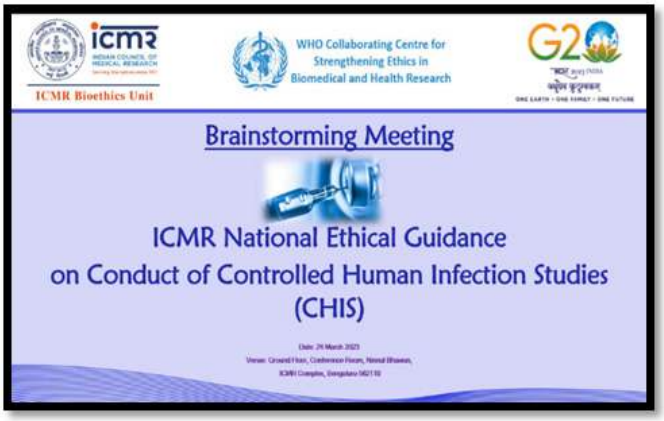
12.2.1 Guidance, Guidelines and Policy Statement Developed During 2023-24

The ICMR Bioethics Unit developed two guidance documents, three guidelines, an addendum to an existing guideline and one policy statement over the past year.

i. ICMR Policy Statement on the Ethical Conduct of Controlled Human Infection Studies (CHIS) in India 2023:

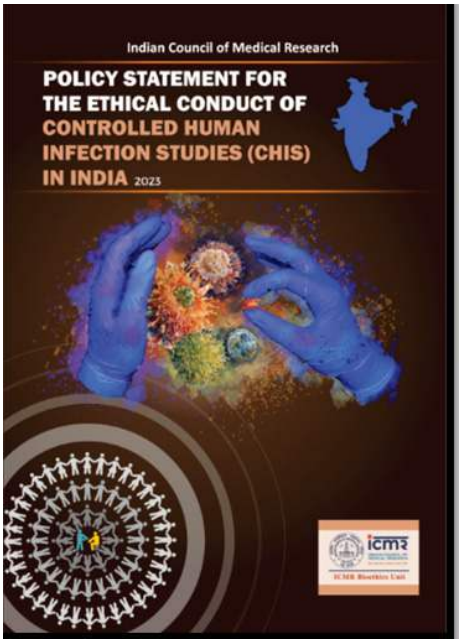
Controlled Human Infection Studies (CHIS) are research methods that intentionally expose healthy human participants to a specific pathogen or infectious agent under controlled conditions to assess vaccines and other treatment modalities and accelerate research through enhanced insights into the disease process in humans. However, CHIS is associated with complex ethical issues related to deliberate harm, risk of third-party infection, post-trial access etc. Ethical guidance to facilitate the conduct of CHIS was lacking in the country.

Brainstorming Meeting– The ICMR Bioethics Unit organized a one-day brainstorming session on March 24, 2024, at the ICMR Bioethics Unit in Bengaluru. The session aimed to develop National Ethical Guidance on the Conduct of CHIS in India. An advisory committee comprising a diverse group of multidisciplinary experts convened to deliberate on the ethical considerations surrounding CHIS. Through collective expertise and collaboration, the committee laid the foundation for a robust ethical framework that safeguards participant well-being and upholds the principles of ethical research conduct. A core drafting committee was identified to further develop the guidelines.



Brainstorming meeting for the ICMR National Ethical Guidance on Conduct of Controlled Human Infection Studies (CHIS)

i. **Public Consultation and Publication** – Following the brainstorming session on 24 March 2024, the ICMR Bioethics Unit drafted a policy statement to address ethical concerns in CHIS in India. The draft was posted on the ICMR website for public consultation from 17 July to 16 August 2023. Feedback received during this period was carefully reviewed by the Advisory Committee and incorporated into the final document. After multiple online meetings and peer reviews by national and international experts, the final policy statement was published. This comprehensive ethical framework is designed to guide researchers, sponsors, institutions, and other stakeholders in reviewing or conducting CHIS, ensuring that studies adhere to the highest ethical standards[1].



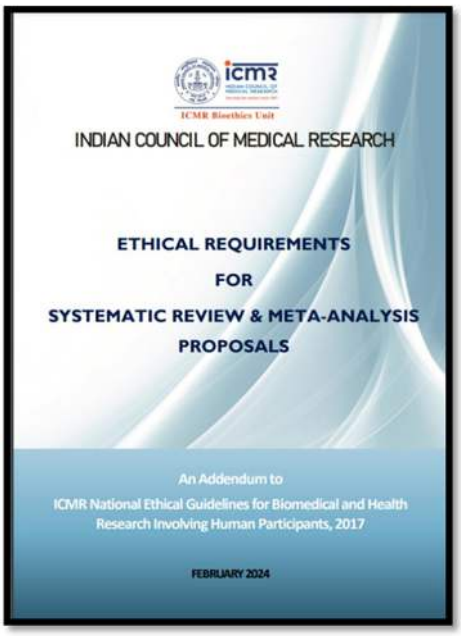
Policy Statement for the ethical conduct of Controlled Human Infection Studies (CHIS)

[1]The policy statement is available at: https://www.icmr.gov.in/icmrobject/custom_data/pdf/resource-guidelines/ICMR_CHIS%20_Policy_Document.pdf[4]Available at: https://www.cnecv.pt/en/publications-in-english/kaleidoscope-on-global-bioethics

ii. Ethical Requirements For Systematic Review & Meta-Analysis Proposals: An Addendum to ICMR National Ethical Guidelines For Biomedical and Health Research Involving Human Participants, 2017:

Systematic reviews and meta-analyses are crucial in synthesizing available evidence to inform healthcare practices and policy-making. To develop an ethical guidance for conducting such studies, the ICMR-CECHR constituted a sub-committee of six subject matter experts. After several online meetings, and thorough reviews by lead discussants of the ICMR-CECHR, the final draft was prepared and approved. The document, titled Ethical Requirements for Systematic Review & Meta-Analysis Proposals: An Addendum to the ICMR National Ethical Guidelines for Biomedical and Health Research Involving Human Participants, 2017, was published on 08 Feb 2024.

This document provides a clear ethical framework for researchers, defining the scope of systematic reviews and meta-analyses and emphasizing adherence to standard guidelines and procedures[1].



Ethical Requirements For Systematic Review & Meta-Analysis Proposals

iii. Guidance on Ethical Requirements for Laboratory Validation Testing:

Laboratory Validation Tests may include tests to assess reproducibility, sensitivity, specificity, accuracy, reliability, fitness for purpose, and quality control/assurance using residual, archived, unlinked, or anonymous samples. However, it excludes independent evaluations of novel products or innovations requiring clinical assessment through regulatory pathways.

The ambiguity regarding whether proposals for laboratory validation tests should undergo ethics review was discussed in an ICMR-CECHR meeting. Following directives from the DG ICMR and ICMR-CECHR, a guidance document was proposed to address this issue. An expert subcommittee was formed to deliberate on key ethical aspects, leading to the development of a final draft through multiple online discussions. After review by ICMR-CECHR members, the guidelines titled Guidance on Ethical Requirements for Laboratory Validation Testing were approved and published on 08 Feb 2024. The guidance promotes validation testing by stating the types of testing that can be exempted from ethics review while safeguarding the rights and well-being of participants[2].

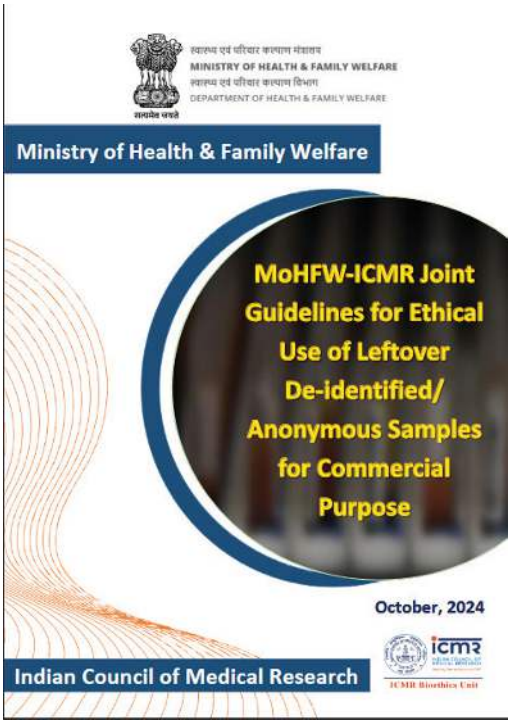
[1]It is available at: https://www.icmr.gov.in/icmrobject/uploads/Guidelines/1724842157_ethical_requirements_for_systematic_review_metaanalysis_proposals_an_addendum.pdf

[2] It is available at: https://www.icmr.gov.in/icmrobject/uploads/Documents/1724842064_guidance_on_ethical_requirements_for_laboratory_validation_testing.pdf

Guidance Document on Ethical Requirements for Laboratory Validation Testing

iii. The Guidelines for Ethical Use of Leftover De-identified/Anonymous Samples for Commercial Purpose:

The Guidelines for Ethical Use of Leftover De-identified/Anonymous Samples for Commercial Purpose was published by the Ministry of Health and Family Welfare, with the ICMR Bioethics Unit playing a key role in their development. These guidelines provide an ethical framework for the use of leftover, non-identifiable, irreversibly de-identified, or pooled samples collected for clinical care (non-research) that are intended for developing future products, technologies, or for commercial purposes. Rather than being discarded as biological waste, these samples can contribute to research and innovation while adhering to stringent ethical standards[1].



Guidelines for Ethical Use of Leftover De-identified/Anonymous Samples for Commercial Purpose

[1]The guidelines are available at: https://www.icmr.gov.in/icmrobject/uploads/Guidelines/1732704229_guidelinesforethicaluse.pdf

In addition to the above, the following guidelines and tool were also developed:-

i. International Guidelines on Good Governance Practice For Research Institutions: Council for International Organizations of Medical Sciences (CIOMS) 29th November 2023[1].

ii. WHO Ethics and governance of artificial intelligence for health: guidance on large multi-modal models, 18th Jan 2024[2].

iii. A WHO tool for benchmarking ethics oversight of health-related research involving human participants: 25th September 2023[3].

12.2 Books

1. Mathur, R. (2023) "Ethics in Biomedical & Health Research," in M.G. Deo, R. Bharadwaj and R. Mulherkar (eds) Research Oriented Medical Education - The Essentials. Pune: White Falcon Publishing, pp. 42–55[4].

2. Mathur, R. (2023) "Kaleidoscope on Global Bioethics" Kaleidoscope on Global Bioethics, Ethical Issues around Covid-19 Vaccine Research in India. pp 105-116[5].

12.2.1 Capacity Building

i. INDO US Workshop- Clinical Research Ethics and Challenging Newer Areas

The ICMR Bioethics Unit, in collaboration with the Department of Bioethics, NIH, USA, organized a workshop from 7-9 Aug 2023 at ICMR Bioethics Unit, Bengaluru, to update clinical researchers on emerging challenges in clinical research ethics. The workshop covered a range of topics, including the ethical aspects of Controlled Human Infection studies, Community Engagement, Equity in Research, Ethics Dumping, and Emerging Technologies and Innovative Treatments. Twelve early career scholars participated, receiving hands-on training and opportunities for one-on-one interactions with US faculty to refine their research ideas into concrete proposals eligible for funding from Indian and international bodies. The Department of Bioethics at NIH committed to further collaborating with promising early career scholars to develop their proposals after the workshop.

[1] Available at: https://cioms.ch/publications/product/international-guidelines-on-good-governance-practice-for-research-institutions/# description

[2] Available at: https://iris.who.int/bitstream/handle/10665/375579/9789240084759eng.pdf? sequence=1&is Allowed=y

[3] Available at: https://iris.who.int/bitstream/handle/10665/373001/9789240080713-eng.pdf?sequence=1) was also developed by the Unit during the last year.

[4] Available at: https://ethics.ncdirindia.org/

[5] Available at:https://www.cnecv.pt/en/publications-inenglish/kaleidoscope-on-global-bioethicsasset/pdf/Medical_Education.pdf

iii. ICMR DHR Outreach Program for Ethics Committees

The ICMR-DHR Outreach Program, conceptualized under the guidance of DG ICMR, was initiated to engage with ethics committees in rural India. Its primary goal was to gain a comprehensive understanding of the challenges they face in their daily operations and to identify gaps in existing guidelines and rules regarding their completeness and adaptability at the functional level. This program aimed to support the development of future guidelines and to facilitate an in-depth understanding of the functioning of ethics committees across the country.

To achieve these objectives, a team of scientists from ICMR and DHR visited ethics committees in different regions. During these visits, they interacted with committee members to understand ground-level issues affecting their operations. Committee members and other stakeholders shared their experiences and the obstacles they faced in conducting ethics reviews. The discussions not only highlighted the problems but also delved into potential solutions to overcome these challenges.

Throughout 2023-24, the outreach program successfully connected with 81 ethics committees, offering support and collecting valuable insights. These interactions provided ICMR with a deeper understanding of functional issues but also took a deep dive into the possible solutions that can be adopted to overcome the challenges. Since the inception of the outreach program in December 2022, a total of 107 Ethics Committees have been engaged(Table No. 6).

NO.	DATE	PLACE	Hosting Institution	No of Ethics Committees
1	24th Jan 2023	Chennai	Directorate of Public Health, Chennai	1
2	25th Jan 2023	Chennai	NIRT Chennai, ICMR	9
3	18th Oct 2023	Bengaluru	In Stem Bengaluru	46
4	7th Dec 2023	Coimbatore	PSGIMSR, Coimbatore	25
Total				81

Table No. 6: Outreach program with 81 ethics committees

iv. Online Course on Ethical and Regulatory Aspects of Clinical Research

The ICMR Bioethics Unit facilitated a 7-week online course titled "Ethical and Regulatory Aspects of Clinical Research," in collaboration with the Department of Bioethics at the National Institutes of Health (NIH), USA. This comprehensive course addressed key topics such as informed consent, decision-making, inclusion of vulnerable populations, post-trial obligations, genetics research ethics, equity in clinical research, standards of care, and biomedical devices. Through video lectures and interactive discussions, participants gained valuable insights into the ethical complexities of clinical research. Additionally, the unit organized four discussion sessions with NIH faculty members, further enriching the learning experience. As a result, 16 scientists from ICMR successfully completed the program and received certification

12.3 POLICY AND COMMUNICATIONS UNIT

In the year 2023-24, the Policy and Communications Unit was involved in multiple activities ranging from interministerial coordination to addressing Parliament Questions, representing ICMR in national exhibitions across India, building capacity for health communication in ICMR, and providing support to the scientific divisions regarding policy inputs on the ministerial subjects.

