ICMR
INDIAN COUNCIL OF MEDICAL RESEARCH
Serving the nation since 1911

Azadi Ka Amrit Mahotsav

Changing the Nation's Health Landscape

75 Stories that Celebrate the Spirit of New India

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NEW DELHI

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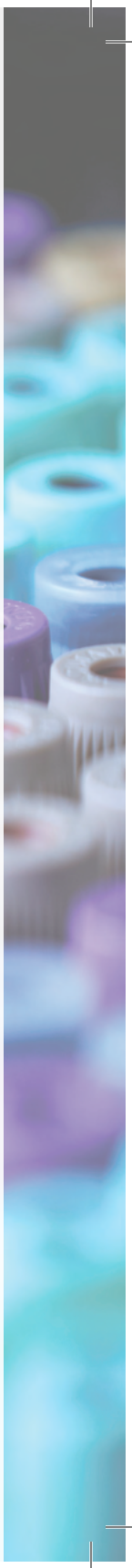


Acronyms

ASHA	Accredited Social Health Activists
AES	Acute Encephalitis Syndrome
AFP	Acute Flaccid Paralysis
AIIMS	All India Institute of Medical Sciences
AI	Avian Influenza
AMR	Antimicrobial Resistance
AMRSN	Antimicrobial Resistance Surveillance & Research Network
AMSP	Antimicrobial Stewardship Programme
ART	Assisted Reproductive Technology
BBIL	Bharat Biotech International Limited
BCG	Bacillus Calmette–Guérin
BGDRC	Bhopal Gas Disaster Research Centre
BSL	Biosafety Levels
CDC	Centers for Disease Control and Prevention
CDV	Canine Distemper Virus
CTD	Central Tuberculosis Division
CHPV	Chandipura Vesiculovirus
CTRI	Clinical Trials Registry - India
CCMP	Comprehensive Case Management Programme
CU	Communication Unit
DEC	Diethylcarbamazine Citrate
DIAMOnDS	DHR-ICMR Advanced Molecular Oncology Diagnostic Services
DOTS	Directly Observed Treatment Short course
DFS	Double Fortified Salt
EWS	Economically Weaker Sections
ENDS	Electronic Nicotine Delivery Systems
ERC	Enterovirus Research Centre
EAR	Estimated Average Requirements
FCTC	Framework Convention on Tobacco Control
GAELF	Global Alliance on Elimination of Lymphatic Filariasis
HTAIn	Health Technology Assessment
HPAI	High Pathogenic Avian influenza
HAFs	Home Available Fluids
HRRC	Human Reproductive Research Centres
IAHSM	India Africa Health Sciences Meet
ITRC	India Tuberculosis Research Consortium
IDU	Injecting Drug Users
ImTeCHO	Innovative Mobile-phone Technology for Community Health Operations
ICPO	Institute of Cytology and Preventive Oncology
IRR	Institute for Research in Reproduction
JALMA	Japan Leprosy Mission for Asia
JEV	Japanese encephalitis virus
KEM	King Edward Memorial Hospital
KFD	Kyasanur Forest Disease
LPAI	Low Pathogenic Avian influenza
LF	Lymphatic Filariasis
MEDP	Malaria Elimination Demonstration Project
MDA	Mass Drug Administration
MMV	Medicines for Malaria Venture
MIC	Methyl Isocyanate

MSU	Mobile Stroke Units
MDTVs	Mobile TB Diagnostic Vans
NARI	National AIDS Research Institute
NCDIR	National Centre for Disease Informatics and Research
NGCP	National Goitre Control Programme
NIRRH	National Institute for Research in Reproductive Health
NIRTH	National Institute for Research in Tribal Health
NIRT	National Institute for Research in Tuberculosis
NICPR	National Institute of Cancer Prevention and Research
NICED	National Institute of Cholera and Enteric Diseases
NIE	National Institute of Epidemiology
NIIH	National Institute of Immunohaematology
NIMR	National Institute of Malaria Research
NIN	National Institute of Nutrition
NIOH	National Institute of Occupational Health
NIV	National Institute of Virology
NNMB	National Nutrition Monitoring Bureau
NRSN	National Rotavirus Surveillance Network
NVBDCP	National Vector Borne Disease Control Programme
NiV	Nipah Virus
OPV	Oral Polio Vaccine
PHC	Primary Health Center
PEM	Protein Energy Malnutrition
RMRIMS	Rajendra Memorial Research Institute of Medical Sciences
RCT	Randomised Control Trials
RTPCR	Reverse Transcriptase Polymerase Chain Reaction
RDAs	Recommended Dietary Allowances
RMRC	Regional Medical Research Centre
RC-VRDL	Resource Centre for the Virus Research and Diagnostic Laboratory Network
RVV	Rotavirus Vaccine
SARS	Severe Acute Respiratory Syndrome
SLT	Smokeless Tobacco Use
STW	Standard Treatment Workflows
TUL	Tolerable Upper Limits
TDT	Triple Drug Therapy
TB	Tuberculosis
UNICEF	United Nations International Children's Emergency Fund
VCRC	Vector Control Research Centre
VL	Visceral Leishmaniasis
WHO	World Health Organization
ZIKVD	Zika virus Disease

Foreword

As we commemorate 75 years of India's independence, we continue to strive towards realising a vision of activating a new India, fueled by the spirit of *Atmanirbhar Bharat*. Since India's independence, the Indian Council of Medical Research (ICMR) has been committed to transform India's public health landscape and ensure the health and wellbeing of India and its people. ICMR has led initiatives cutting across a wide spectrum of issues like communicable diseases, non-communicable diseases, maternal and child health, nutrition, tribal health, environmental health. The Council continues to draw its inspiration from its ability to provide solutions to the current national health challenges and to prepare effectively for those emerging in the future.

After 75 years of India's independence, ICMR remains committed to its vision of translating research into action for improving the health of the population. The Council strives to provide critical support to the government in a consistent and targeted manner, thereby enabling the implementation of the government's policies. ICMR's expertise in generating evidence for policy formulation, disease surveillance, capacity building, designing, and implementing health strategies, clinical trials, provides significant impetus to the national efforts to bring India closer to achieving universal health coverage.

This photobook is a compilation of 75 success stories of ICMR as an example of the Council's relentless pursuit to transform the public health landscape of India and impact the quality of human lives, during the last 75 years since India's independence. It specifically covers the Council's leading work in research, diagnosis, surveillance, and therapeutics during the COVID-19 pandemic which has enabled the country in fighting a novel virus. The publication acknowledges the concerted efforts of all ICMR institutes, partners, governing bodies, etc. that have, in a variety of ways, impacted the quality of human lives. The inspiring stories in the book are a testament to the fact that innovative and dedicated efforts in a targeted manner could bring significant improvements in health outcomes.

Each success story is a product of the untiring efforts of dedicated teams working at the ICMR and its institutes. The focus has always been on providing unique solutions especially designed to suit the local contexts. This book highlights some of ICMR's landmark contributions in ensuring a healthy India. I wish to thank all the staff and scientists of ICMR for their insightful contribution in bringing this publication alive. I am confident of a great future for ICMR where the power of science and research is able to overpower the health challenges faced by our country, especially in cases of global pandemics.

Balram Bhargava
Director General, ICMR

COVAXIN

Bharat ki Apni vaccine

The COVAXIN is the first COVID-19 vaccine entirely developed in India by ICMR-National Institute of Virology (NIV) and Bharat Biotech International Limited (BBIL). In March 2020, following the successful isolation of the SARS CoV-2 virus at ICMR-NIV, ICMR entered into a public-private partnership with BBIL to develop the virus isolate into an effective vaccine candidate. The former characterized the vaccine developed by BBIL through in-vitro experiments and animal studies. The demonstrated efficacy of the vaccine has been highlighted in more than nine international scientific journals and doses have been supplied beginning January 2021 to support the national vaccine rollout program. In November 2021, COVAXIN was provided emergency use listing (EUL) from the WHO. Apart from this, COVAXIN has also received emergency use approval in countries around the world. Regulatory approvals for the vaccine are in process for other countries as well. The 'bench to bedside' journey of COVAXIN took less than eight months demonstrating a self-reliant India's capabilities to fight the COVID-19 battle.