In particular, the P&C unit undertook significant initiatives across various domains to enhance health communication and research capacity. The ICMR Health Communications Course trained 30 scientists in its first cohort, culminating in a valedictory event where capstone projects were presented. Excellence within ICMR was celebrated through the Intramural Research & Innovation Excellence Recognition event, which facilitated the best research in ICMR institutes. Under Phase 2 of the WHO-ICMR-VHAI Media Literacy Project, 8,500 students and 650 teachers were trained in 75 schools to combat misinformation, impacting over 75,700 individuals. Similarly, the Health Communications Internship Program (IHCIP) 2023 placed 25 interns across ICMR institutes, with 80% of mentors rating the program as excellent.

To bolster public communication, the Unit managed social media campaigns for key health observances and addressed journalist queries. A strategic partnership with Amity University was established through a MoU for capacity building in health research. The unit produced films showcasing achievements of ICMR-NIE and ICMR-NIRTH and conceptualized exhibition stalls at G20 Health Working Group Meetings, garnering international commendations. Communication capacity-building workshops were conducted for Nodal Communication Officers (NCOs), students, and participants at Society for Education, Action and Research in Community Health (SEARCH). Efforts to strengthen ICMR branding included logo support for high-profile events like the World Diabetes & Wellness Forum 2023. Additionally, the Unit coordinated parliamentary inputs, attended inter-ministerial meetings, and ensured ICMR's activities were well-represented in government documents.

12.3 Some of the notable activities in FY 2023-24:

i. ICMR Health Communications Course of the first cohort was completed. The Unit contributed to the development, implementation, and evaluation of the course. During the first cohort, 30 scientists were trained.

ii. ICMR Intramural Research & Innovation Excellence Recognition – The Unit successfully organized the event recognizing excellence within ICMR. Contributions included drafting the call for participation, reviewing guidelines, overseeing the entire review and selection process, and coordinating a ceremony for felicitations and technology display

iii. WHO-ICMR Media Literacy Project – In phase 2, this project implemented social media literacy training in collaboration with State and District Education Departments across 75 schools in five Tier II cities in India. The initiative targeted students (grades 9–12) and teachers, using structured, engaging modules translated into five regional languages. The program trained 8,500 students and 650 teachers, with 1,125 recognized as Digital Champions who formed committees to combat misinformation and educate peers. The project reached 13,026 students in schools and approximately 75,700 individuals outside. Assessments showed significant improvements in discerning fake health information, verifying news, and adopting responsible online behaviours, with over 90% of students and teachers consistently verifying health news post-training.

iv. ICMR Website Redesign and Development – The Unit led the redesign of the official website, enhancing its functionality as an information repository on ICMR's diverse knowledge products (journals, papers, policy briefs, etc.). Contributions included upgrading the UI/UX, streamlining navigation, and updating content and data.

v. Director-General Press Conference – The Unit supported the planning and coordination of the Director-General's press conference. Responsibilities included managing on-site logistics, overseeing attendee arrivals and media check-ins, facilitating Q&A sessions, and conducting post-conference follow-ups to reinforce key messages and maintain positive media relations.

vi. Performance Evaluation Committee – The unit facilitated the successful conduct of PEC meetings and prepared minutes, contributing to the development of the PEC interim report.

vii. ICMR Collaborating Centers of Excellence (CCoEs) Coordination – The Unit initiated capacity-building efforts for recently inducted ICMR scientists at the ICMR-CCoEs. In line with program objectives, scientists were placed in interdisciplinary areas for enhanced cross-learning, with 60 scientists connected to 18 CCoEs for observerships.

viii. Event Coordination and Press Releases – The Unit coordinated multiple events, including the launch of the Haemophilia

and von Willebrand A diagnostic kit, inaugurations of research facilities, and significant initiatives like the MedTech Mitra launch and drone delivery in Himachal Pradesh. Press releases were developed to ensure effective media coverage and outreach

ix. Media Engagement and Social Media Management – The Unit spearheaded social media campaigns for key health-related observances such as Poshan Maah, along with tweets related to ICMR's activities and research developments. Additionally, media queries from health journalists were addressed promptly.

x. Parliamentary Coordination – The Unit coordinated parliamentary questions for ICMR, scrutinizing and preparing inputs for approval during Monsoon and Winter Sessions for FY 2023-24

xi. Inter-Ministerial Engagement – The Unit provided inputs, briefings, and attended meetings with ministries, DHR, and NITI Aayog on public health matters. It ensured ICMR's activities were highlighted in major government output dissemination documents.

CHAPTER 13
Publications

As evidenced by its extensive and varied publication portfolio, ICMR is at the forefront of biomedical research and public health advances in India. In 2023-24, ICMR disseminated quality scientific research output through a variety of publication formats including but not limited to books, journals, guidelines, and reports.

13.1 ICMR Research Publications

The Indian Council of Medical Research (ICMR) achieved a remarkable milestone this year, with over **3,300** research papers published in peer-reviewed journals. This impressive output includes **1,809** papers from extramural research initiatives and **1,500** from intramural research efforts. Notably, the global impact of ICMR's research is highlighted by over 40 intramural papers published in prestigious journals with an impact factor exceeding 20. This achievement signifies the organization's leading role in addressing critical health challenges on a global stage. These publications address critical issues across a spectrum of fields, including public health, occupational hazards, environmental science, chronic illness management, and implementation science, reflecting ICMR's holistic and interdisciplinary strategy. By integrating innovation with practical implementation, ICMR continues to shape health policies and solutions that benefit both India and the global community.

Data from the year also reveal that 1.75% of ICMR publications were published in top 1%, 8.69% of publications were in the top 10%, and 27.81% of publications were through international collaborative research.

The extensive publication activities of the ICMR during the course of the year and collaboration with esteemed international publishers have amplified the reach and impact of ICMR's research, reinforcing its position as a leader in the global scientific community. A robust publication framework will continue to remain essential to ICMR's objective of improving public health outcomes and supporting global health goals as it broadens its research scopes. The list of top 50 publications that have resulted from Intramural and Extramural Research is provided below:

Top 50 Publications from Intramural Research

S. No.	Reference/Source	Journal Impact Factor
1	Ong, K. L., Stafford, L. K., McLaughlin, S. A., Boyko, E. J., Vollset, S. E., Smith, A. E., ... &Brauer, M. (2023). Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet, 402(10397), 203-234.	202.7
2	Schumacher, A. E., Aali, A., Abate, Y. H., Abbasgholizadeh, R., Abbasian, M., Abbasi-Kangevari, M., ...& Arafa, E. A. (2024). Global fertility in 204 countries and territories, 1950–2021, with forecasts to 2100: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. The lancet.	169

S. No.	Reference/Source	Journal Impact Factor
3	Naghavi, M., Ong, K. L., Aali, A., Ababneh, H. S., Abate, Y. H., Abbafati, C., ...&Alqutaibi, A. Y. (2024). Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet, 403(10440), 2100-2132.	169
4	Schumacher, A. E., Kyu, H. H., Aali, A., Abbafati, C., Abbas, J., Abbasgholizadeh, R., ...&Amzat, J. (2024). Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. The Lancet, 403(10440), 1989-2056.	168.9
5	Phelps, N. H., Singleton, R. K., Zhou, B., Heap, R. A., Mishra, A., Bennett, J. E., ... &Barbagallo, C. M. (2024). Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults. The Lancet, 403(10431), 1027-1050.	168.9
6	Zorbas, C., Jeyapalan, D., Peeters, A., Kapeke, K., Sethi, V., Murira, Z., ...&Backholer, K. (2023). World Children's Day 2022: power, policy, and children's rights to nutrition. The Lancet, 402(10396), e1-e3.	168.9
7	Schumacher, A. E., Kyu, H. H., Aali, A., Abbafati, C., Abbas, J., Abbasgholizadeh, R., ...&Amzat, J. (2024). Global age-sex-specific mortality, life expectancy, and population estimates in 204 countries and territories and 811 subnational locations, 1950–2021, and the impact of the COVID-19 pandemic: a comprehensive demographic analysis for the Global Burden of Disease Study 2021. The Lancet, 403(10440), 1989-2056.	168.9
8	Munshi, H., &Gajbhiye, R. K. (2023). Addressing disparities and challenges in global health from an LMIC perspective. The Lancet, 402(10396), 102-103.	168.9
9	RECOVERY Collaborative Group. (2023). Higher dose corticosteroids in patients admitted to hospital with COVID-19 who are hypoxic but not requiring ventilatorysupport (RECOVERY): a randomised, controlled, open-label, platform trial. Lancet (London, England), 401(10387), 1499.	168.9
10	John, J., Bavdekar, A., Rongsen-Chandola, T., Dutta, S., Gupta, M., Kanungo, S., ...& Kang, G. (2023). Burden of typhoid and paratyphoid fever in India. New England Journal of Medicine, 388(16), 1491-1500.	158.5
11	Aggarwal, C., Ahmed, H., Sharma, P., Reddy, E. S., Nayak, K., Singla, M., ...&Murali-Krishna, K. (2024). Severe disease during both primary and secondary dengue virus infections in pediatric populations. Nature medicine, 30(3), 670-674.	82.9
12	Singh, A., Singh, S. K., Kumar, V., Gupta, J., Kumar, M., Sarma, D. K., ...&Verma, V. (2023). Derivation and characterization of novel cytocompatibledecellularized tissue scaffold for myoblast growth and differentiation. Cells, 13(1), 41.	66.85

S. No.	Reference/Source	Journal Impact Factor
13	Faust, L., Naidoo, P., Caceres-Cardenas, G., Ugarte-Gil, C., Muyoyeta, M., Kerkhoff, A. D., ...&Subbaraman, R. (2023). Improving measurement of tuberculosis care cascades to enhance people-centred care. The Lancet Infectious Diseases.	56.3
14	Niranjan, R., Saxena, N., & Das, A. (2024). Dengue control, if not by vaccination and vector strategies, then possibly by therapeutics. The Lancet Infectious Diseases, 24(3), e144.	56.3
15	Ogutu, B., Yeka, A., Kusemererwa, S., Thompson, R., Tinto, H., Toure, A. O., ...&Grobusch, M. P. (2023). Ganaplacide (KAF156) plus lumefantrine solid dispersion formulation combination for uncomplicated Plasmodium falciparum malaria: an open-label, multicentre, parallel-group, randomised, controlled, phase 2 trial. The Lancet Infectious Diseases, 23(9), 1051-1061.	56.3
16	Steinmetz, J. D., Seeher, K. M., Schiess, N., Nichols, E., Cao, B., Servili, C., ...&Atalell, K. A. (2024). Global, regional, and national burden of disorders affecting the nervous system, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet Neurology, 23(4), 344-381.	46.5
17	Nag, S., Shrivastava, S., &Chakma, T. (2023). Metabolic non-communicable diseases in India: time to act. The Lancet Diabetes & Endocrinology, 11(12), 896-897.Patel, D., & Kumar, R. (2024). Community health workers in India should be trained to offer genetic counselling for rare diseases. Nature Medicine, 30(2), 319-319.	44.5
18	Anjana, R. M., Unnikrishnan, R., Deepa, M., Pradeepa, R., Tandon, N., Das, A. K., ...&Ghosh, S. (2023). Metabolic non-communicable disease health report of India: the ICMR-INDIAB national cross-sectional study (ICMR-INDIAB-17). The Lancet Diabetes & Endocrinology, 11(7), 474-489.	44.5
19	Abani, O., Abbas, A., Abbas, F., Abbas, J., Abbas, K., Abbas, M., ...& Ail, D. (2023). Empagliflozin in patients admitted to hospital with COVID-19 (RECOVERY): a randomised, controlled, open-label, platform trial. The Lancet Diabetes & Endocrinology, 11(12), 905-914	44.5
20	Dutta, A., Dutta, P. K., Dihingia, P., Baruah, S. M., Ray, A., Bhat, D. S., ...&Yajnik, C. S. (2024). Non-autoimmune, lean diabetes in young people from Assam, India highlights the role of undernutrition in its aetiology–PHEnotypingNOrthEastINDianYoung type 2 diabetes (PHENOEINDY-2). medRxiv, 2024-02.	44.5
21	Anjana, R. M., Elangovan, N., Pradeepa, R., Deepa, M., Unnikrishnan, R., & Mohan, V. (2023). Challenges in implementing nationwide epidemiological studies on metabolic non-communicable diseases in low-income and middle-income countries. The Lancet Diabetes & Endocrinology, 11(12), 889-891.	44.5

S. No.	Reference/Source	Journal Impact Factor
22	Portman, M. A., Harahsheh, A. S., Raghuveer, G., Sundraram, B., Venkataraman, A., Yamazaki-Naksahimada, M., ...&McCrindle, B. W. (2023). Pattern of Use of Anakinra for Patients With Kawasaki Disease versus Multisystem Inflammatory Syndrome in Children Associated With COVID-19. Circulation, 148(Suppl_1), A15506-A15506.	39.9
23	Singhania, A., Singla, A., Kalsi, H., Mahendru, D., Singh, S., Goyal, I., ...& Mohan, B. (2023). Home Blood Pressure Monitoring Among Hypertensive Patients and Their Caregivers in a North Indian Population. Circulation, 148(Suppl_1), A16560-A16560.	39.9
24	Bhaumik, S., Menon, G. R., &Habib, A. G. (2023). Prioritising snakebite in the child and adolescent health agenda. The Lancet Child & Adolescent Health, 7(11), 753-755.	37.546
25	Angamuthu, D., Vivekanandan, S., & Hanna, L. E. (2023). Experimental models for HIV latency and molecular tools for reservoir quantification—an update. Clinical Microbiology Reviews, 36(4), e00013-23.	36.8
26	Ledesma, J. R., Ma, J., Zhang, M., Basting, A. V., Chu, H. T., Vongpradith, A., ...&Fagbamigbe, A. F. (2024). Global, regional, and national age-specific progress towards the 2020 milestones of the WHO End TB Strategy: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet Infectious Diseases.	36.4
27	Walia, K., Mendelson, M., Kang, G., Venkatasubramanian, R., Sinha, R., Vijay, S., ...&Ohri, V. C. (2023). How can lessons from the COVID-19 pandemic enhance antimicrobial resistance surveillance and stewardship?. The Lancet Infectious Diseases, 23(8), e301-e309.	36.4
28	Bhargava, A., Bhargava, M., Meher, A., Teja, G. S., Velayutham, B., Watson, B., ...& Joshi, R. (2023). Nutritional support for adult patients with microbiologically confirmed pulmonary tuberculosis: outcomes in a programmatic cohort nested within the RATIONS trial in Jharkhand, India. The Lancet Global Health, 11(9), e1402-e1411.	34.3
29	Muniyandi, M. (2023). Families affected by catastrophic costs due to tuberculosis. The Lancet Global Health, 11(10), e1492-e1493.	34.3
30	Tiwari, A., De, A., &Sinha, A. (2023). Increasing blood pressure: could malaria have a role?. The Lancet Global Health, 11(11), e1697.	34.3
31	Wallau, G. L., Abanda, N. N., Abbud, A., Abdella, S., Abera, A., Ahuka-Mundeke, S., ...&Zaini, Z. (2023). Arbovirus researchers unite: expanding genomic surveillance for an urgent global need. The Lancet global health, 11(10), e1501-e1502.	34.3
32	Gurudas, S., Vasconcelos, J. C., Prevost, A. T., Raman, R., Rajalakshmi, R., Ramasamy, K., ...&Chawla, G. (2024). National prevalence of vision impairment and blindness and associated risk factors in adults aged 40 years and older with known or undiagnosed diabetes: results from the SMART-India cross-sectional study. The Lancet Global Health, 12(5), e838-e847.	34