On successful isolation of the SARS CoV-2 virus at ICMR-NIV, ICMR entered into a public-private partnership with Bharat Biotech International Limited to develop the virus isolate into an effective vaccine candidate.


Vaccine
Covid-19

COVAXIN

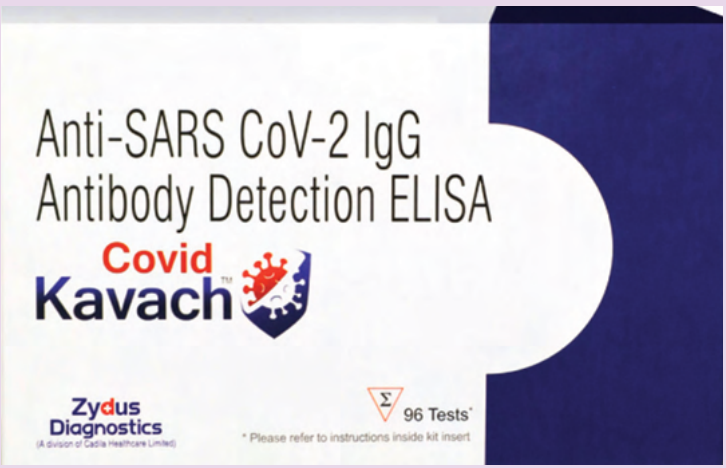

VT-TNV


INDIA LEADS
INNOVATION WITH
COVAXIN
COVAXIN
READY TO VACCINATE INDIA
BHARAT BIOTECH
1ST INDIGENOUS
COVID-19
VACCINE
COVAXIN
BHARAT BIOTECH

2

COVID Kavach ELISA: ICMR-NIV's indigenous test kit for antibody detection

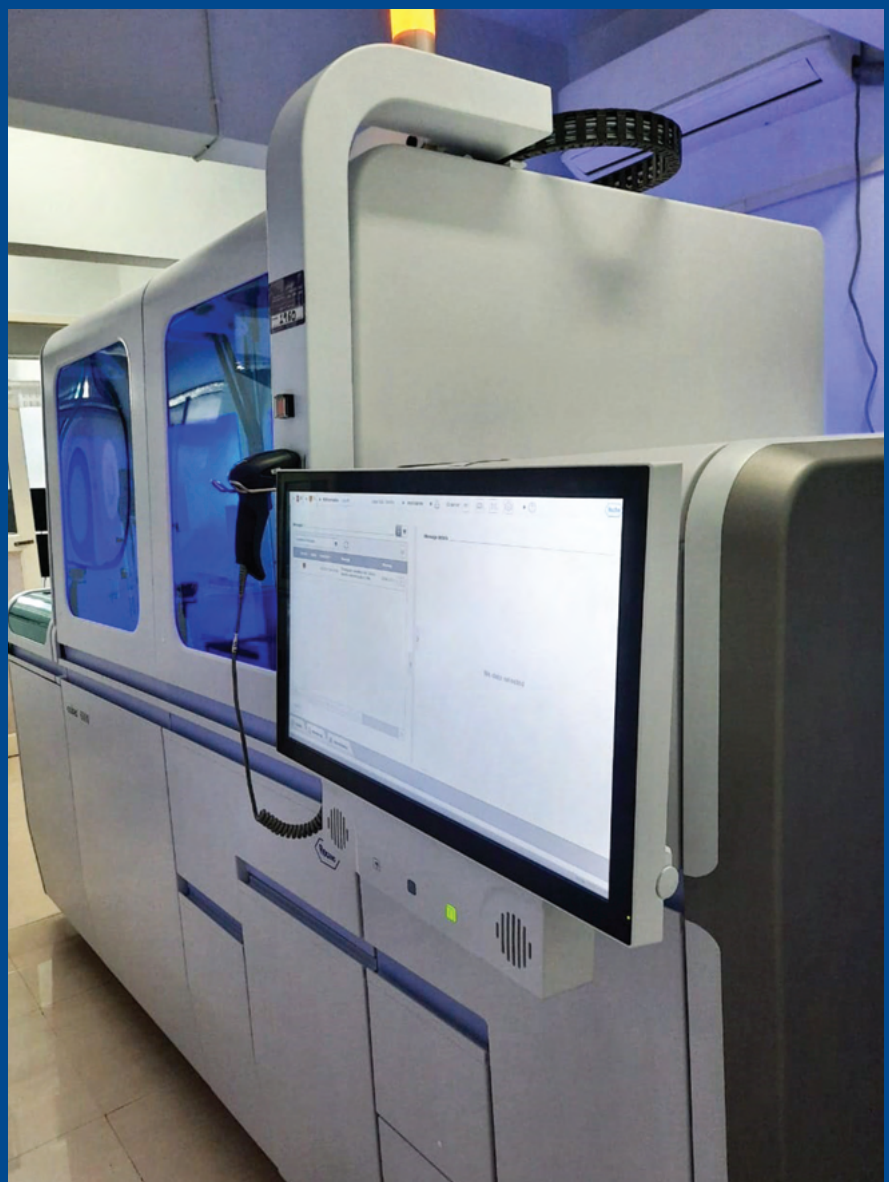
Ever since COVID-19 came to India, ICMR has been at the helm of affairs to battle the pandemic in an effective way. In one of the many path-breaking achievements by the council, scientists at ICMR-National Institute of Virology (NIV) successfully developed India's first indigenous antibody testing kit 'ELISA' to combat COVID-19. It is a kind of blood test similar to rapid antibody tests, which detect antibodies in the blood to find out whether an individual was infected with COVID-19 infection. The ELISA kit has played an active role in the surveillance of the proportion of the population exposed to COVID-19. These kits were used during serological surveys conducted by ICMR and its institutes across India as they are able to process 90 samples together in a single run of two-and-a-half hours. Moreover, ELISA based testing is easily possible even at district level and allows efficient testing even in the remotest corners of the country. ELISA antibody Covid-19 Test kit is a powerful solution for the diagnostic labs to fast-pace India's comprehensive monitoring and detection process. There are also minimal biosafety and biosecurity requirements as compared to the real-time RT-PCR test. This test has an advantage of having much higher sensitivity and specificity as compared to the several rapid test kits.



3

Ramping up the pan-India COVID-19 testing network

The COVID-19 pandemic posed a challenging situation for countries across the world. In India, ICMR has been a nodal organisation in the fight against COVID-19 not only through strategy and timely treatment but also by ensuring access to necessary resources and facilities on the ground. To prevent and control the outbreak of COVID-19, ICMR prioritized increasing the number of labs and tests. After establishing labs in every district, ICMR worked to augment the testing capacity across the country. ICMR escalated the testing from one lab in January 2020 to over 3,050 labs by December 2021. In a notable achievement led by ICMR, the first COVID-19 laboratory was set up in May 2020 in the Union Territory of Ladakh – accomplishing a challenging task of setting up a laboratory at a height of 18 thousand feet. Apart from this, a state-of-the-art COVID-19 testing machine was also installed at Patna's Rajendra Memorial Medical Science Research Institute (RMRIMS) to expedite the testing of samples. ICMR continuously encouraged the 'test, track and treat' strategy, followed by approval of antigen testing in Delhi to ensure quicker test results and at the same time, allowing private laboratories to conduct COVID-19 tests to tackle the increasing number of cases.



Dealing with Nipah virus outbreak

In 2018, a deadly outbreak took place in the Kozikhode district of Kerala, which claimed the lives of 19 people. Later it was found that this was the first Nipah virus (NiV) outbreak in southern India, located far from the two earlier outbreaks in 2001 and 2007, in eastern India. In June 2019 there was a second outbreak in Kerala, with only one patient testing positive for the NiV disease. The Nipah virus disease is scary because of high mortality rates, similar to that of the Ebola virus. Add to this the lack of vaccines or definitive treatment and the fact of human-to-human transmission, and the panic it creates is understandable. The virus has a natural reservoir in fruit-eating bats of the genus *Pteropus*. Though bats remain healthy despite the virus being shed in their saliva and urine, the same is not the case once it enters some other mammal, who gets sick and may pass on the disease to others.

ICMR-NIV, Pune confirmed both the outbreaks and undertook extensive onsite training of health workers. ICMR-NIE, Chennai further provided epidemiological support for outbreak investigation to the Government of Kerala and identified risk factors for mortality. An expeditious outcome, in the aftermath of the Kerala experience, was the development and validation of a point-of-care test for NiV – the first of its kind in the world. Indigenous serological assays were developed for screening of humans, bat and swine. A country-wide serosurvey in bats (reservoir of NiV infection) led to understanding the role of *Pteropus* bats in the transmission. ICMR-NIV, Pune and ICMR-NIE, Chennai actively contributed to a global research collaboration to test the m102.4 monoclonal antibodies on humans. A research platform, involving nine countries from the WHO SEAR was established, pooling expertise and resources for a variety of emerging and re-emerging diseases.

5

Containing Zika virus outbreak

The first evidence for Zika virus circulation in India had been established in 1954 by ICMR-NIV, Pune. Zika virus infection was declared a Public Health Emergency of International Concern in February 2016 by the WHO, following outbreaks in Brazil and other countries. As part of the country's preparedness, the Resource Centre for the Virus Research and Diagnostic Laboratory Network (RC-VRDL) at ICMR-NIV, rapidly optimized the protocols for laboratory diagnosis of Zika virus disease, developed diagnostic and research capacities and trained manpower from identified laboratories including VRDLs. Establishment of a countrywide network was a critical step by ICMR and ICMR-NIV, for responding to the threat of ZIKVD in India. This network started screening for ZIKVD in pregnant women, patients with Acute Febrile illness (AFI) and other suspected cases, including microcephaly. The first case of ZIKVD in Ahmedabad, Gujarat, in December 2016 was confirmed by ICMR-NIV, Pune. Sporadic cases in Gujarat, Rajasthan, Tamil Nadu, and Madhya Pradesh during 2017-2018 and outbreaks in Rajasthan and Madhya Pradesh during 2018 were identified. ZIKVD was reported in July 2021, in Kerala along with Kanpur and Pune with confirmation by ICMR-NIV, Pune. The proactive role of ICMR-NIV in setting up the laboratory surveillance network has helped in timely detection and management of ZIKVD in the country. ICMR-NIE, Chennai provided evidence through a cohort study post the outbreak that did not find any significant increase in the risk of adverse pregnancy outcomes among ZIKVD positive pregnant women.