S. No.	Reference/Source	Journal Impact Factor
33	Da Cunha, A. R., Compton, K., Xu, R., Mishra, R., Drangsholt, M. T., Antunes, J. L. F., ...&Tabari, M. A. K. (2023). The global, regional, and national burden of adult lip, oral, and pharyngeal cancer in 204 countries and territories: A systematic analysis for the global burden of disease study 2019. JAMA oncology, 9(10), 1401-1416.	28.4
34	Preethi, L., Alina, M. S., Chandran, L., Asvin, S., Jagadeesan, M., Vijayakumar, T. M., ...&Zaman, K. (2023). Duration of seroprotection of the live attenuated SA-14-14-2 Japanese encephalitis vaccine in children in India. Journal of Travel Medicine, 30(2), taac147.	25.7
35	Gardner, W. M., Razo, C., McHugh, T. A., Hagins, H., Vilchis-Tella, V. M., Hennessy, C., ...&Dongarwar, D. (2023). Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990–2021: findings from the Global Burden of Disease Study 2021. The Lancet Haematology, 10(9), e713-e734.	24.7
36	Mensah, G. A., Fuster, V., Murray, C. J., Roth, G. A., & Global Burden of Cardiovascular Diseases and Risks Collaborators. (2023). Global burden of cardiovascular diseases and risks, 1990-2022. Journal of the American College of Cardiology, 82(25), 2350-2473.	24
37	Moran, A. E., & Gupta, R. (2023). Implementation of global hearts hypertension control programs in 32 low-and middle-income countries: JACC international. Journal of the American College of Cardiology, 82(19), 1868-1884.	24
38	Manesh, A., Gautam, P., Kumar D, S. S., Mannam, P., Jasper, A., Gunasekaran, K., ...& Varghese, G. M. (2023). Effectiveness of adjunctive high-dose infliximab therapy to improve disability-free survival among patients with severe central nervous system tuberculosis: a matched retrospective cohort study. Clinical Infectious Diseases, 77(10), 1460-1467.	20.9
39	Baker, K. S., Jauneikaite, E., Nunn, J. G., Midega, J. T., Atun, R., Holt, K. E., ...& Peacock, S. J. (2023). Evidence review and recommendations for the implementation of genomics for antimicrobial resistance surveillance: reports from an international expert group. The Lancet Microbe.	20.9
40	Mendelson, M., Laxminarayan, R., Limmathurotsakul, D., Kariuki, S., Gyansa-Lutterodt, M., Charani, E., ...&Mpundu, M. (2024). Antimicrobial resistance and the great divide: inequity in priorities and agendas between the Global North and the Global South threatens global mitigation of antimicrobial resistance. The Lancet Global Health, 12(3), e516-e521.	19.9
41	Barman, D., Annadhasan, M., Bidkar, A. P., Rajamalli, P., Barman, D., Ghosh, S. S., ...&Iyer, P. K. (2023). Highly efficient color-tunable organic co-crystals unveiling polymorphism, isomerism, delayed fluorescence for optical waveguides and cell-imaging. Nature communications, 14(1), 6648.	16.6
42	Singh, A., Jain, A., Tabbassum, H., Siraj, F., Rishi, B., &Misra, A. (2024). Changing the paradigm of AML care in India. The Lancet Haematology, 11(1), e9	15.4

S. No.	Reference/Source	Journal Impact Factor
43	Sinha, A., Devi, K. G., Kalra, S., Mani, K., Hari, P., &Bagga, A. (2024). An open label non-inferiority randomized controlled trial evaluated alternate day prednisolone given daily during infections vs. levamisole in frequently relapsing nephrotic syndrome. Kidney International, 105(5), 1113-1123.	14.8
44	Mukherjee, A., Kumar, G., Turuk, A., Bhalla, A., Bingi, T. C., Bhardwaj, P., ...& Panda, S. (2023). Vaccination saves lives: a real-time study of patients with chronic diseases and severe COVID-19 infection. QJM: An International Journal of Medicine, 116(1), 47-56.	14.04
45	Badekila, A. K., Pai, V., Vijayan, V., &Kini, S. (2024). Engineering alginate/carboxymethylcellulose scaffolds to establish liver cancer spheroids: Evaluation of molecular variances between 2D and 3D models. International Journal of Biological Macromolecules, 254, 128058.	13.7
46	Wilson, M. L., Fleming, K. A., Sayed, S., Walia, K., & Horton, S. (2024). A world health assembly resolution on diagnostics: implications for the ESCMID community. Clinical Microbiology and Infection, 30(4), 416-418.	13.3
47	Arun, B., Joshi, M., Kakkar, A. K., Madki, S., Ivaturi, V., Chinnaswamy, G., ...&Gota, V. (2024). Bioequivalence study followed by model-informed dose optimization of a powder for oral suspension of 6-mercaptopurine. Pediatric Blood & Cancer, 71(3), e30813.	12.8
48	Kedia, S., Virmani, S., Bajaj, A., Markandey, M., Singh, N., Madan, D., ...&Ahuja, V. (2024). Coconut Water Induces Clinical Remission in Mild to Moderate Ulcerative Colitis: Double-blind Placebo-controlled Trial. Clinical Gastroenterology and Hepatology, 22(6), 1295-1306.	12.6
49	Arora, V., Yasmin, E., Tanwar, N., Hathwar, V. R., Wagh, T., Dhole, S., & Kumar, A. (2023). Pincer–Ruthenium-Catalyzed Reforming of Methanol-Selective High- Yield Production of Formic Acid and Hydrogen. Acs Catalysis, 13(6), 3605-3617.	11.3
50	Chowdhury, A., Deka, B., Jagnani, S., &Bandyopadhyay, D. (2023). Centrifugable Multiplexer Targeting Frugal Point-of-Care-Testing. IEEE Journal on Flexible Electronics.	10.6

Table No. 7: Top 50 Publications from Intramural Research

Top 50 Publications from Extramural Research

S. No.	Reference/Source	Journal Impact Factor
1	Kahol, S., &Mathur, S. (2023). 29P HUWE1 inhibition has tumor suppressive effect in triple-negative breast cancer cell lines by modulating glycolytic and immune modulatory markers. Annals of Oncology, 34, S1484.	56.7
2	Ayiraveetil, R., Chittem, M., Lakshminarayanan, S., Veeraiah, S., Penumadu, P., Pandjatcharam, J., ...&Ganesan, P. (2023). 1745P Why do adult patients with cancer abandon treatment in India? A nationwide qualitative study to understand the perspectives of healthcare workers. Annals of Oncology, 34, S946.	56.7

S. No.	Reference/Source	Journal Impact Factor
3	Madhavan, Y., Shyamsundar, V., Kuppuloganathan, M., Krishnamurthy, A., Ramshankar, V., &Venugopal, D. C. (2023). 368P Distinct gene expression profiling explored using nanostring tumor signalling 360 panel with validations in different clinical stages of oral submucous fibrosis patients: A first Indian study. Annals of Oncology, 34, S1612.	56.7
4	Singh, V., Singh, M. K., Jain, M., Pandey, A. K., Kumar, A., &Sahu, D. K. (2023, December). The relationship between BCG immunotherapy and oxidative stress parameters in patients with nonmuscle invasive bladder cancer. In Urologic Oncology: Seminars and Original Investigations (Vol. 41, No. 12, pp. 486-e25). Elsevier.	56.7
5	Ramasubbu, M. K., Hota, D., Majumdar, S. D., Mukherjee, P., &Srinivasan, A. (2023). 471TiP A group sequential, response-adaptive randomized double-blinded clinical trial to evaluate add-on olanzapine plus pregabalin to prevent chemotherapy-induced nausea and vomiting (CINV) in patients belonging to low socio-economic status. Annals of Oncology, 34, S1645.	56.7
6	Yadav, M. K., Maharana, J., Yadav, R., Saha, S., Sarma, P., Soni, C., ...&Gati, C. (2023). Molecular basis of anaphylatoxin binding, activation, and signaling bias at complement receptors. Cell, 186(22), 4956-4973.	45.5
7	Bhartiya, D., Singh, P., &Kaushik, A. (2023). Transformation of tissue-resident, very small embryonic-like stem cells (VSELs) into cancer stem cells (CSCs) and its role in cancer initiation via epigenetic changes.	42.1
8	Panwar, V., Singh, A., Bhatt, M., Tonk, R. K., Azizov, S., Raza, A. S., ...&Garg, M. (2023). Multifaceted role of mTOR (mammalian target of rapamycin) signaling pathway in human health and disease. Signal transduction and targeted therapy, 8(1), 375.	40.8
9	McQuaid, C. F., Sinha, P., Bhargava, M., Weerasuriya, C., Houben, R. M., &Bhargava, A. (2023). Tuberculosis and nutrition: what gets measured gets managed. The Lancet Respiratory Medicine, 11(4), 308-310.	38.7
10	Kelm, J. M., Pandey, D. S., Malin, E., Kansou, H., Arora, S., Kumar, R., &Gavande, N. S. (2023). PROTAC'ingoncoproteins: targeted protein degradation for cancer therapy. Molecular Cancer, 22(1), 62.	27.7
11	Qin, W., Chandra, J., Abourehab, M. A., Gupta, N., Chen, Z. S., Kesharwani, P., & Cao, H. L. (2023). New opportunities for RGD-engineered metal nanoparticles in cancer. Molecular Cancer, 22(1), 87.	27.7
12	Hasan, N., Nadaf, A., Imran, M., Jiba, U., Sheikh, A., Almalki, W. H., ...& Ahmad, F. J. (2023). Skin cancer: understanding the journey of transformation from conventional to advanced treatment approaches. Molecular cancer, 22(1), 168.	27.7
13	Gajbhiye, K. R., Salve, R., Narwade, M., Sheikh, A., Kesharwani, P., &Gajbhiye, V. (2023). Lipid polymer hybrid nanoparticles: a custom-tailored next-generation approach for cancer therapeutics. Molecular Cancer, 22(1), 160.	27.7

S. No.	Reference/Source	Journal Impact Factor
14	Maiwall, R., Pasupuleti, S. S. R., Hidam, A. K., Kumar, A., Tevethia, H. V., Vijayaraghavan, R., ... &Sarin, S. K. (2023). A randomised-controlled trial (TARGET-C) of high vs. low target mean arterial pressure in patients with cirrhosis and septic shock. Journal of Hepatology, 79(2), 349-361.	26.8
15	Sharma, N., Pandey, S., Yadav, M., Mathew, B., Bindal, V., Sharma, N., ...& Maras, J. S. (2023). Biomolecular map of albumin identifies signatures of severity and early mortality in acute liver failure. Journal of Hepatology, 79(3), 677-691.	26.8
16	Devi, A., Pahuja, I., Singh, S. P., Verma, A., Bhattacharya, D., Bhaskar, A., ...& Das, G. (2023). Revisiting the role of mesenchymal stem cells in tuberculosis and other infectious diseases. Cellular & Molecular Immunology, 20(6), 600-612.	21.8
17	Shukla, M., Verma, N. V., Mohanta, Z., Tripathi, S., &Pandya, A. (2023). A review on tunable multi-functional Prussian blue nanoparticles; their promising biological applications & future directions. Coordination Chemistry Reviews, 496, 215414.	20.3
18	Bagchi, A., Ghosh, P., Ghosh, A., &Chatterjee, M. (2023). POS0240 Effect of methotrexate upon oxidative stress mediated trans-differentiation of neutrophils in rheumatoid arthritis.	20.3
19	Singh, K., Misra, D. P., Katiyar, S., &Agarwal, V. (2023). AB0119 Evaluation of P-GP and MRP-1 expression on plasma cells and th17 lymphocytes in peripheral blood and bone marrow of lupus nephritis.	20.3
20	Singh, K., Rathore, U., Rai, M. K., Behera, M., Jain, N., Ora, M., & Misra, D. P. (2023). AB0163 Functional annotation of differentially-expressed genes between takayasu arteritis and healthy controls using whole-blood transcriptome analysis reveals differences related to protein binding and intracellular signaling processes.	20.3
21	Khan, H. Y., Ahmad, A., Hassan, M. N., Khan, Y. H., Arjmand, F., & Khan, R. H. (2024). Advances of metallodrug-amyloid □ aggregation inhibitors for therapeutic intervention in neurodegenerative diseases: Evaluation of their mechanistic insights and neurotoxicity. Coordination Chemistry Reviews, 501, 215580.	20.3
22	Pandian, J. D., Kate, M. P., Sylaja, P. N., Khurana, D., Pamidimukkala, V., Ray, B. K., ... & George, J. (2023). Secondary prevention with a structured semi-interactive stroke prevention package in INDIA (SPRINT INDIA): a multicentre,randomised controlled trial. The Lancet Global Health, 11(3), e425-e435.	19.9
23	Pattnaik, B. R., Bhatraju, N., Pb, S., Mittal, S., Arava, S., Mohan, A., ...&Madan, K. (2023). An Exhaled microRNA Panel Interrogated for Sarcoidosis and Mediastinal Tuberculosis: A Pilot Study in a TB-endemic Setting. In A27. WHITE PLAGUE (TUBERCULOSIS) RESEARCH (pp. A1207-A1207). American Thoracic Society.	19.3