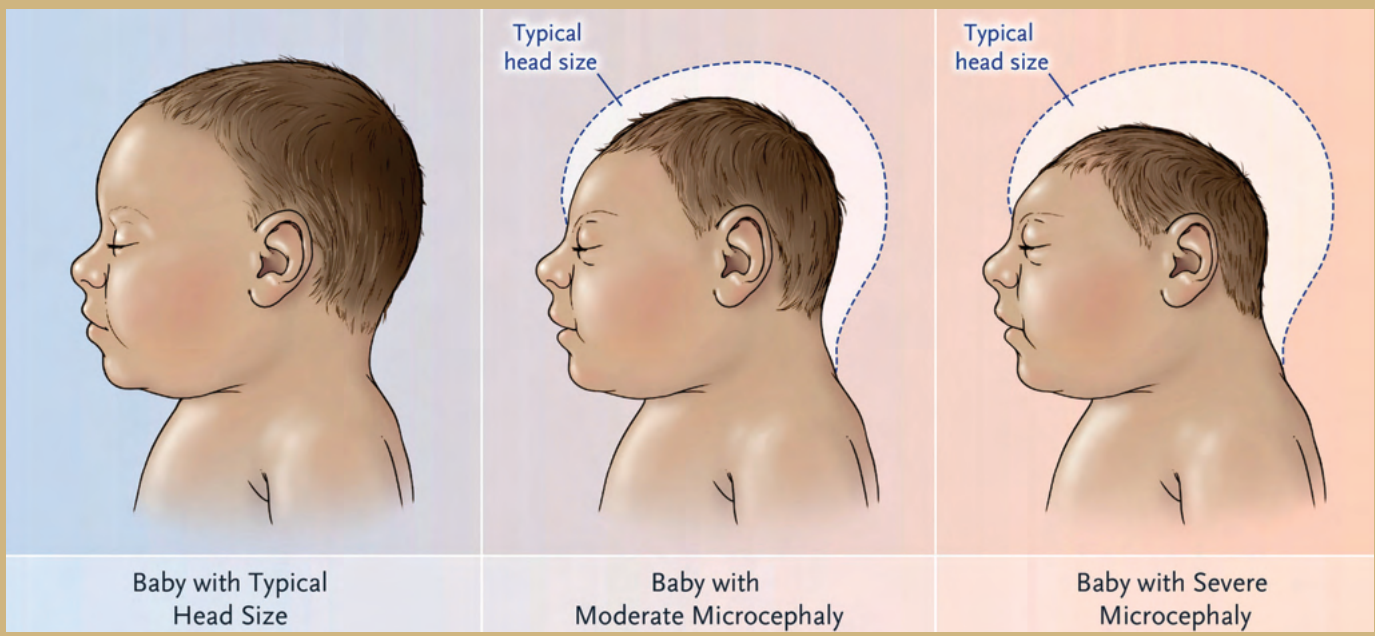


Photo: nejm.org

Microcephaly among infants associated with maternal Zika virus infection

Discovering Chandipura virus

6

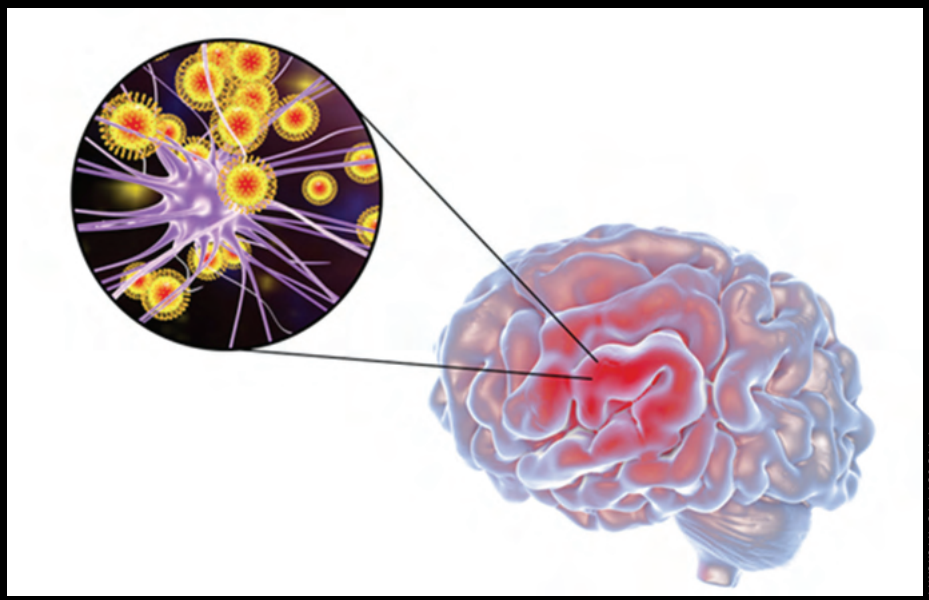


Photo: M3 India.in

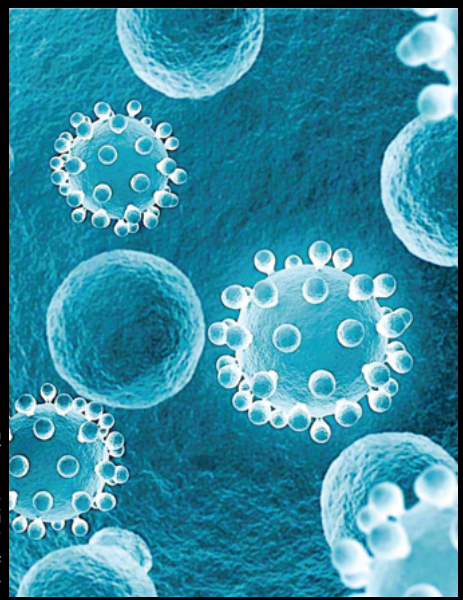


Photo: Creative Biolabs

In 2003, Chandipura virus was detected to be responsible for an outbreak in southern India in which 329 children developed acute encephalitis and 183 died. The symptoms included sudden high fever accompanied by headache, convulsions and vomiting, sometimes leading to unconsciousness. Based on the symptoms, doctors recommended a blood test. The samples were sent to ICMR's National Institute of Virology based in Pune.

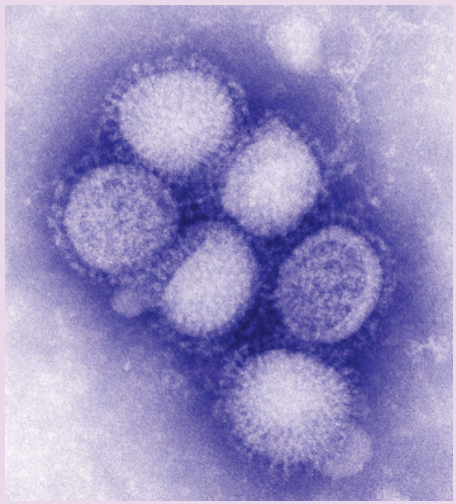
Virologists at NIV Pune were the first ones to discover Chandipura virus (CHPV). ICMR-NIV conducted a door-to-door survey to identify cases. Antibodies for Chandipura, Japanese encephalitis, dengue, chikungunya and West Nile viruses were tested by ELISA in probable cases. Chandipura virus RNA was tested from both human blood samples and sand flies. Vector surveys were also conducted. Through these efforts ICMR-NIV became the first institute in India to detect and isolate the deadly virus in India.

7

Leading response to the 2009 Swine Flu Pandemic

The first pandemic of this century was caused by a swine origin influenza A/H1N1 virus and Mexico was the first country to be affected in early 2009. The symptoms of the flu were similar to other influenza which included fever, cough, headache, sore throat, chills, etc. In India, the preparedness activities were initiated at ICMR - National Institute of Virology (NIV), Pune, at a WHO designated National Influenza Centre, since 2003. With the first fatality recorded in August 2009, India ramped up its testing strategy as well and ICMR-NIV took up the task of capacity building for influenza diagnostics by expansion of the laboratory network across India. The institute also provided resources and training to the network and extended diagnostic facilities to the entire country in addition to supporting the WHO SEAR countries.

A host of scientific studies performed by ICMR on the grounds of genome sequencing, assays for determination of drug resistance, serosurveys in different populations, etc., led to important policy decisions like change in case definition, antiviral drug administration to suspected patients and proactive administration to contacts.



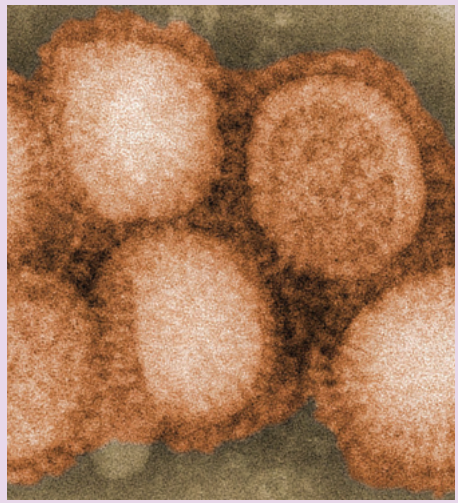


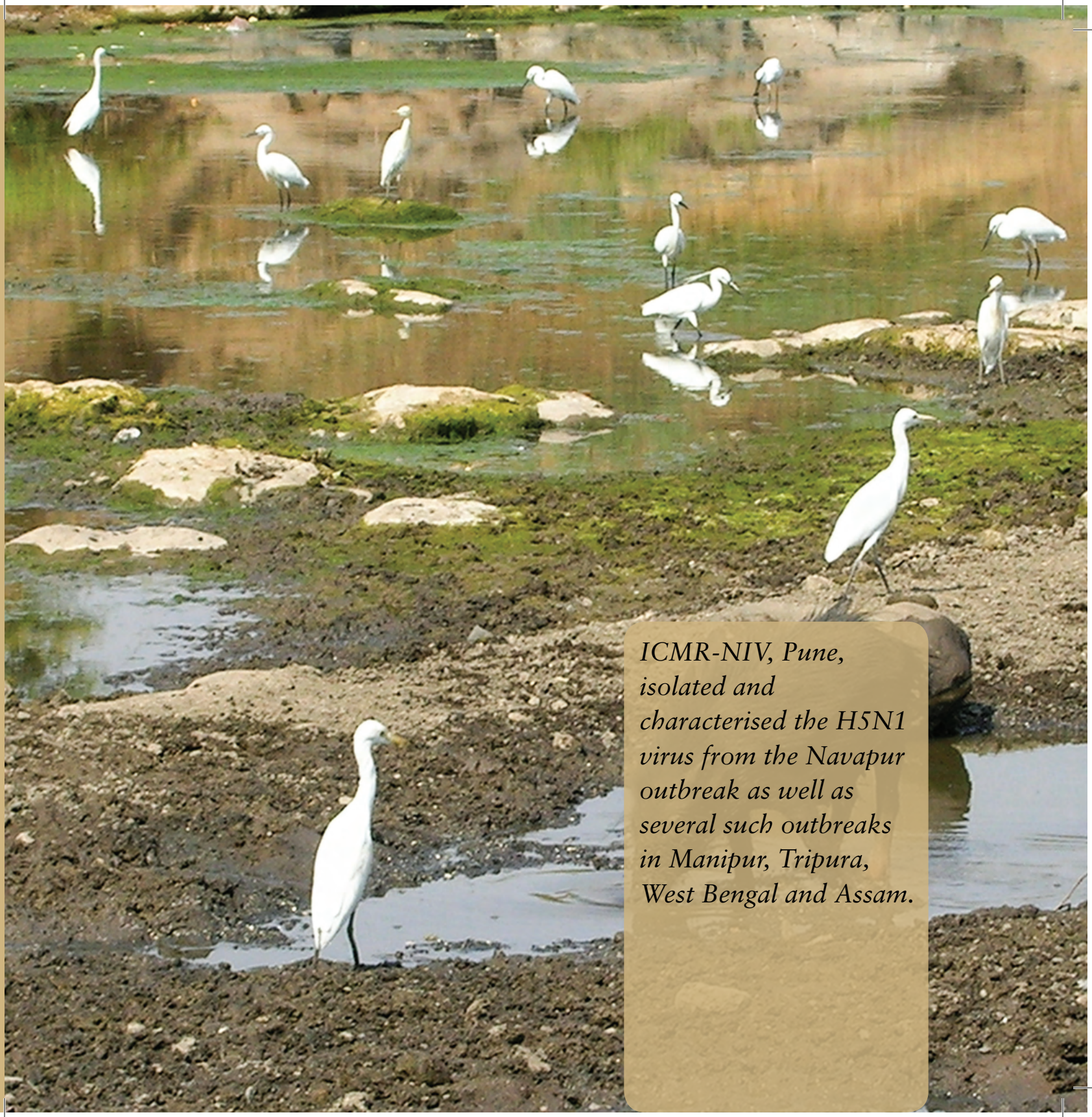
Photo: Wiki Commons

Tackling Bird Flu

8

ICMR-NIV, Pune initiated the research for Avian influenza (AI) in 2006. AI commonly known as bird flu is a highly contagious viral disease caused by influenza A virus, that normally infect only birds AI viruses are classified as low pathogenic (LPAI), which cause few or no clinical signs, and highly pathogenic (HPAI), which can cause severe clinical signs and high mortality, in birds. There is a risk of human infection, through close contact with infected birds.

In 2006, India experienced the first outbreak of one such HPAI, H5N1 virus among poultry birds in Navapur, Maharashtra. ICMR-NIV, Pune, isolated and characterized the H5N1 virus from the Navapur outbreak as well as several such outbreaks in Manipur, Tripura, West Bengal and Assam. Active surveillance for AI was undertaken among wild birds, migratory birds and poultry. The laboratory was recognized as a WHO recognized reference centre for diagnosis and research on AI for South-East Asia. In view of the first human case of HPAI/H5N1 virus reported from India in July 2021, human-animal interface studies on AI continue to remain a national priority.



ICMR-NIV, Pune, isolated and characterised the H5N1 virus from the Navapur outbreak as well as several such outbreaks in Manipur, Tripura, West Bengal and Assam.

9

Demystifying Monkey Fever: Kyasanur Forest Disease

ICMR and its institutes have played a pivotal role in diagnosing, managing and controlling a range of diseases affecting the Indian population. One such disease is the Kyasanur Forest Disease (KFD). Internationally, this virus is ranked as one of the most high-risk categories of pathogens. This disease was first identified by ICMR- National Institute of Virology (which was known as the Virus Research Centre at the time) in the dense evergreen forests of Kyasanur, located in Shimoga district, Karnataka.

It was in April 1957, when a team of field investigators from NIV, Pune was sent to Shimoga to check the cause of numerous large-scale deaths of monkeys in the nearby forest. Interestingly, there was an associated emergence of a mysterious disease in the nearby forests of this area. Many villagers fell ill with common symptoms like the sudden onset of fever lasting about one to two weeks, headache, body ache, general weakness and sometimes even diarrhoea, vomiting and pain in the abdomen. In 1957, nearly 500 individuals were affected by this disease and 70 of them succumbed to it. The disease earned a local name 'monkey fever' which depicted the close association of the strange disease with the death of monkeys. The diagnosis of suspected cases of KFD was dependent on conventional techniques, which were laborious and caused an increased disease burden. Along with helping state govts set up diagnostic labs for diagnosis of KFD which is less laborious, scientists at ICMR NIV also developed the first ever viral vaccine to fight this disease. In addition to this, the diagnostic services provided by ICMR have helped in identification of KFD in five states of India.

10

Identifying Andaman Haemorrhaegic Fever as Leptospirosis

During the late 1980s, seasonal outbreaks of a mysterious fever engulfed the local population of The Andaman Islands in the Bay of Bengal. It was locally known as “Andaman Haemorrhagic Fever” (AHF). The mystery of AHF was unravelled in 1995 when ICMR’s Regional Medical Research Centre at Port Blair established that AHF was a clinical variant of leptospirosis. Leptospirosis was last reported in the 1930s in the penal settlements in Andamans. The medical history of the islands and the epidemiological features of the outbreak indicated the possibility of leptospirosis though the clinical features were very different. The identification of Leptospira as a cause of the disease helped in defining the treatment protocol and thus improved patient outcome. Toward this end, the RMRC has played an essential role in identifying a multi-layered approach in fighting the disease and detecting post-disaster outbreaks of leptospirosis in collaboration with the Directorate of Health Services, the Department of Animal Husbandry, and the Department of Agriculture. Regular awareness programs by RMRC among farmers, medical and paramedical professionals and veterinarians in the Andamans, helped ward off the disease. In addition to this, RMRC, along with other international centres is actively involved in search for an effective DNA vaccine to combat this disease. With the establishment of the Port Blair institution, there has been access to setting up reference and diagnostic laboratories for half a billion people in the Southeast Asia region, including India, where people are predominantly involved in wet farming and therefore stand at a greater risk of contracting leptospirosis. ICMR-RMRC was successful in not only diagnosing and managing the disease across the country, but it also controlled cases of incidence in the Andaman Islands as well.

ICMR-RMRC, Port Blair was successful in not only diagnosing and managing the disease across the country, but it also controlled cases of incidence in the Andaman Islands as well.

ICMR-RMRC Dibrugarh also carries out targeted and timely awareness and treatment interventions in endemic regions.

Deciphering Paragonimiasis

11

The local doctors in north-eastern states of India revealed long-term treatment failure in clinically and radiologically diagnosed tuberculosis cases. The scientists at ICMR 's Regional Medical Research Centre (RMRC) in Dibrugarh dug deeper. After much research on the disease and the local food habits, human pulmonary paragonimiasis was identified. This is a food-borne disease which is caused by the parasitic lung fluke Pragonimus. It is usually contracted by consuming raw, pickled or undercooked infected crabs, crayfish, and in rare cases, frogs. Also, RMRC developed a diagnostic kit to detect paragonimiasis to ensure correct diagnosis and treatment. RMRC Dibrugarh was not only successful in identifying the disease but scientists at the institute used their expertise to implement targeted treatment and awareness interventions in a sustained manner. The disease was assumed to occur only in the state of Manipur, but an in-depth investigation conducted by ICMR revealed that the infection was prevalent in the northeast region of India, and cases had been detected in Arunachal Pradesh, Assam, and Nagaland. RMRC Dibrugarh also carries out targeted and timely awareness and treatment interventions in endemic regions. A survey conducted in Changlang, Arunachal Pradesh in 2011 following a community-based study performed here in 2002 demonstrated a decline in the prevalence of paragonimiasis owing to treatment and community-based awareness and education.

Breaking the myth of Gorakhpur Encephalitis

The Japanese Encephalitis (JE) virus is the leading cause of viral acute encephalitis syndrome (AES) in many countries of Asia, with an estimated 68,000 clinical cases every year. The Gorakhpur division of the state of Uttar Pradesh, in particular, used to record over 2000 AES cases annually with high morbidity and mortality among children.

A Field Unit of ICMR-National Institute of Virology (NIV), Pune, was also established in Gorakhpur in 2008, which was later upgraded as ICMR – Regional Medical Research Centre (RMRC), Gorakhpur in 2018. The Institute played a pivotal role in the JE outbreak investigation in the area by providing an around-the-clock and timely diagnosis of AES cases. The Institute also conducted extensive research to examine the prevalence of JE infection in amplifying hosts during the summer and rainy seasons in the endemic area of Gorakhpur and played a crucial role in developing serological and molecular diagnoses of the disease.

After introducing a JE vaccine and other preventive measures, JE cases in the region declined substantially; however, AES was still causing significant mortality amongst young children. To understand the persisting problem and ascertain the mysterious reason for the disease in the region, ICMR formed a multi-disciplinary team of scientists from ICMR-NIV, Pune ICMR-National Institute of Epidemiology (ICMR-NIE), Chennai, ICMR-Vector Control Research Centre (ICMR-VCRC), Puducherry, ICMR-National Institute of Malaria Research (ICMR-NIMR), Delhi and ICMR-National AIDS Research Institute (ICMR-NARI), Pune. Laboratory investigations identified Scrub typhus (ST) as the major aetiology of AES in the area. Surveillance of acute febrile illness among children attending peripheral health facilities revealed scrub typhus as an important aetiology of febrile illness during monsoon and post-monsoon months. Population-based serosurveys indicated high endemicity of scrub typhus. Entomological studies demonstrated natural infection of *Orientia tsutsugamushi* in small animal hosts and vector mites. Children acquired this infection through recent exposure to outdoor environment, while playing, or visiting fields or defecating in open fields. These investigations helped to understand the transmission dynamics of scrub typhus in Gorakhpur division and recommended strategies for its control including treatment algorithm. The implementation of the control strategies recommended by ICMR has led to a substantial decline in mortality attributable to AES amongst children in the division.