S. No.	Reference/Source	Journal Impact Factor
24	Carwile, M., Zhang, V., Dauphinais, M., Cintron, C., Flynn, D., Tang, A., &Sinha, P. (2023). A Systematic Review of National Institutes of Health Funding for Tuberculosis Comorbidities. A27. WHITE PLAGUE (TUBERCULOSIS) RESEARCH, A1216-A1216.	19.3
25	Suman, S. K., Chandrasekaran, N., &Priya Doss, C. G. (2023). Micro-nanoemulsion and nanoparticle-assisted drug delivery against drug-resistant tuberculosis: recent developments. Clinical Microbiology Reviews, 36(4), e00088-23.	19
26	Fatma, B., Andrabi, S. M., Gupta, S., Verma, V., Kumar, A., Pitsalidis, C., &Garg, A. (2023). Biocompatible, breathable and degradable microbial cellulose based triboelectricnanogenerator for wearable transient electronics. Nano Energy, 114, 108628.	16.8
27	Dixit, S., Sahoo, K., Gaur, M., Sahoo, R. K., Dey, S., Gupta, V. K., &Subudhi, E. (2023). A meta-omics approach to explore the biofuel-producing enzyme potential from extreme environmental conditions. Renewable and Sustainable Energy Reviews, 186, 113670.	16.3
28	Kour, A., Panda, H. S., Singh, I. R., Kumar, A., & Panda, J. J. (2023). Peptide-metal nanohybrids (PMN): Promising entities for combating neurological maladies. Advances in Colloid and Interface Science, 318, 102954.	15.9
29	Prakash, R., Vyawahare, A., Sakla, R., Kumari, N., Kumar, A., Ansari, M. M., ...&Raza, S. S. (2023). NLRP3 inflammasome-targeting nanomicelles for preventing ischemia–reperfusion-induced inflammatory injury. ACS nano, 17(9), 8680-8693.	15.8
30	Shaikh, S., Qayoom, I., Sarvesha, R., & Kumar, A. (2023). Bioresorbable magnesium-based alloys containing strontium doped nanohydroxyapatite promotes bone healing in critical sized bone defect in rat femur shaft. Journal of Magnesium and Alloys, 11(1), 270-286.	15.8
31	Quadir, S., Khan, N. A., Singh, D. K., Faraz, A., Jhingan, G. D., & Joshi, M. C. (2023). Exposure to High Dosage of Gold Nanoparticles Accelerates Growth Rate by Modulating Ribosomal Protein Expression. ACS nano, 17(16), 15529-15541.	15.8
32	Sarma, P., Carino, C. M. C., Seetharama, D., Pandey, S., Dwivedi-Agnihotri, H., Rui, X., ...&Shukla, A. K. (2023). Molecular insights into intrinsic transducer-coupling bias in the CXCR4-CXCR7 system. Nature Communications, 14(1), 4808.	14.7
33	Barman, D., Annadhasan, M., Bidkar, A. P., Rajamalli, P., Barman, D., Ghosh, S. S., ...&Iyer, P. K. (2023). Highly efficient color-tunable organic co-crystals unveiling polymorphism, isomerism, delayed fluorescence for optical waveguides and cell-imaging. Nature communications, 14(1), 6648.	14.7
34	Bhardwaj, T., Gadhave, K., Kapuganti, S. K., Kumar, P., Brotzakis, Z. F., Saumya, K. U., ...&Giri, R. (2023). Amyloidogenic proteins in the SARS-CoV and SARS-CoV-2 proteomes. Nature Communications, 14(1), 945.	14.7

S. No.	Reference/Source	Journal Impact Factor
35	Maharana, J., Sarma, P., Yadav, M. K., Saha, S., Singh, V., Saha, S., ...&Shukla, A. K. (2023). Structural snapshots uncover a key phosphorylation motif in GPCRs driving ß-arrestin activation. Molecular cell, 83(12), 2091-2107.	14.5
36	Kaur, K., Sharma, S., Abhishek, S., Kaur, P., Saini, U. C., Dhillon, M. S., ...&Verma, I. (2023). Metabolic switching and cell wall remodelling of Mycobacterium tuberculosis during bone tuberculosis. Journal of Infection, 86(2), 134-146.	14.3
37	Uniyal, A., Tiwari, V., Tsukamoto, T., Dong, X., Guan, Y., & Raja, S. N. (2023). Targeting sensory neuron GPCRs for peripheral neuropathic pain. Trends in Pharmacological Sciences.	13.9
38	Shafi, H., Rashid, R., Rather, S. U., Reddy, D. S., Azmi, L., Abdal-hay, A., ...& Sheikh, F. A. (2023). Super disintegrating oromucosalnanofiber patch of zolmitriptan for rapid delivery and efficient brain targeting. Chemical Engineering Journal, 463, 142481.	13.3
39	Rathinavelu, S., Shanmugam, M. K., Gummadi, S. N., &Nambi, I. M. (2023). Inactivation of antibiotic resistant bacteria and elimination of transforming ability of plasmid carrying single and dual drug resistance genes by electro-oxidation using Ti/Sb-SnO2/PbO2 anode. Chemical Engineering Journal, 461, 141807.	13.3
40	Khan, S., Hassan, M. I., Shahid, M., & Islam, A. (2023). Nature's toolbox against tau aggregation: An updated review of current research. Ageing Research Reviews, 87, 101924.	12.5
41	Chakravarti, M., Dhar, S., Bera, S., Sinha, A., Roy, K., Sarkar, A., ...& Bose, A. (2023). Terminally exhausted CD8+ T cells resistant to PD-1 blockade promote generation and maintenance of aggressive cancer stem cells. Cancer research, 83(11), 1815-1833.	12.5
42	Singh, R., Hussain, J., Kaur, A., Jamdare, B. G., Pathak, D., Garg, K., ...&Sunkaria, A. (2023). The Hidden Players: Shedding Light on the Significance of Post-Translational Modifications and miRNAs in Alzheimer's Disease Development. Ageing Research Reviews, 102002.	12.5
43	Salman, M., Kumar, P., Khan, M. A., Jamal, A., &Parvez, S. (2023). Age-related pathophysiological alterations in molecular stress markers and key modulators of hypoxia. Ageing Research Reviews, 102022.	12.5
44	Basha, S., Mukunda, D. C., Rodrigues, J., D'Souza, M. G., Gangadharan, G., Pai, A. R., &Mahato, K. K. (2023). A comprehensive review of protein misfolding disorders, underlying mechanism, clinical diagnosis, and therapeutic strategies. Ageing Research Reviews, 102017.	12.5
45	Ali, M., Tiwari, P., Alam, M. M., Hattiwale, H. M., Jamal, A., &Parvez, S. (2023). Unravelling of molecular biomarkers in synaptic plasticity of Alzheimer's disease: Critical role of the restoration of neuronal circuits. Ageing Research Reviews, 102069.	12.5
46	Wali, Z., Hattiwale, S. H., Jamal, A., &Parvez, S. (2024). GLP-1/Sigma/RAGE receptors: An evolving picture of Alzheimer's disease pathology and treatment. Ageing Research Reviews, 93, 102134.	12.5

S. No.	Reference/Source	Journal Impact Factor
47	Gautam, N., Tiwari, M., Kidwai, M., Dutta, P., &Chakrabarty, D. (2023). Functional characterization of rice metallothioneinOsMT-I-Id: Insights into metal binding and heavy metal tolerance mechanisms. Journal of Hazardous Materials, 458, 131815.	12.2
48	Gupta, P., Mahapatra, A., Suman, A., Ray, S. S., Malafaia, G., & Singh, R. K. (2023). Polystyrene microplastics disrupt female reproductive health and fertility via sirt1 modulation in zebrafish (Daniorerio). Journal of Hazardous Materials, 460, 132359.	12.2
49	Kansara, S., Singh, A., Badal, A. K., Rani, R., Baligar, P., Garg, M., &Pandey, A. K. (2023, June). The emerging regulatory roles of non-coding RNAs associated with glucose metabolism in breast cancer. In Seminars in Cancer Biology. Academic Press.	12.1
50	Kulkarni, S., Bhandary, D., Singh, Y., Monga, V., &Thareja, S. (2023). Boron in cancer therapeutics: An overview. Pharmacology & Therapeutics, 108548.	12

Table No. 8: Top 50 Publications from Extramural Research

13.2 The Indian Journal of Medical Research (IJMR):

The Indian Journal of Medical Research (IJMR) is the flagship Journal of ICMR and successfully completed its 110 years of uninterrupted publication in the year 2023-24. This peer-reviewed biomedical Journal publishes 12 monthly issues under two volumes each year. In addition to original research articles, IJMR features Editorials, Commentaries, and Review/Mini Review articles on contemporary biomedical topics contributed by global experts. Other sections include Research Correspondences, View Points, Perspectives, Systematic reviews & Meta-analyses, Student IJMR, Letters to Editor, Book reviews, Policy Documents and Special/Status Reports occasionally. The Impact factor of the IJMR in 2022 as reported in the 2023 Journal Citation Reports® (Clarivate Analytics, 2023) was 4.2.

During the year 2023-24, approximately 75% of the submissions came from India, with the remaining 25% from over 60 countries. The journal engaged over 1,000 reviewers in its peer-review process and published 170 articles, with 10% originating from outside India. In total, 10 issues (including 1 special issue) were published, and nearly 2,500 submissions were received. The special issue on Substance Use/HIV/STIs was released in November-December 2023.

13.3 Journal of Vector Borne Diseases (JVBD):

The Journal of Vector Borne Diseases (JVBD) is a peer-reviewed, open-access biomedical journal published by the National Institute of Malaria Research (NIMR), New Delhi, on behalf of ICMR. It is published quarterly, in March, June, September, and December each year. JVBD is one of India's oldest journals, first published in 1947 as the Indian Journal of Malariology, which was later succeeded by The Journal of Vector Borne Diseases in 2003. In the fiscal year 2023-24, the journal published five issues, featuring articles from several countries. These publications covered critical domains such as public health, occupational hazards, environmental science, chronic disease management and implementation science, reflecting ICMR's commitment to addressing pressing health challenges both nationally and internationally.

13.4 Books, Guidelines, and Monographs:

Books and book chapters formed a significant portion of ICMR's output, with eight books and 37 book chapters published during the year spanning across specialized areas such as the

neuroprotective potential of natural molecules, occupational stress from environmental pollutants, chronic disease management strategies, and the role of diet in preventing non-communicable diseases.

Monographs published by the Discovery Research Division focused on rural diagnostic kits and preclinical research techniques. Newsletters addressed vital topics such as fertility, occupational health hazards, waste management, and virology research, thereby translating scientific findings into actionable knowledge for policymakers and the public.

ICMR also published five critical national guidelines, including the Technology Development Collaboration - 2024, the ICMR Intellectual Property (IP) Policy, and Guidelines for Utilization of Corporate Social Responsibility Funds. Additionally, consensus documents for the management of retinoblastoma and prostate cancer were released, providing standardized protocols that enhance clinical practices and patient outcomes.

The impact and significance of these publications are multifaceted. ICMR's global research footprint was enhanced through international publications on mycobacterial research and integrative omics, positioning the council as a leader in the global scientific community. Domestically, the guidelines and newsletters ensured the timely dissemination of research guidance, aiding policymakers and healthcare providers in making informed decisions and improving healthcare delivery.

Moreover, the diverse portfolio of monographs and practical guidelines focused on innovative and regionally adaptable solutions, enhancing local healthcare capabilities and addressing specific health challenges in underserved regions. Consensus documents for the management of retinoblastoma and prostate cancer exemplify ICMR's dedication to evidence-based interventions, improving clinical practices and patient care standards across the nation.

CHAPTER 14
Patents and Products

14.1 Health Technologies (Technology Transfer & Commercialization)

The year 2023-24 has been transformative for ICMR, marking significant strides in the development and commercialization of technologies aligned with national health priorities. Intellectual Property Rights (IPR) management has played a pivotal role in translating research into impactful healthcare solutions. With robust frameworks for patent filing, licensing, and technology transfer, ICMR has strengthened its role as a leader in driving product development and innovation in the healthcare sector.

ICMR's updated Intellectual Property Policy provides a strong foundation for fostering an IP ecosystem that drives biomedical research and innovation. While the impact of these measures is yet to be fully realized, the policy has established standardized frameworks for inventorship, ownership, licensing, and revenue-sharing protocols across its institutes. These steps enhance transparency and efficiency in intellectual property management, ensuring that innovations are well-positioned for future societal and economic benefits.

The revised Guidelines for Technology Development Collaboration (2024) provide a strategic framework for royalty determination, material transfer agreements, and fostering strategic partnerships. While these guidelines are still in their early stages of implementation, they define clear pathways for commercialization, facilitating the transition of innovations from research to market. This direction is expected to facilitate the development of diagnostics, therapeutics, and medical devices, ensuring a robust ecosystem for equitable benefit-sharing in the future.

Moreover, these policies have significantly contributed to advancing public-private partnerships, leveraging Corporate Social Responsibility (CSR) initiatives, and fostering collaborations with industry leaders. By cultivating an environment that supports innovation,

Overall, the updated policies reflect ICMR's commitment to building a robust IP ecosystem aligned with national health priorities. By fostering innovation and promoting equitable technology transfer, these initiatives are paving the way for impactful biomedical advancements that enhance public health outcomes.

During the review period, ICMR filed 29 Indian patents, 6 design applications, 9 copyright applications, 4 trademark applications, and 4 foreign patents. Key achievements include the commercialization of critical technologies such as the Haemophilia Diagnostic Kit, Monkeypox Virus Assay, and Nipah Virus RT-LAMP Assay. These innovations, backed by strong IP strategies, address pressing healthcare challenges and make cutting-edge solutions accessible to communities.

Beyond the numbers, the success of ICMR's IPR initiatives lies in their tangible impact on product development and deployment. By fostering public-private partnerships and leveraging CSR initiatives, ICMR has facilitated the transition of innovations from research labs to markets. Technologies such as the NutriCARE App for gastroenterological health and the Newborn Sickle Cell Screening Portal exemplify how IP-driven research can lead to transformative healthcare outcomes. These achievements underline the importance of a well-defined IPR ecosystem in advancing healthcare innovation and improving public health outcomes.