13

JENVAC: India's first indigenous Japanese Encephalitis vaccine

Japanese encephalitis virus (JEV) is the most common cause of viral encephalitis in Asia. While most infections show little or no symptoms, there may be occasional inflammation of the brain. In these cases, symptoms may include headache, vomiting, fever, confusion and seizures. About 600 million people in India live in JE-endemic regions, and 1,500 to 4,000 cases are reported annually. Vaccination of the human populations at-risk is the only effective and long-term JE control measure.

ICMR has been instrumental right from detection of the first human JE case (Vellore, Tamil Nadu, 1955), virus isolation, and identification of Culex spp (type of mosquito) as the primary vector to establish its natural cycle of transmission. The JE MAC ELISA which has been developed by ICMR-NIV is recommended for diagnosis and surveillance in Asian countries by the WHO. The preclinical studies, antigenic and genetic stability of the inactivated vaccine candidate (JENVAC) were performed at ICMR-NIV and later the technology was transferred to BBIL. The phase 2/3 human clinical trials of the JENVAC performed in 1–50-year-old healthy Indian population were also supervised by ICMR-NIV for assurance on the vaccine safety and protection. Till date, JENVAC is the only cell culture–based inactivated vaccine developed, licensed for human use, and commercialized. With concerted efforts and research led by ICMR along with others, India hopes to see a day with no cases of Japanese encephalitis being reported in the country.

14

State-of-the-art highest containment Bio Safety Level-4 (BSL-4) facility: First in Asia

ICMR carries out a gamut of public health research studies which requires adherence to safety standards across all stages. Biosafety levels (BSL) are used to identify these protective measures needed in a laboratory setting to protect workers, the environment, and the public. There are a total of four biosafety levels where each level has specific controls for containment of microbes and biological agents.

In 2013, ICMR set up the nation's first Biosafety Level 4 (BSL 4) high containment laboratory. Located on the main campus of the Microbial Containment Complex at the ICMR-National Institute of Virology (NIV) in Pune, the facility has helped India investigate outbreaks of highly infectious diseases like Severe Acute Respiratory Syndrome (SARS), Avian and Swine origin pandemic Influenza, Nipah virus, Crimean Congo hemorrhagic fever virus and Kyasanur forest disease virus. These viruses created fear amongst the population, and their investigations require high safety standards. Some of the salient features of the lab setup included self-contained electric power fencing, gamma radiation chambers used for inactivation of samples to facilitate processing in support laboratories, a unique training area to provide experience and environment of BSL 4 experience outside real-time research, high-class boiler, breathing air system, motors, HEPA filter banks, power supply sources, autoclaves, decontamination stations, etc. Overall, with the high level of monitoring, surveillance, and data recording, this facility is unique not only for India but also for Southeast Asia. The laboratory has been critical in investigating and researching the SARS-Cov-2 virus, which caused the COVID-19 pandemic.

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National Institute of One Health: Game-changer to tackle Zoonotic infections

In today's interconnected world, there is a growing threat of deadly diseases transmitted from animals to humans. According to scientists, there are about 830 diseases that can originate in animals and transmit to humans. Each year around the world, it is estimated that zoonoses (diseases shared between humans and animals) cause 2.5 billion cases of sickness and 2.7 million deaths.

ICMR and its institutes have done pioneering work in fighting these diseases be it Nipah virus, Ebola and the most recent, Coronavirus. To further strengthen India's preparedness against such viruses, ICMR has joined hands with Maharashtra Animal and Fisheries Science University (MAFSU), Nagpur, to establish a National Institute of One Health. The Institute will study the different disease-causing pathogens in domestic as well as wild animals for better preparedness to contain diseases that humans may get in future. The Indian Journal of Medical Research (IJMR) brought out a Special Issue on One Health in April 2021 on the occasion of International Symposium on One Health to support ICMR's initiative towards the 'One Health' approach, corroborating multi sectoral research informing regarding biosafety, preparedness and response. It has original articles, viewpoints, perspectives and reviews from the eminent experts in the field. Streamlined research carried out at the One Health Centre will help scientists develop a vaccine in lesser time, when a new disease gets transmitted from animals to humans in the future. This institute is now part of Prime Minister's Ayushman Bharat Health Infrastructure Mission (PM-ABHIM), launched recently by the Hon'ble PM.

Photo: Jo-Anne McArthur/unsplash.com

Strengthening the health research infrastructure of the nation: Network of MRU, MRHRU and VRDLs

Through the years, DHR-ICMR has developed a robust culture of health research to address the pressing health needs of the nation across geographies and demographics. At present, ICMR has a pan-India presence with 27 research institutes mandated to conduct research focused on national health research needs. These institutes have enabled outstanding contributions in understanding and mitigating various diseases of national importance such as malaria, Japanese encephalitis, tuberculosis, AIDS, Kala-azar, Filariasis, Leprosy and Poliomyelitis. This network has also advanced significant contributions in the areas of nutrition, reproduction, maternal and child health, occupational and environmental health and research complementing health systems.

Additionally, DHR in synergy with ICMR steers an extensive network of 125 Viral Diagnostic and Research laboratories across the country. These are facilitated at Regional, State Level and Medical College level labs and have been instrumental in tackling outbreaks of viral infections, reducing turn-around time as well as creating more capacity for medical research. This emphasis on quality research is also being integrated into the medical colleges by the establishment of 90 Multi-disciplinary Research Units (MRU) across the country. These units serve to promote and encourage quality medical research, aid medical colleges to set up appropriate research facilities and nurture a pipeline of next-generation quality health researchers.

At the grass-root level, DHR with the technical support of ICMR is actively promoting health research and taking technological advances from the lab to the field by establishing 25 Model Rural Health Research Units (MRHRU) in different parts of the country. This will be critical in enabling the younger generation to do high-quality work on problems affecting the rural population.

Photo: Lucas Vasques/unsplash.com

Photo: Ousa Chea/unsplash.com

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Building public health capacity of the nation: ICMR School of Public Health

In 2006, the ICMR School of Public Health (ICMR SPH) was established at ICMR-National Institute of Epidemiology (ICMR-NIE) in Chennai, with the primary goal of creating professional and efficient public health trained manpower at different levels of health system in different regions of the country. The vision was to link public health laboratories with public health institutes, develop an effective network of public health institutes for rapid action and support surveillance programmes, epidemic alerts and response, and to evaluate public health activities for continuous quality improvement. With emphasis on training the 'in-service' health professionals working in government health departments, ICMR SPH initially delivered two affiliated programmes of Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram: (1) Master of Applied Epidemiology (MAE) (until 2010), and (2) Master of Public Health (Health Services Development and Research) (2008-2010). In 2011, the two programmes were integrated into a single competency-based Master of Public Health (Epidemiology and Health Systems) programme that combines the best of the 'foundational knowledge' of epidemiology and the six building blocks of health systems with 'learning by doing model' of field epidemiology training programmes (FETP) that builds the public health skills by responding to public health emergencies such as disasters and outbreaks, evaluating how health programmes work and doing epidemiologic studies to identify solutions to priority public health problems in their State. Since 2018, ICMR SPH also offers other FETPs including the India Epidemic Intelligence Service (EIS) - Southern Hub, FETP –Non-Communicable Diseases, and Intermediate FETP – Non-Communicable Diseases. Besides FETP, the ICMR SPH offers MSc (Biostatistics) affiliated to Periyar University, Tamil Nadu, PhD in Epidemiology (affiliated to the University of Madras (UOM) and The Tamil Nadu Dr. MGR Medical University), Biostatistics (UOM) and Microbiology (UOM) and short courses in various public health disciplines along with several Massive Open Online Courses (MOOCs) in health research. Till date, the ICMR SPH has trained 200,000+ public health professionals, researchers, doctors and students from all States/ UTs in the country. It continues to be instrumental in galvanizing a highly skilled workforce to deal with the complex public health challenges in the country and provide a common platform for synergising research and training needs of numerous scientists and public health service providers, ultimately leading to improving the health status of the people.