14.2 Achievements in Patents and Technology

During the period under review, Intellectual

Property generated from innovation projects funded by ICMR and intramural projects are as under[2]:

i. **Indian Patent Applications:** A total of 29 Indian patent applications were filed, including innovations in diagnostics, therapeutics, medical devices, and nanotechnology. Notable patents included advancements such as a dipstick-based test kit for Orientiatsutsugamushi detection, CRISPR-Cas13-based tuberculosis detection tools, biodegradable scaffolds for wound healing, and point-of-care testing devices.

ii. **Foreign Patent Applications:** Four foreign patents were filed, showcasing global outreach. These included a fluorescent latex bead-based biosensor, colorimetric isothermal assays for bacterial detection, and patents were filed in Russia, Europe, Indonesia, and the Philippines.

iii. **Granted Patents:** 18 Indian patents were granted, encompassing a range of innovations such as diagnostic devices for asthma-COPD differentiation, eco-friendly mosquito larval traps, and CRISPR-engineered knockout cells. Additionally, four foreign patents were granted, including methodologies for tuberculosis drug susceptibility and SARS-CoV-2 detection.

iv. **Copyright Applications:** Nine copyrights were filed for diverse outputs, including apps, educational materials, and databases. Key applications included the Burn Injury Community Survey App, the SSAHAY youth health app, and educational materials on snakebite for healthcare workers.

v. **Design Applications:** Six design applications were filed, focusing on usability and technological innovation. These included innovations like tamperproof sample drying chambers, versatile compact immunoassay devices (VCHARI and PVCHARI), and an integrated electrode system.

vi. **Trademark Applications:** Four trademark applications were filed, including "ClinBG14" for blood group antigen detection and "PrescReSof" for healthcare software. Certificates for two trademarks were issued, reflecting recognition of these innovations.

vii. **Products Developed, Transferred and Commercialized:** ICMR successfully licensed and commercialized multiple healthcare technologies, enhancing their accessibility and potential impact. In the area of bleeding disorders, the Haemophilia Diagnostic Kit was licensed to Bharat Biotech India Pvt. Ltd., facilitating improved diagnostics for patients. In viral diagnostics, two critical technologies were commercialized: the Monkeypox Virus Assay, licensed to Axiva Sichem Biotech and Acrannolife, and the Nipah Virus RT-LAMP Assay, licensed to Acrannolife Genomics and Karwa Enterprises.

14.3 Case Studies: Technologies developed through intramural/extramural grants

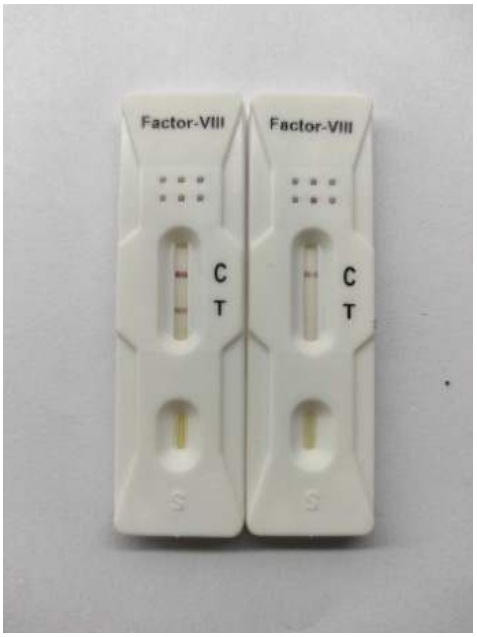
i. Haemophilia and von Willebrand disease point of care kit: First in the World

Haemophilia A and von Willebrand Disease (vWD) are two of the most common lifelong inherited bleeding disorders, characterized by symptoms such as joint bleeding, bruising, and soft tissue bleeding. Women with vWD are particularly at risk of heavy menstrual bleeding and excessive bleeding during childbirth. India has the second-largest Haemophilia population globally, with an estimated 1.5 lakh individuals affected, and approximately 1% of the general population suffering from vWD. However, these disorders remain significantly underdiagnosed due to the limited availability of laboratories equipped to perform gold standard tests and the high costs of diagnosis, which range from ₹2,000 to ₹9,000. Only 27,000 Haemophilia cases are diagnosed and registered with Haemophilia Federation India. To address these challenges, the ICMR-NIIH, Mumbai, has developed the world's first diagnostic kits for

[2] Annexure II Patent, Copyright , Design and Trademark Details

Haemophilia A and vWD. These innovative kits enable rapid, accurate diagnosis using just one drop of blood or plasma, making point-of-care testing feasible at all levels of public health infrastructure.

With the technology transferred to Bhat Biotech India Pvt. Ltd., the kits will be commercially available at an affordable cost of few hundred rupees, significantly improving accessibility to diagnostic services nationwide. It was launched by Hon'ble Union Minister, Ministry of Health and Family Welfare, Government of India, Government of India: Dr. Mansukh Mandaviya in the august presence of Prof. S.P. Singh Baghel and Dr. BharatiPravinPawar, Hon'ble Ministers of State Ministry of Health and Family Welfare at Manekshaw Center Auditorium at New Delhi.



POC Testing Kit for diagnosis of Haemophilia and von Willebrand disease (vWD)

ii. Method and Kit involving Club Cell protein 16 as a marker for Silicosis/ Silico-Tuberculosis

Silicosis is an incurable, irreversible and progressive lung occupational disease caused by prolonged exposure to respirable crystalline silica dust, leading to lung inflammation and fibrosis. It is usually diagnosed at an advanced stage where the prognosis is poor. Affected individuals are also at higher risk of TB and lung cancer. With an estimated 12.5 million silicosis-affected individuals, India's goal of eliminating TB by 2025 faces a significant challenge. Controlling silicosis through early detection is key, but requires a reliable predictive marker. To address this, ICMR-NIV (Mumbai Unit) and ICMR-NIOH have jointly developed a point-of-care (POC) silicosis screening kit for early detection.

This novel POC technology has been developed with 95% sensitivity and 99% specificity, requiring only 10 µl of serum for testing. This field-deployable assay eliminates the need for instruments or extensive technical expertise, making it ideal for use in resource-limited settings. It serves as a proxy marker for periodic screening and early detection of silicosis among workers exposed to silica dust. The technology has been successfully transferred to Axiva Sichem Biotech, Delhi, and Acrannolife Genomics Pvt. Ltd., Chennai, marking a significant step toward improving silicosis screening and diagnosis in vulnerable populations.

POC Testing for Silicosis Screening

iii. Development of a colorimetric isothermal assay for detection of Monkeypox virus

Monkeypox is a zoonotic viral disease that has re-emerged as a global public health concern, with cases reported in over 121 countries between January 2022 and September 2024. Early and accurate diagnosis is crucial for controlling its spread, but conventional diagnostic methods like real-time PCR require sophisticated instruments, highly skilled personnel, and extended processing times, limiting their utility in resource-constrained settings.

To address these challenges, the ICMR-NIV developed a novel colorimetric isothermal loop-mediated amplification (LAMP) assay for the rapid detection of Monkeypox virus. This innovative assay targets the Orthopoxvirus genus-specific B6R gene and the Monkeypox virus-specific F3L gene, providing high sensitivity and specificity (both 100%). The technology is designed for use at the point of care, requiring only a single heating device and no specialized technical expertise. Results are visually interpretable based on a color change from pink to yellow within 40 minutes, making it user-friendly and cost-effective. The assay's affordability and simplicity make it suitable for deployment in healthcare centers, surveillance laboratories, airports, and other frontline facilities.

This LAMP assay represents a significant advancement in public health diagnostics, overcoming the limitations of traditional PCR-based tests. With technology transfer underway and commercialization expected soon, this innovation promises to enhance early detection and containment of Monkeypox outbreaks, both in India and globally.

The technology has been transferred to AxivaSichem Biotech, Delhi, and Acrannolife Genomics Pvt. Ltd, Chennai.

iv. Development of a non-permissive cell line for Poliovirus

As global poliovirus eradication nears its final stages, safe handling and containment of potentially infectious materials (PIMs) – such as fecal or respiratory samples – remain critical to preventing facility-associated risks..Laboratories working with human or Laboratories working with non-polio enteroviruses (NPEVs) face challenges since human and monkey cell cultures used in research are susceptible to poliovirus, making compliance with WHO-GAP III containment guidelines financially and logistically demanding.

To address this, ICMR's National Institute of Virology (NIV) has developed a novel Poliovirus Non-Permissive Cell Line using CRISPR/Cas9 gene-editing technology. By knocking out the CD155/PVR gene – essential for poliovirus entry – this modified RD cell line (RD-SJ40) prevents poliovirus growth while maintaining full susceptibility to NPEVs. The innovation

ensures safe handling of PIMs without the need for extensive containment facilities. Validated across three national laboratories using over 600 stool samples, the RD-SJ40 cells demonstrated high efficacy in isolating NPEVs without poliovirus contamination.

This breakthrough technology is a significant step toward minimizing poliovirus-associated risks in research and diagnostics, aligning with global containment guidelines and enabling cost-effective laboratory practices post-eradication. The technology has been transferred to Acrannolife Genomics Pvt. Ltd, Chennai and Karwa Enterprises Pvt. Ltd, New Delhi by ICMR-NIV.

v. CEREBO®: A novel machine learning powered near-infrared spectroscopy based device

Traumatic brain injuries (TBI) are a significant public health challenge, particularly in emergency settings, rural areas, and underserved populations where advanced diagnostic tools like CT or MRI scans are inaccessible or delayed. Traditional methods, such as the Glasgow Coma Scale (GCS), are prone to errors and subjective interpretations, while imaging techniques require specialized infrastructure, trained personnel, and are cost-intensive. To address this issue, CEREBO® - a portable, non-invasive brain injury diagnostic tool - has been developed using advanced near-infrared spectroscopy technology powered by machine learning.

Capable of detecting intracranial bleeding and edema within a minute, CEREBO® provides color-coded, radiation-free, and cost-effective results. Designed for deployment in ambulances, trauma centers, rural clinics, and disaster response units, it enhances early TBI detection and patient outcomes.

Developed through a collaboration between ICMR-MDMS, AIIMS Bhopal, NIMHANS Bengaluru, and Bioscan Research, CEREBO® has undergone clinical validation, regulatory approvals, and feasibility studies, paving the way for global adoption in emergency and military healthcare systems.

Portable Non-Invasive Brain Injury Diagnostic tool

vi. Mobilab-The Nanotechnology based affordable, portable and easy to use multidiagnostic point-of-care device for Kidney, Liver, Heart, and Pancreas disorders

Non-communicable diseases, such as kidney, liver, heart, and pancreas disorders, remain a leading global health challenge, particularly in underserved and remote areas with limited diagnostic access. Traditional diagnostic methods require centralized laboratories, sophisticated infrastructure, and prolonged processing times, which delay timely interventions and limit access to care

for vulnerable populations. To address this, Mobilab, a nanotechnology-based, portable diagnostic device, has been developed under the ICMR-DHR Centre of Excellence at IIT Guwahati in collaboration with Primary Healthtech Pvt. Ltd.. This battery-operated, IoT-enabled device analyzes 25+ health parameters from a single blood sample, delivering AI/ML-powered, real-time results within minutes.

The collaboration between IIT Guwahati's Centre for Nanotechnology and ICMR's Medical Device and Diagnostics Mission Secretariat (MDMS) has been instrumental in Mobilab's development. Clinical validation studies conducted at AIIMS Delhi and Guwahati Medical College ensured its reliability and accuracy across diverse healthcare settings. Regulatory approvals, including CDSCO certification, further validate its safety and efficacy. Its portability, affordability, and rapid testing capabilities make it a game-changer for rural clinics, mobile health camps, and disaster response units, bridging critical gaps in healthcare delivery.

Portable multi diagnostic POC device

iv. TrueNat® M. leprae assay

Leprosy, a chronic infectious disease caused by Mycobacterium leprae, remains a public health challenge, especially in endemic regions where early diagnosis is critical to reduce transmission and prevent disabilities. However, the absence of sensitive, field-friendly diagnostic tools has hindered timely identification and treatment, particularly for early and paucibacillary (PB) cases. Traditional diagnostic methods are limited to clinical expertise, which is declining due to leprosy's reduced prevalence, and existing molecular techniques require sophisticated laboratory infrastructure, delaying diagnosis. To overcome these barriers, the TrueNat® M. leprae assay—a portable, multiplex PCR-based diagnostic tool—has been developed. Running on the TrueLab® Real-Time micro-PCR platform, this battery-powered system detects three specific genes (RLEP, 16SrRNA, SodA) with high sensitivity (93%) and specificity (100%), delivering results within an hour, including DNA extraction.

Developed by The Leprosy Mission Trust India and Molbio Diagnostics Pvt. Ltd., with support from ICMR, the assay is currently under large-scale validation and has received a manufacturing license from CDSCO. With its successful deployment, it is expected to significantly reduce leprosy cases and support India's goal of zero leprosy by 2030.

POC diagnostic kit for Leprosy

Table 1: Indian and Foreign Patent Applications

S. No.	Tile of invention	Patent Application no	Filing Date	Intramural/ Extramural
1.	Design and Fabrication of a Microgel Membrane in Paper Device for Nucleic Acid based Point of Care Testing.	202311034763	18 May 2023	Extramural
2	Paper-Based Aptasensor for the Detection of the Four Serotypes of Dengue Virus	202311035529	May 22, 2023	Extramural
3	Novel Trivalent Iron Nanoparticles Electroporated Outer Membrane Vesicles	202311037297	May 30, 2023	Intramural
4	A dipstick-based test kit for the detection of Orientia tsutsugamushi and method of detection thereof"	202311040300	June 13, 2023.	Intramural
5	An aqueous stable leuprolide composition	202311038988	Jul 21, 2023	Extramural
6	Development and In-Vitro Characterization of Rare Earth Phosphate Coatings for Biodegradable and Biocompatible Magnesium based Temporary Implants.	202311053235	August 08, 2023	Extramural
7	"A biodegradable scaff"a biodegradable scaffold for deep wound healing and methods for preparation and application thereof"	202311055273.	August 17, 2023	Extramural

S. No.	Tile of invention	Patent Application no	Filing Date	Intramural/ Extramural
8	Development of a safe and cost-effective universal Shigella	202311061296	12 September 2023	Intramural
9	“High-voltage high-frequency pulse power supply for dielectric barrier discharge device to generate cold atmospheric plasma”	202311062859.	September 19, 2023.	Extramural
10	“Non-invasive differential diagnosis of non-diabetic kidney disease from diabetic nephropathy by analysing urinary exosome microRNA”	202311063851	September 22, 2023	Extramural
11	liposomal formulations of decitabine for leukemia treatment and methods thereof”	202311064593	September 26, 2023.	Extramural
12	“A composition for diabetes-associated complications”	202311067322	October 07, 2023	Intramural
13	glycoconjugate containing Salmonella Typhi outer membrane protein T2544 and Salmonella Typhimurium O-specific polysaccharide.	202311070211	October 16, 2023	Intramural
14	"Design and development of Point of care test for Cardiac Troponin I and T"	02311070640	October 17, 2023	Extramural
15	“Robotic intubation system for precise and safe endotracheal intubation”	202311072640	October 25, 2023	Extramural
16	“A CRISPR-CAS13-based tool for rapid detection of mycobacterium tuberculosis.	202311071943	October 20, 2023	Intramural
17	Anti-psoriatic drug loaded microneedles patch for the treatment of psoriasis.	202311080385	November 27, 2023.	Extramural
18	A Biodegradable Mg-Alloy And Method for Preparation Thereof.	202311089083	December 27, 2023	Extramural
19	A near-infrared scanning laser ophthalmoscope system for imaging of human retina: apparatus and method	202311090140	December 30, 2023	Extramural
20	Method and electronic device for selecting one or more carbon dots for optimal quantum yield	202411000119	January 01, 2024	Intramural
21	Formulation development of solid self-emulsifying drug delivery system (Solid SEDDS) of Luliconazole using hot melt extrusion technology.	202411004994	January 24, 2024	Extramural
22	Immunodiagnostic Kits for Detection of Aspergillus Fumigatus in Sera of Patients with Bronchial Asthma and Pulmonary Tuberculosis.	202411008706	February 08, 2024.	Intramural
23	Multiplexed biosensing device for detection of antibiotic- resistant bacteria	202411015293	March 01, 2024	Extramural

S. No.	Tile of invention	Patent Application no	Filing Date	Intramural/ Extramural
24	A method and a kit for detecting scrub typhus	202411015407	March 01, 2024	Intramural
25	A diagnostic device for observing cell-free reactions	202411016083	March 07, 2024	Intramural
26	Tubeless extraction of nucleic acid using biofunctionalized paper devices.	202411016536	07th March 2024	Extramural
27	Micro RNAs in urinary exosomes predicted incident chronic kidney disease (CKD)	202411018711	March 14, 2024	Extramural
28	Carbon-based conductive ink composition, method of preparation and fabrication of degradable screen- printed electrode thereof".	202411019519	March 16, 2024	Extramural
29	An intravenous pharmaceutical medicament for candidiasis infection.	202411019977	March 18, 2024	Intramural

Foreign Patent				
S. No.	**Foreign application number**	**Application title**	**Date of filing**	**Intramural/ Extramural**
30	Russia Patent App. no.: 2024103427	Fluorescent latex beads based nano-biosensor for detection of specific circulating cell-free miRNAs.	February 12,2024	Intramural
31	EP app. no. 22779318.9.	Development of a colorimetric isothermal assay for detection of Corynebacterium diphtheria.	Sept. 20, 2023	Intramural
32	Indonesia Patent App No. P00202309223		Sept. 20, 2023	
33	Philippines App. No: 1-2023-552700		Sept. 26, 2023	

Table No. 9: Indian and Foreign Patent Applications

Table: Indian and Foreign Patent granted during the period

S. No.	Tile of invention	Patent no	Grant Date	Intramural/ Extramural
Indian Patent				
1	A diagnostic device and method for differentiating asthma-copd overlap syndrome (aco) from asthma and copd	435183	19/06/2023	Extramural

2	MAPCON-A Consensus based Myeloid Anti-Microbial Peptide	435514	June 26, 2023	Intramural
3	A process for the preparation of an eco-friendly dehairing protease engyme from bacillus sp. For leather Processing"	435940	27/06/2023	Intramural
4	Sulphadoxine and pyrimethamine (sp) Resistance in plasmodium falciparum, through loop-mediated isothermal Amplification (lamp)	438631	13/07/2023	Intramural
5	An apparatus for detection of Precancerous lesions of uterine cervix	451103	12/09/2023	Intramural
6	An improved alcoholic composition and methodology therefor	451267	13/09/2023	Extramural
7	Nano-engineered biodegradable polymer-composite for bone-sift tissue fixation application	452521	18/09/2023	Extramural
8	A novel pro-apoptotic peptide for selective elimination of malignant cells	458643	12/10/2023	Intramural
9	A combustible coil composition	462167	26/10/2023	Intramural Extramural
10	A process for the chemical synthesis Of alpha hydroxy succinamic acid; a herbal antidiabetic compound isolated From e. Jambolana	467810	09/11/2023	Extramural
11	A squa-tool apparatus	484477	18/12/2023	Extramural
12	A paper disc based method for Determining the drug susceptibility of mycobacterium tuberculosis	471729	22/11/2023	Extramural
13	Device for developing germfree and gnotobiotic mosquitoes	11202202863Q	11 /12/2023	Intramural
14	Structure of eco-friendly mosquito larvae trapping device	490754	28/12/2023	Intramural
15	Neuro-endoscope box trainer	501025	19/01/2024	Extramural
16	Tricompartmental microcarriers for management of parkinson's disease	493164	02/01/2024	Extramural
17	A multi-serotype outer membrane vesicles (momv) of shigellae as a novel candidate vaccine	502420	23/01/2024	Intramural
18	Poliovirus receptor (PVR/CD155) knockout cells derived from RD (human rhabdomyosarcoma) cell line by CRISPR	513045	21/02/2024	Intramural
19	A non-invasive system for detection of analytes and applications thereof	514056	22/02/2024	Intramural

Foreign Patents				
20	A paper disc based method for determining the drug susceptibility of Mycobacterium tuberculosis.	South African Patent 2022/11453	April 26, 2023	Extramural
21	A rapid and sensitive method for detecting SARS-COV-2	Italy Patent no. 1120220 00176184	February 09, 2024	Intramural
22	In-Vitro Detection of Human Parvovirus-4.	Brazil patent no. BR 11 2017 009321 9	March 5, 2024	Intramural
23	Device for developing germfree and gnotobiotic mosquitoes	Singapore 11202202863Q	Dec. 11, 2023	Intramural

Table No. 10: Indian and Foreign Patent granted during the period

Table: Copyright applications

S. No.	Tile of invention	Copyright app. no	Filing Date	Intramural/ Extramural
1	Burn Injury Community Survey (BICS) APP	11540/2023-CO/SW	3/05/2023	Extramural
2	Gene Expression Profiling and Design a Novel Genetic Database of Non syndromic Hearing Loss	12836/2023-CO/L , May 16,2023	May 16,2023	Extramural
3	PrescReSof”	Registration Number : SW-16762/2023 12701/2023-CO/SW	06/07/2023 15/05/2023	Intramural
4	Blind funnel method for prioritising essential health products	Diary No. 10962/2023-CO/L Registration Number : 135332/2023	03/10/2023	Extramural

Table No. 11: Copyright applications

Table: Design applications

S. No.	Tile of invention	Design app. no	Filing Date	Intramural/ Extramural
1	Tamperproof Samples Drying Chamber	385576-001	17/07/2023	Extramural
2	Versatile Compact Health And Research Immunoassay [VCHARI] Device	393333-001	August 22, 2023	Intramural
3	Poly Versatile Compact Health And Research Immunoassay [PVCHARI] Device	393334-001	August 22, 2023	Intramural
4	Cell culture plate with interconnected wells	400143-001	17/11/2023	Intramural
5	Integrated Electrodes System	407644-001	4 /03/ 2024	Extramural
6	Solid bulleted porous PLIF spinal cage	409308-001 Date of Issue Certificate: 02/05/2024	02/03/2024	Extramural

Table No. 12: Design applications

Table: Trademark application

S. No.	Tile of invention	Application no.	Filing Date	Intramural/ Extramural
1	Multiplex PCR assay for clinically significant common antigens in Kell, Kidd, Duffy, Rh and MNS blood group system; Trademark app. Titled: ClinBG14	6194911	23 Nov. 2023	Intramural
2	GDzyme	6194910	23 Nov. 2023	Intramural
3	ClinBG14	6194911	23-11-2023 Issued certificate: 03/06/2024	Intramural

Table No. 13: Trademark application

CHAPTER 15
Support Services

As evidenced by its extensive and varied publication portfolio, ICMR is at the forefront of biomedical research and public health advances in India. In 2023-24, ICMR disseminated quality scientific research output through a variety of publication formats including but not limited to books, journals, guidelines, and reports.

15.1 ICMR Research Publications

The Indian Council of Medical Research (ICMR) achieved a remarkable milestone this year, with over 3,300 research papers published in peer-reviewed journals. This impressive output includes 1,809 papers from extramural research initiatives and 1,500 from intramural research efforts. Notably, the global impact of ICMR's research is highlighted by over 40 intramural papers published in prestigious journals with an impact factor exceeding 20. This achievement signifies the organization's leading role in addressing critical health challenges on a global stage. These publications address critical issues across a spectrum of fields, including public health, occupational hazards, environmental science, chronic illness management, and implementation science, reflecting ICMR's holistic and interdisciplinary strategy. By integrating innovation with practical implementation, ICMR continues to shape health policies and solutions that benefit both India and the global community.

Data from the year also reveal that 1.75% of ICMR publications were published in top 1%, 8.69% of publications were in the top 10%, and 27.81% of publications were through international collaborative research.

The extensive publication activities of the ICMR during the course of the year and collaboration with esteemed international publishers have amplified the reach and impact of ICMR's research, reinforcing its position as a leader in the global scientific community. A robust publication framework will continue to remain essential to ICMR's objective of improving public health outcomes and supporting global health goals as it broadens its research scopes. The list of top 50 publications that have resulted from Intramural and Extramural Research is provided below:

A. **Tuberculosis:** ICMR advanced the development and validation of innovative technologies to improve the diagnosis and management of Tuberculosis (TB). Over the past year, several advanced tools and diagnostic kits have been evaluated and validated, contributing to more effective detection and monitoring of TB. Key initiatives include:

i. **Cy-Tb (New Skin Test for Latent TB):** The validation of the Cy-Tb intradermal skin test marks a promising advancement in the diagnosis of latent TB, a critical step in TB control and prevention efforts.

ii. **Molecular Diagnostic Kits**: Several molecular tests, including the Pathodetect MTB & NTM detection kit, were evaluated for their sensitivity and specificity in detection in TB suspects, compared to the microbiological reference standard.

iii. **PRORAD Atlas (Mobile Handheld X-ray Machine):** This portable and mobile X-ray technology was validated to enhance the accessibility and convenience of TB screening, especially in remote and underserved areas.

iv. **AI-Assisted Diagnostic Tools:** The development of AI-driven tools for the automated reading and reporting of Line Probe Assay (LPA) strips and X-ray images has been a breakthrough in streamlining TB diagnostics and improving accuracy in interpretation.

v. **RT-PCR Kits and Sputum Transportation:** Five new RT-PCR kits and a sputum transportation kit were validated for their efficiency in TB detection, ensuring reliable and swift diagnosis, even in resource-limited settings.

vi. **Cy-TB for Children:** The validation of the Cy-TB test for paediatric TB diagnosis represents a major step forward in improving TB detection in children, an often-underdiagnosed group.

These technological advancements are pivotal in enhancing early diagnosis, improving treatment outcomes, and driving the nation's efforts toward achieving TB elimination.

B. **Vector borne diseases:** ICMR made significant progress in devising control strategies for vector-borne diseases through research, development and validation of new tools to improve early detection, diagnosis, and management of diseases. Few notable examples include:

i. **Dengue:** Laboratory performance evaluation of Dengue NS1 Rapid Diagnostic Test (RDT) kits and ELISA kits to ensure reliable and timely detection.

ii. **Lymphatic Filariasis**: Field validation of the Q Filariasis Antigen Test (QFAT) to improve diagnostic accuracy in endemic areas.

iii. **Malaria:** Lot testing of malaria diagnostics to evaluate their performance in field conditions and ensure quality control.

iv. **Vector Control:** Insecticide and larvicide testing for effective vector control measures to combat the spread of vector-borne diseases.

v. **Kala-azar:** Validation of the Kala-azar Dipstick Test as part of efforts to streamline diagnosis and treatment in endemic regions.

vi. **Japanese Encephalitis:** Development and validation of JEV IgM ELISA kits for more efficient and accurate diagnosis of Japanese Encephalitis.

C. **Neonatal Sepsis:** Supported by the ICMR Task Force grant, the Droolie biomarker test-panel has been developed to screen for early onset neonatal sepsis, offering a promising diagnostic tool for timely intervention and improved neonatal outcomes.

D. **Blood related conditions**

i. **Anaemia:** ICMR conducted validation studies on innovative non-invasive devices aimed at improving the accuracy and accessibility of anaemia diagnostics.

ii. **Haemophilia:** In collaboration with Bharat Biotech, ICMR validated the Haemophilia A rapid card test, aimed at efficient diagnosis of Haemophilia A and Von Willebrand Disease (VWD).

iii. **Sickle Cell Disease Diagnostic Technologies:** ICMR validated a range of innovative diagnostic tools for Sickle Cell Disease, including the Sickle Cell Rapid Test Kit, Sickle Cell Point-of-Care Diagnostic Kit, and Point-of-Care (POC) devices, to enhance early and accessible detection methods

ICMR validated 35 technologies, primarily in tuberculosis, chest X-ray interpretation, blood disorders, transfusion-transmitted infections, vector-borne diseases, preclinical trials, and molecular diagnostics.

15.2 Support to National & State Programs: Strengthening India's Public Health Programs

In 2023-24, ICMR provided multifaceted support to numerous central and state government health programs. This spanned a range of critical health areas, from combating infectious diseases like tuberculosis to advancing maternal and child health, mental health, and universal health coverage. By offering technical expertise, innovative diagnostic solutions, and evidence-based policy guidance, ICMR supports the implementation and strengthening of public health initiatives nationwide.