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Saving the endangered Asiatic Lions from mysterious virus

In 2018, a deadly and mysterious virus struck India's endangered Asiatic lions in their last remaining natural habitat situated in Gujarat's Gir National Park. Following years of concerted government efforts, the lion population in Gir National Park has swelled to nearly 700, according to an official census in 2020. But in 2018, the conservation success looked to be in danger when over 23 Asiatic lions started to die in one part of the 1,400 square kilometre forest. This had urged the government to launch intense operations to ensure that the infection does not spread to other big cats.

Scientists at ICMR-National Institute of Virology (NIV) in Pune were the first to discover and confirm the cause of deaths among Asiatic lions by a highly contagious and life-threatening viral infection, canine distemper virus (CDV). The virus was confirmed after a complete genome test was done by the scientists of ICMR in the laboratory at ICMR-NIV in Pune. This was the first time that a complete genome of CDV was recovered by ICMR-NIV. The Council also went on to recommend CDV vaccine shots for all the Gir lions as an immediate protective measure.

Photo: Gareth Davies/Pexels

Efforts in making India Polio-free

In 2014, India was officially declared polio-free. India's journey from being a hyper-endemic region for polio to being completely polio-free spanned many decades with numerous hurdles on the way. The country's fight against polio began in 1949 when the Indian Council of Medical Research (ICMR) established a Polio Research Unit in Bombay (now Mumbai), called the Enterovirus Research Centre (ERC) - a WHO Global Specialized Laboratory (now a part of NIV, Pune).

ERC's mapping studies of infected population and high-risk areas have made a major contribution to the national polio elimination effort by providing crucial and timely information regarding high-endemic zones, the type of polio infection and its primary modes of transmission. The ERC carried out laboratory diagnosis to investigate the presence of poliovirus in individuals with Acute Flaccid Paralysis (AFP) - a clinical syndrome where children under the age of 15 suffer from a sudden onset of muscle weakness or paralysis. Apart from this, the ERC also initiated an environmental surveillance system, by testing sewage samples from various locations to determine the circulation and prevalence of poliovirus.

In another path breaking achievement towards polio elimination, the ERC introduced Oral Polio Vaccine (OPV) in India by conducting the very first OPV clinical trial in the country in three states of Andhra Pradesh, Maharashtra and Rajasthan. ICMR's concerted efforts in successful elimination of polio in a populous country like India have become an example for other polio endemic countries working towards elimination of the disease.

ICMR's concerted efforts in successful elimination of polio in India have become an example for other polio endemic countries working towards elimination of the disease.

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India's first 'Scientifically Documented' Test Tube Baby

On August 6, 1986, India officially made an entry into the novel world of assisted conception with the widely publicised birth of its first 'scientifically documented' IVF baby, Harsha Shah. The entire scientific process of in-vitro fertilization was perfected and performed as a collaborative project between ICMR-National Institute for Research in Reproductive Health (NIRRH) and King Edward Memorial Hospital, Bombay. The NIRRH was referred to as the Institute for Research in Reproduction (IRR) which was established in February 1970. Located across the KEM Hospital, this technology was the product of a perfect collaboration between a hospital, which had the infrastructure for the bedside procedures, and a research institute that had the necessary settings for all the laboratory procedures. Later on, baby Harsha went on to conceive naturally and deliver a healthy baby boy in March 2016 which was a testament of this technology that provided hope to millions of infertile couples who yearned for biological parenthood.

Dr. T.C. Anand Kumar, Director IRR (now NIRRH) and Dr. Indra Hinduja, Gynaecologist, KEM Hospital with India's first scientifically documented test tube baby Harsha born on 6 August 1986.

Dr. Puri, Dr. Smita Mahale and Dr. Gopalakrishnan

Baby Harsha with her mother

... this technology provided hope to millions of infertile couples who yearned for biological parenthood.

21

Oral Rehydration Therapy: Simple solution for a complex problem

Diarrhoea is one of the leading killers of children under the age of five not just in India but across the globe. As estimated by the Ministry of Health and Family Welfare (MoHFW), Government of India, 1.2 lakh children under the age of five die every year, indicating that about 328 children succumb to diarrhoea per day and 13 per hour.

To this end, the Oral Rehydration Therapy/ Solution to prevent mortality caused by diarrhoea was initiated. It is a basic mixture of sodium chloride, potassium chloride, sodium bicarbonate and glucose which has remarkably changed the treatment of diarrhoea by offering a safe, easy and effective alternative to intravenous fluid infusion therapy. Later, ICMR also found that home available fluids (HAFs) like sharbat, lassi and rice water were equally effective for mild diarrhoea without any dehydration and recommended adequate amounts of the same to children with initial symptoms of diarrhoea.

The National Institute of Cholera and Enteric Diseases (NICED) in Kolkata has been at the forefront in the development and dissemination of this therapy and the institute has also conducted several studies on 'improved ORS' and documented the efficacy of the formula by carrying out a study on dehydrating persistent diarrhoea.

In a noteworthy achievement by ICMR, the new ORS formula was launched by WHO and its partners during the United Nations General Assembly, Special Session on Children in May 2002 and later the solution was made available through government and private sector channels in all the Lower Middle Income Countries (LMICs) where diarrhoeal disease burden is high.

In a noteworthy achievement by ICMR, the new ORS formula was launched by WHO and its partners during the United Nations General Assembly, Special Session of Children in May 2002.

Discovering the Bombay Blood Phenotype

The discovery of Bombay Blood Group took place more than 50 years ago with a patient who was admitted to KEM Hospital and required blood transfusions. A sample of blood was sent to the Blood Bank for grouping as is the usual practice. Due to technical complications, the transfusion had to be stopped. A detailed study of the patients' blood revealed a rare genotype (blood group), which was neither 'A' nor 'B' nor 'AB' nor 'O'. Since the first case was detected in Mumbai (then Bombay), the blood group came to be called the Bombay Blood Group. ICMR's National Institute of Immunohematology (NIIH) and its scientists have played a central role in the detection of the Bombay phenotype – from its initial discovery to the current surveillance of individuals with this blood group.

Through targeted research and screening tests 1956 onwards, NIIH determined that 1 in 4,500 individuals in the Konkan and Goa region belong to the Bombay blood phenotype. Since then, NIIH aggregates a list of all individuals with the Bombay phenotype, which enables the institute to supply blood to patients in other states, and sometimes also to other countries like Malaysia and South Africa. Through cutting edge research, awareness generation programs and capacity building of medical staff on ground, ICMR continues to work towards building a better understanding of the blood group and its incidence to ensure safe and easy blood transfusion for patients with this unique blood group.

ICMR's National Institute of Immunohematology and its scientists have played a central role in detection of the Bombay phenotype – from its initial discovery to the current surveillance of individuals with this blood group.