ICMR's Support to National & State Programs

Program Area	Program Name	Details of Support
Communicable Diseases		
Tuberculosis	Central TB Division, MoHFW	Evaluation and validation of diagnostic kits, vaccines and Cy-Tb
	Central TB Division	Support for TB diagnostics
	National TB Elimination Program	Molecular diagnostic machine, Pathodetect, handheld X-rays, active case finding support support with state teams
	National Tuberculosis Elimination Program	Collaborative support
	Adult BCG Vaccination	Protocol development and launch support
Vector-Borne Diseases	National Vector Borne Disease Control Programme	Strategic communication and advocacy for prevention
HIV/AIDS	National AIDS Control Programme (NACP)	HIV Estimation. Member of the technical committee for equipment, kit, and drug specifications
Outbreak Control	State Outbreak Control Program	Provision of epidemiological Support for outbreak investigations Surveillence for IDSP State Health Support
Universal Immunisation Programme	National Technical Advisory Group on Immunization (NTAGI) and Adverse Events Following Immunization (AEFI) Secretariat	Expert member Conduct of vaccine related studies for guiding policy
Reproductive & Child Health and Nutrition		
Nutrition	Anemia Mukt Bharat	Technical input on IV iron use during pregnancy
	POSHAN Abhiyan	Recommendations to improve quality and uptake of take-home rations
Newborn Health	Home-Based Newborn Care & Home-Based Care for Young Child	Technical input for strengthening Information, Education, Communication (IEC) component
	India Newborn Action Plan (INAP)	Evidence on stillbirth risk factors and interventions to reduce stillbirth

Non-Communicable Diseases		
Hypertension	Indian Hypertension Control Initiative (IHCI)	Support for program upscaling
Sickle Cell Anemia	National Sickle Cell Anemia Elimination Mission	Development of a user-friendly device for SCD mass screening
Snakebite	National Action Plan for Prevention and Control of Snakebite	Stakeholder and expert group representation
Mental Health	National Mental Health Program	Drafting workflows for Community Health Officers
Oral Health	National Oral Health Program	Expert member on steering committee for the National Oral Health Program (NOHP), MoHFW

Table No. 14: ICMR's Support to National & State Programs

Over the past year, ICMR institutes have also strengthened several national and state health programs through a range of support services. This included providing training and capacity building, offering implementation support, delivering diagnostic and treatment services, conducting monitoring & evaluation, and contributing data collection and epidemiology expertise to various public health initiatives. Institutes also aided in policy development with research insights and supported dissemination of findings.

Key programs supported by ICMR Institutes include the National TB Elimination Program, Integrated Disease Surveillance Program, National Rabies Control Program, National Sickle Cell Anemia Elimination Mission, National Filaria Control Programme, National Viral Hepatitis Control Program, and the Ayushman Bharat – Pradhan Mantri Jan Arogya Yojana (AB - PMJAY), among others.

This breadth of ICMR's contributions to government health programs underscores unwavering commitment to improve health outcomes in India. By providing comprehensive support across diverse program areas, ICMR amplifies the impact of public health interventions. Through its strategic support, ICMR empowers a responsive health system that is well-prepared to address present and future public health challenges, guiding India closer to its vision of a Viksit Bharat 2047.

15.3 ICMR's Frontline Role in Tackling Emerging Health Threats

In the past year, ICMR and its institutes were at the forefront of India's response to numerous national disasters and infectious disease outbreaks. From pioneering rapid diagnostic tools for Mpox and enhancing surveillance for zoonotic diseases, to coordinating emergency responses in Nipah and measles outbreaks, ICMR's interventions were critical in both preventing and managing public health threats and has strengthened India's resilience against emerging health challenges. Notable examples include:

A. **Mpox:** During the Mpox outbreak, ICMR and its institutes, particularly ICMR-NIV, Pune, made significant strides in the rapid detection and management of the disease. Their efforts include the development of diagnostic technology and the surveillance of Mpox cases across India.

i. **Development of India's First Rapid Mpox Test Kit:** ICMR-NIV developed India's first rapid Mpox (monkeypox) test kit, a pioneering tool that provides results within an hour and costs between Rs.350 to Rs.400, meeting the urgent need for timely diagnosis.

ii. **Technology transfer:** ICMR's technical guidance supported firms in further developing, manufacturing, and

commercializing this vital diagnostic tool, bolstering India's capacity to handle Mpox outbreaks efficiently.

iii. **Surveillance and Case Detection:** ICMR-NIV played a critical role in identifying Mpox cases, including five cases in Kerala in 2023. Through enhanced surveillance, ICMR-NIV also detected a case of buffalopox in Kerala in January 2024.

B. **Nipah virus:** In response to the Nipah virus outbreak in Kozhikode, Kerala, ICMR and its institutes played a pivotal role in outbreak investigation, rapid response, and containment efforts. Key actions included contact tracing, environmental investigation, active-case finding, and establishing epidemiological links to manage virus transmission effectively.

i. **Outbreak Support and Laboratory Assistance:** ICMR-NIRRCH deployed scientists to work alongside the ICMR-NIV Mobile Containment Lab to provide laboratory support and establish testing facilities for immune monitoring during the 2023 outbreak. Training for nurses and lab staff on biosafety and point-of-care testing further strengthened local capacity.

ii. **Coordinated Emergency Response:** ICMR Headquarters, with support from ICMR-NITVAR (formerly ICMR-NARI) facilitated the international procurement of monoclonal antibodies from Australia. It was administered to a patient with a relapse in Kozhikode, marking a critical intervention in the outbreak management.

C. **Measles:** During the measles outbreaks in 2022-2023, ICMR-NIRTH Jabalpur responded rapidly to outbreaks in Satna and Maihar, collaborating with the WHO team for investigation and sample collection to facilitate timely diagnosis. ICMR-NIV Mumbai Unit significantly ramped up testing efforts, processing a 10-fold increase in samples compared to previous years.

D. **Hepatitis** A Virus: During the Hepatitis A outbreak near Jabalpur, ICMR teams swiftly intervened with timely diagnosis, comprehensive door-to-door surveys, and community awareness efforts on virus transmission and preventive measures. In another instance, ICMR-NIRBI, Kolkata analyzed water samples from Hooghly district, where jaundice cases were reported. Of the samples received, six out of nine tested positive for Hepatitis A virus, highlighting ICMR's pivotal role in early detection and response to viral outbreaks.

E. **Yellow Fever Preparedness:** In response to the potential yellow fever threat posed by Operation Kaveri, a mission launched by the Government of India in April 2023 to evacuate Indian nationals from crisis-hit Sudan, ICMR institutes played a pivotal role in ensuring public health safety. ICMR established protocols for managing febrile illness among Sudan evacuees, enhancing preparedness for yellow fever diagnosis. Regional and state VRDLs were trained and activated for rapid response, while ICMR-NIV, Pune strengthened its diagnostic capabilities to facilitate swift testing and timely intervention.

F. **COVID-19:** ICMR-NIRT, Chennai pioneered the use of advanced scanning technology to explore potential links between sudden deaths and post-COVID syndromes. The COVID-19 testing laboratory at ICMR-NIIH, Mumbai efficiently managed a daily capacity of 150-200 tests, handling samples from various regions. From April 2023 to March 2024, 3,197 samples were processed, with 308 testing positive.

G. **West Nile Virus:** ICMR -VCRC, Puducherry conducted a West Nile Virus outbreak investigation in Thrissur district, Kerala, in May 2023. This critical intervention helped assess outbreak dynamics and reinforced surveillance efforts in affected regions.

Additionally, ICMR and its institutes played a crucial role in investigating and managing multiple health outbreaks across India. This included examining 15 acute diarrheal disease outbreaks, identifying sources and pathogens in seven cases, enabling swift containment

and mitigation. ICMR-NIV, Pune, provided vital support during acute conjunctivitis and mumps outbreaks, confirming an outbreak of infectious conjunctivitis in Kalburgi district where 54.5% of cases tested positive. Furthermore, ICMR-NIV, Pune, led investigations into dengue and chikungunya outbreaks in Maharashtra and conducted an assessment in Jorhat, Assam, identifying Aedes mosquito breeding sites and alerting local health authorities for prompt intervention.

CHAPTER 16
Collaborations

16.1 NATIONAL COLLABORATION

The Council had several national collaborations with government institutions, state government departments, technical agencies, and private institutions.

The government institutions included the Central Tuberculosis Division (CTD), the National Institution for Transforming India (NITI) Aayog, Central Drugs Standard Control Organization, the National Health Systems Resource Centre, the Department of Education (Ministry of Education) Central Council for Research in Ayurvedic Sciences (Ministry of AYUSH), Department of Science & Technology, Department of Biotechnology, Translational Health Science and Technology Institute, Council of Scientific & Industrial Research (Ministry of Science and Technology in India) Society for Applied Microwave Electronics Engineering & Research, Centre for Materials for Electronics Technology, Centre for Development of Advanced Computing (Ministry of Electronics and Information Technology) IIT Delhi, IIT Madras, IIT Bombay, Indian Council of Agricultural Research and its institutes and the Department of Animal Husbandry & Dairying, Northeast Space Application Centre, Andhra Pradesh Med-Tech Zone to name a few.

Collaboration with Indian states for projects predominantly included states of Andaman & Nicobar Islands, Assam, Arunachal Pradesh, Delhi, Gujarat, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Odisha, Punjab, and Rajasthan State Health Departments of Meghalaya, Mizoram, Tripura and Arunachal Pradesh, Manipur State Government, Senapati District Student Association (SDSA) and Department of Health Service, Manipur, Assam State Health Department, Government of Sikkim, Government of Rajasthan, Government of Telangana Health and Family Welfare Department of 5 states namely Punjab, Gujarat, Madhya Pradesh, Orissa, Puducherry.

The private institutions included CADILLA Pharma, SERUM Institute, India HIV/AIDS Alliance, Resolve to Save Lives, Government Institute of Social Sciences Greater Noida; and JP Institute of Information Technology, Noida and Taru Leading Edge

Some of the Medical Colleges/institutions collaborations included PGIMER, Chandigarh Kasturba Medical College, Manipal, AIIMS New Delhi, AIIMS, Jodhpur, AIIMS Bibinagar, AIIMS, Patna, AIIMS, Rishikesh, AIIMS, Bhopal, AIIMS, Raipur, AIIMS, Jodhpur, AIIMS, Bhubaneswar, Gauhati Medical College, Guwahati, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Dayanand Medical College & Hospital, Ludhiana, Guru Angad Dev Veterinary & Animal Sciences University, Lady Harding Medical College New Delhi, , VMMC & Safdarjung hospital, New Delhi, SGPGI, Lucknow, CMC Vellore, JIPMER, Pondicherry, Sri Ramchandra Medical College & Research Institute, Chennai, St.John's National Academy of Health Sciences Bengaluru, SKIMS, Srinagar, IPGMER Kolkata, SMS, Jaipur, AFMC, Pune, NEIGRIHM, Shillong, KGMC, Lucknow, KEM, Mumbai, GMC. Amritsar, NIZAM Institute of Medical Science, Hyderabad, Telangana, R&R Hospital, New Delhi, VMMC & Safdarjung Hospital, New Delhi, CMC Vellore, JIPMER, Pondicherry, Sri Ramchandra Medical College & Research Institute, Chennai, St.John's National Academy of Health Sciences Bengaluru, SKIMS, Srinagar IPGMER Kolkata, PGIMER Chandigarh, SMS, Jaipur, AFMC, Pune, NEIGRIHM, Shillong. Some of the other collaborations included CAMH, Kolkata, SRHU, Dehradun, NEIGRIHMS, Shillong, and ROHC, Banglore.

Outlined below is an example that highlights the collaborative efforts and valuable contibutions of collaborators

16.1.1 The Medtech Mitra Collaboration

NITI Aayog, Central Drugs Standard Control Organization (CDSCO), and ICMR joined hands to

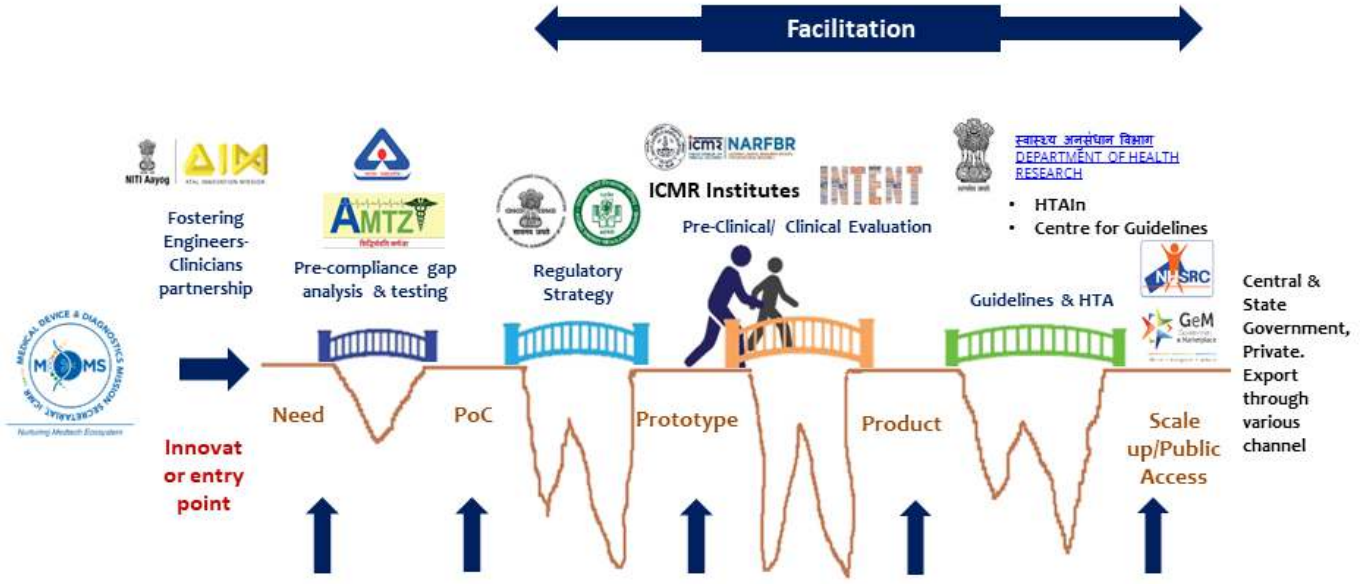
create a common platform called 'MedTech Mitra' for providing handholding support to innovators for clinical evaluation, regulatory facilitation, and uptake of new products.

ICMR is the key facilitator for the following:

i. Fostering collaboration between engineers and clinicians for unmet need-driven technology development

ii. To act as an 'Information source' for:

- Applicable Standards
- Testing and/ or Manu-facturing facilities
- Funding Opportunity
- I.P. Advisory



Knowledge partners and their defined areas of expertise for the Medtech Mitra initiative

16.1.2 NOTABLE NATIONAL MoUs/ MoA

a. ICMR-Faculty of Medical Research (FMR) was established in collaboration with Academy of Scientific Innovative Research (AcSIR), under CSIR, wherein a Memorandum of Agreement (MoA) was signed between ICMR and AcSIR, after in principal approvals from the Hon'ble FM on 8th December 2023. Establishment of ICMR-FMR will surely pave the way for new avenues in the biomedical research and trans-disciplinary fields for enrolment of students for academic programs at the level of Masters, Doctoral or any other academic programs in medical research for medical and non-medical students; medical and non-medical students selected at ICMR Institutes will be allowed to enroll at any of the existing Faculty of Study of AcSIR to encourage trans-disciplinary research. The first call of Ph.D enrollment under this newly established FMR will be advertised in June 2024 by AcSIR.

b. MoU was signed with prestigious research and academic institutions AIIMS Bhopal, AIIMS Deoghar and Balaghat University for fostering research on tribal Health by ICMR-NIRTH.

c. MoU was signed between NACO and AIIMS-New Delhi, ICMR-NARI, ICMR-NICED, ICMR-NIE, PGIMER-Chandigarh, and RIMS-Imphal). It is a long-term partnership with MoU revised every year since 2003 by ICMR NIMS.

d. MoU was signed for Strengthening Mortality statistics through e-Mor in Tamil Nadu on 11 April 2023 by ICMR-NCDIR.

e. BMHRC signed MoUs with People's Hospital, Noble Hospital and Hajela Hospital

respectively to provide cashless facility to the employees and their dependents at CGHS rates for facilities.

f. MoU was signed by Dr. Manisha Shrivastava, BMHRC Director In-charge, and Dr Sandeep Bhalla, Associate Vice President, ECHO India on 19th January, 2023,.

g. MoU was signed between ICMR-BMHRC and ICMR-NIREH to give medical students best facilities.

h. BMHRC honored the blood donors at Indian Institute of Science Education and Research (IISER) on the occasion of World Youth Day with a MoU signed that the two institutions would work together for treatment of staff and students of IISER, Bhopal

i. MoU was signed between ICMR-RMRIMS and BHU Varanasi on 6th Oct. 2023 for taking science to greater heights

j. Signing of MoU between ICMR and NIHFW on 15.03.2024 at the ICMR Hqrs, on Standard Treatment Workflows (STWs)

16.2 NOTABLE INTERNATIONAL COLLABORATIONS

Details of MoUs/Agreements signed/renewed– The following MoUs were signed by the International Health Division, ICMR from April 2023-March 2024 for advancing health research.

1. A LoA between the ICMR and The Bill & Melinda Gates Foundation (BMGF), USA on Health Research was signed on 12th March, 2024 at ICMR Hqrs. New Delhi. The LoA aims to cooperate in supporting and promoting mutually beneficial health research in line with some of India's important health priorities.

2. An MoU between ICMR and the African Union (AU) was signed on 27thMarch, 2019 at ICMR, New Delhi. First Addendum to the MoU between AU & ICMR on India - Africa Health Sciences Cooperation was signed on 29th September, 2023 and 18th October, 2023 respectively for a period of 3 years.

3. Implementing Agreement between ICMR & NIDDK was signed on 15th June, 2023 & 29th June, 2023 respectively for a period of 10 years. This Implementing Agreement was signed in accordance with the MoU between the HHS and the MOHFW concerning Cooperation in the field of Health and Biomedical Sciences, signed at New Delhi on 28th September, 2021.

4. LoI between the Indian Council of Medical Research (ICMR), and the Coalition for Epidemic Preparedness Innovations (CEPI), To work together in furtherance of achieving their shared goal of supporting the development and evaluation Vaccine Research, Development and Innovation was signed on 23rd February 2023 at New Delhi

5. MoU between the Indian Council of Medical Research (ICMR) under Department of Health Research (DHR) and the Institute for Basic Science (IBS) under Ministry of Science and ICT (MSIT), Republic of Korea in the field of Basic and Health Research was signed by ICMR on 1st Dec 2023 and IBS on 8th January 2024

i. List of activities conducted under MoU

a. Joint call for proposals under ICMR-Deutsche Forschungsgemeinschaft e.V. (DFG), Germany MoU: Under the MoU signed on 15th December 2021 between Deutsche Forschungsgemeinschaft e.V. (DFG) and Indian Council of Medical Research (ICMR), a joint call for proposals was announced in the area of Toxicology in June, 2023. As part of this joint call, 18 joint proposals were submitted and reviewed by both sides, resulting in 2 joint projects being approved and funded jointly.

b. Joint call for proposals under ICMR-International Aids Vaccine Initiative, USA MoU: 16 joint Expression of Interests were received against the joint call launched on 31st March 2023, which were reviewed by experts in India and Africa. Based on the scores, full proposals were submitted and scientifically robust and comprehensive joint proposals were placed before the Apex Committee and 4 joint proposals were jointly funded under the call.

c. **Indo-Sweden Collaboration** – Under Bilateral Call for Proposal in the Area of Aging 2022-5, projects are ongoing.

d. **US Collaboration in Diabetes** – AIIMS, Delhi, Center for Communication and Change-India (CCCI), Gurugram, and SRM University, Chennai. (All three projects have been completed. Bilateral MoU has been renewed during visit of Hon'ble PM to USA in June 2023).

CHAPTER 17
Outreach Activities

The outreach activities of ICMR are primarily designed to connect organizations, institutions, or individuals with specific communities or target audiences aiming to provide public health-oriented information and services, foster engagement, build relationships, or address the health-related needs of the community while promoting the goals of the council. Some major outreach activities in 2023-24 included workshops and training sessions in areas such as public health, clinical research, laboratory techniques, community awareness programs on public health or disease prevention, healthcare camps, collaborative programs, and field visits and surveys. ICMR and its institutes also engaged actively in various health-related activities at school level, which include various behavioral change communications in the area of nutrition, vector-borne diseases, adolescent health, maternal and child health and TB. Additionally, ICMR participated in more than 50 exhibitions across India during this period.

As part of its outreach activities, ICMR also leveraged digital communication, utilizing social media platforms such as Facebook, Instagram, Twitter, and YouTube, as well as media communication through press briefings. These platforms help disseminate important updates, research findings, guidelines, and health advisories to a wider audience. Additionally, ICMR also participates in exhibitions based on recommendations of Hon'ble Member of Parliament, state governments, and other ministerial departments in different parts of India. These exhibitions attract large footfalls, providing ICMR with opportunities to showcase its research activities to students and other stakeholders.

Some major outreach activities of ICMR in FY 2023-24 addressed a wide range of public health initiatives aimed at tackling regional and national health challenges:

i. Advanced training programs for health officials and researchers in diagnostics and outbreak management.

ii. Community-based HIV prevention campaigns and innovative healthcare models like PrEP

iii. Awareness events tied to India's G20 Presidency and health literacy programs for tribal populations.

iv. Mobile diagnostic units and workshops focused on tackling diseases like dengue, scrub typhus, and Japanese encephalitis.

v. Sickle Cell Anemia Elimination Mission, training healthcare workers and addressing non-communicable diseases in tribal regions.

vi. Development of vector surveillance tools and training communities on vector-borne disease control

vii. Awareness campaigns and diagnostic programs for tuberculosis and leprosy.

viii. Pre-clinical research and capacity building in biomedical innovation.

ix. Diagnostic kits for visceral leishmaniasis and TB developed and community awareness initiatives conducted.

x. Advanced TB elimination through operational research and evaluated HIV programs in multiple states.

xi. Contributed to the National HIV surveillance and hosted workshops on data quality improvement.

xii. Engaged in malaria control through research, community outreach, and training programs.

Together, these efforts underscored ICMR's commitment to enhancing public health, disease prevention, and capacity building across diverse communities in India. Some of the activities are pictorially presented here.

Auto-immune Disease Community Awareness Program on the occasion of 'The World Lupus Day'

Cancer Awareness Program among school students conducted by ICMR-National Institute of Cancer Prevention & Research (ICMR-NICPR), Noida

A comprehensive Hemophilia laboratory workshop at AIIMS Patna on 'Path to Access & Treatment (PACT)' from 20th to 22nd January, 2023

Tuberculosis preventive treatment administration for Agate workers in Khambhat, Gujarat

Workshop on “Advanced TB Diagnostics” at ICMR-National Institute for Research in Tuberculosis (ICMR-NIRT), Chennai

CHAPTER 18
Government Initiatives

In the reporting year, over 26000 participants attended Government of India initiatives organized by the ICMR institutes. Key initiatives included Swachchta Abhiyan, Nikshay Mitra, Yoga Day, Hindi Pakhwada, Vigilance Awareness week, National Pharmaco Vigilance Week, Fit India Movement, Rashtriya Ekta Diwas, Samvidhan Diwas, Poshan Maah, etc.

Swachchta Abhiyan

The Swachh Bharat Abhiyan, launched under the leadership of Prime Minister Narendra Modi, is a nationwide cleanliness campaign inspired by Mahatma Gandhi's vision of a clean and hygienic India. The campaign has mobilized millions, including government officials, celebrities, athletes, and spiritual leaders and the public to address sanitation issues. It extends beyond cleanliness to tackle problems like the lack of toilets in households, which impact public health. Social media campaigns like #MyCleanIndia have further amplified participation.

ICMR and its Institutes organized cleanliness drives, lectures, and felicitated cleaning staff, witnessing participation of over 4,000 employees. The activities were aimed at creating garbage-free public spaces and spreading awareness.

ICMR-NIP, New Delhi observing the Swachchta Abhiyan

ICMR-NIP, New Delhi observing the Swachchta Abhiyan

Swacchata Shramdaan organised by ICMR-NCDIR, Bengaluru

ICMR took Swachhta Pledge - a commitment to cleanliness, health, and a greener tomorrow

ICMR took part in Swachh Bharat Abhiyan cleanliness drive

Hindi Pakhwada

Hindi Pakhwada Celebration at ICMR Headquarters

Like every year, this year also Hindi Fortnight Celebration was organized in Indian Council of Medical Research New Delhi and Its Institutes across India, from 16th September to 29th September, 2023. During Hindi Fortnight, various competitions like 1. Hindi General Knowledge and Essay, 2. Hindi Noting and Drafting, 3. Hindi Dictation, 4. Hindi Typing, 5. Hindi Speech Competition and 6. Hindi Poetry Recitation Competition etc. were organized for the staff of the Headquarters. Two competitions were organized for the permanent staff of the centers / institutions of the Headquarters: - Hindi Speech and Hindi Poetry Recitation Competitions, under the chairmanship of Dr. Rajiv Bahl, Secretary, Government of India and Director General of the ICMR and in the presence of Mrs. Manisha Saxena, Senior Deputy Director General Administration, Dr. R. Lakshminarayanan, Deputy Director General (Admin.), Shri Jagdish Rajesh, Assistant Director General (Admin.), Hindi Diwas celebration and award distribution was organized.

ICMR-NICED celebrating the Hindi Pakhwada

ICMR-NIOH In-charge Director, Dr. Shantasabuj Das, addressing the employees during the inauguration ceremony of Hindi Pakhwada

Hindi Pakhwada Celeberation at ICMR Head Quarter

While inaugurating the Hindi Diwas celebrations and Kavi Sammelan, Secretary, Government of India and Director General of the ICMR addressed the Officers/Employees of the Council in his speech and said that Hindi is a scientific, widespread, rich, strong and lively language. He also urged all the officers and employees of the Council headquarters and all the Centres/Institutions to do all their daily official work in the official language Hindi.

Yoga Day

Yoga, an ancient gift from Indian tradition, has become a trusted method for enhancing physical and mental well-being. Recognizing yoga's holistic benefits, June 21 was declared International Yoga Day by the UN General Assembly, following Prime Minister Modi's initiative. The UNGA recognized Yoga as a holistic approach to health, emphasizing its role in promoting overall well-being and striking a balance in life. In ICMR, the celebration of the day involved Yogasana session demonstration and lectures by some health experts with around 1800 employees participating in the event.

ICMR-NIRTH celebrating the 9th International day of Yoga

ICMR-NIMR celebrating the Yoga Day

The 9th International Yoga Day (21 June, 2023) at ICMR-NIV Chief Guest: Prof. Dr. D. Sathyanath, Senior Medical Officer, NIN, Pune

Vigilance Awareness week

Organized by the Central Vigilance Commission (CVC), Vigilance Awareness Week promotes ethics, transparency, accountability in governance and elimination of corruption. Observed annually around Sardar Vallabhbhai Patel's birthday on October 31, the initiative includes a three-month preventive vigilance campaign. In 2024, Vigilance Awareness Week was held from October 28 to November 3, and ICMR organized activities like vigilance pledge by the staff members, vigilance awareness rally, with participation of around 1800 employees.

Vigilance Awareness week observed by ICMR-NITVAR

Fit India Movement

The Fit India Movement, launched by Prime Minister Narendra Modi on August 29, 2019, encourages citizens to integrate fitness into their daily lives. The initiative aims to promote fitness as enjoyable, easy, and free while spreading awareness about physical activities that enhance health. In 2024, ICMR joined the national movement, through an event that witnessed participation of around 100 employees.

In addition to the above, ICMR and its institutes also observed National Pharmacovigilance Week, Sexual Harassment At Workplace Prevention Week, Ayushman Bhav Campaign, Drivers Day Celebration, Tuberculosis Day, National Science Day, Sports Day, Environment Day, Earth Day, National Unity Day, Constitution Day, Republic Day, Independence Day, Poshan Maah, Gandhi Jayanti, Women's Day, Rashtriya Ekta Diwas, Samvidhan Diwas, Poshan Abhiyan, and AIDS Day

E-governance Initiative:

ICMR has implemented various e-governance initiatives to streamline project management, administrative processes, and financial operations at HQ and across its institutes. Notable achievement is the development and deployment of the electronic Project Management System (ePMS) that enables efficient handling of submissions, evaluations, and financial aspects related to project evaluations. Additionally, the eBill system was introduced to manage institutional expenditures and grants, further enhancing financial governance. Significant progress has been made in adopting e-office systems, with approximately 40,578 e-files created and maintained across ICMR institutes.

Software tools have been integral to these efforts, with several specialized applications complementing the e-office system. For instance, the ICMR Balance Software and G. Pay Software are used for fund management and payroll processing, respectively. The SFACTS system has been adopted for governance and administrative purposes, providing centralized management of key operations.

ICMR has also implemented additional tools tailored to specific requirements. The Leave Management System, and Budget Management Portal have been used to support workflow automation and resource management. Similarly, systems like PFMS, GeM, and Biometric software have been utilized for procurement, fund flow management, and attendance tracking. Other institutes have integrated LAN-based software, salary management software, and customized accounting tools such as the ICMR-TATA Accounting Software to enhance operational efficiency.

These e-governance measures resulted in a substantial transition to digital workflows, with some institutes eliminating the use of physical files. As these initiatives continue to expand, they will further strengthen the digital infrastructure of the ICMR.

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