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Mission DELHI

Delhi Emergency Heart Attack Initiative

As part of a major initiative in collaboration with AIIMS, Delhi, an emergency medical service with a motorbike-borne assistance unit can be quickly summoned for a person suffering heart attack or chest pain was launched by ICMR in 2019, known as Mission DELHI (Delhi Emergency Life Heart-Attack Initiative). Under this, a pair of motorcycle-borne trained paramedic nurses would be the first responders for treating heart attack patients. On getting a call, the pair would rush to the spot, gather basic information on the patient's medical history, conduct a quick medical examination, take the ECG (electrocardiography), and establish a virtual connection with the cardiologists at AIIMS and deliver expert medical advice and treatment. Access to these key services and treatment before reaching the hospital is an effective intervention that will save time and reduce death and disability in those with heart attacks. Along with robust health infrastructure and talented doctors, thrombolytic therapy (administration of drugs that dissolve blood clots that cause sudden blockage to major arteries or veins as in case of a heart attack) is crucial to address mortality caused by heart attacks. Mission Delhi is currently in its pilot phase and is successful in providing 24x7 Delhi Emergency cardiac healthcare services in 5 km radius around AIIMS. The provision of timely emergency treatments like Mission DELHI to patients will go a long way in reducing incidences of heart attacks which are often life threatening.

India Hypertension Control Initiative

It is estimated that at least one in four adults in India suffer from hypertension. Yet, only about 10% of them have their blood pressure under control. To achieve India's target of a 25% relative reduction in the prevalence of raised blood pressure, we need to scale hypertension treatment across the country rapidly. The India Hypertension Control Initiative (IHCI) was launched in November 2017 as a collaborative project of the Ministry of Health and Family Welfare (MoHFW), State Governments, the Indian Council of Medical Research (ICMR), and the World Health Organization (WHO), along with a technical partnership with the global non-profit organisation Resolve to Save Lives. The project aimed to implement five strategies under protocols, availability of drugs, team-based care, patient-centered services and monitoring systems in the case of blood pressure control rates.

Overall, 100 districts across 19 states enrolled more than 1.6 million patients in nearly 10,000 health facilities by October 2021. In the 26 initial districts, almost one-fifth (20%) of the district's estimated total number of people with hypertension were enrolled. More than half of the patients who were treated were able to control the disease using the mechanisms mentioned above.

A core team from MoHFW, ICMR HQ, ICMR- National Institute of Epidemiology, Chennai and WHO-India coordinated the project at the national level. This initiative has seen notable successes, including effective coordination and commitment among multiple partners; selection of state-specific hypertension treatment protocols; improvement in drug logistics systems and thereby ensuring the availability of protocol drugs; recognition of the value of professional digital blood pressure devices; provision of adequate training; distribution of 30-day supplies of medications to patients, etc. To sustain the initiative and the subsequent efforts as part of it, the best practices have been disseminated to all partners, and several states are gradually scaling the best practices beyond project districts.

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Mobile Stroke Unit: Doorstep treatment for saving lives

Stroke is a leading cause of death and disability in India. Leveraging technology, ICMR pioneered an initiative to provide stroke treatment in hard-to-reach areas in India. ICMR recognized early on that mobile health is the future of India. The Council launched a state-of-the-art Mobile Stroke Unit on 28 September 2020, which brings the services of hospitals to the patient's door steps by providing acute stroke care management. The Mobile Stroke Units (MSU) first launched in Tezpur and Dibrugarh areas of Assam, India, provides services such as imaging, mobile laboratories, telemedicine (relevant connection with a hospital), appropriate medication and assessment tools - contributing to reducing the time between the diagnosis of a stroke symptom and relevant treatment for the same. As part of capacity building, training manuals were also developed for doctors, paramedics, CT (Computed Tomography) technicians and drivers by ICMR with an overall vision to control the cases of stroke and save as many lives as possible. The mobile stroke unit revolutionalizes medical care in hard to reach and remote areas in India by addressing the needs of people in remote areas of Assam in Tezpur and Dibrugarh area of Assam.

Knowledge hub for Smokeless Tobacco Use (SLT)

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Tobacco use is one of the biggest public health threats, globally. In addition to causing loss of lives it has heavy social and economic costs. India is the second largest producer and consumer of tobacco and poses a major risk factor for many chronic diseases, including cancer, lung disease, cardiovascular disease and stroke. ICMR has been successful in leading numerous efforts towards building awareness on this issue and recommending relevant action to be undertaken at the policy level.

In 2016, WHO made Noida based Institute of Cytology and Preventive Oncology (ICPO), now ICMR- National Institute of Cancer Prevention and Research (NICPR), a 'Knowledge Hub' in India for 'Smokeless Tobacco Use' (SLT). As the seventh knowledge hub under WHO-FCTC (Framework Convention on Tobacco Control), ICMR-NICPR is a specialised centre on SLT. The initiative acts as a vital platform for information dissemination and also works as a research setup that reports and studies the existing policies and plans on use of tobacco products. In another initiative, as part of a white paper released by ICMR in 2019, the council noted that e-cigarettes and other such devices contained not only nicotine solution, which was highly addictive, but also harmful ingredients such as flavoring agents and vaporizers. This led to the recommendation of a complete ban on e-cigarettes and other Electronic Nicotine Delivery Systems (ENDS).

ICMR's recommendation has paved the way for the aversion of tobacco addiction by India's youth which is a threat to the country's tobacco control laws and ongoing tobacco control programs.

Photo: Kristaps Solims/unsplash.com

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DIAMOnDS: DHR-ICMR Advanced Molecular Oncology Diagnostic Services

ICMR's Bengaluru-based National Centre for Disease Informatics and Research (NCDIR) estimated 13.9 lakh cases of cancer in India in 2020 and predicted a rise to 15.7 lakh by 2025. A majority of the country's population does not have access to a well-organized and well-regulated cancer care system. A diagnosis of cancer often leads to a heavy personal health expenditure compounded with low levels of awareness about the disease, poor prognosis and lack of or inequitable access to affordable curative services.

Against this backdrop, zonal molecular oncopathology labs were set up in India in 2019 to provide basic as well as high-end advanced diagnostic services to cancer patients and research facilities for basic, translational and clinical research. Along with diagnosis, the labs also perform active research. These labs were identified as DHR-ICMR Advanced Molecular Oncology Diagnostic Services (DIAMOnDS). In addition to encouraging and strengthening diagnostic research in the field of oncology, this initiative aims to provide free of cost oncopathology diagnostic services to cancer patients and bridge the infrastructure gap inhibiting cancer patients in availing necessary diagnostic services. By ensuring the provision of facilities, infrastructure and manpower, the goal is to reduce the cases of cancer incidence in the country.

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Revolutionising TB diagnostics and treatment

Tuberculosis (TB) has been a significant health problem in India for a long time. There has been a vast amount of research and initiatives led by ICMR coupled with concerted efforts from the government that are being ensured in India to achieve elimination of the disease. A landmark study done in 1958 led by ICMR-National Institute for Research in Tuberculosis (NIRT), Chennai, provided evidence for home-based treatment for TB patients - as a breakthrough event.

ICMR set up an investigation with WHO and the Union Mission Tuberculosis Sanatorium, Arogyavaram (Andhra Pradesh, India) in 1958 to study the efficacy of home-based treatment for TB in rural settings, in other words, known as domiciliary drug therapy. Through Randomised Control Trials (RCT), the study was executed against various parameters such as cases of incidence, treatment results, trends of mortality, etc. The study proved that home-based treatment, both short-term and long-term, was as good as sanatorium treatment, with no additional risk to household contacts. This meant that patients did not require admission in TB sanatoria, which was the only way to get TB treatment at that time. The strategy helped cut down the cost of TB treatment and enabled patients to access treatment from home with family and social support.

In addition to this, the research contributions of ICMR have played a crucial role in the formulation of the Directly Observed Treatment Short course (DOTS) strategy for TB control globally. As part of domiciliary chemotherapy, patients were required to self-administer the drugs daily for a prolonged period. Research showcased a large amount of concealed irregularity in drug intake in this method, even though patients came and collected the drugs regularly - thus creating a need for supervised treatment.

Studies led by ICMR-National Institute for Research in Tuberculosis (ICMR-NIRT) showcased for the first time that a fully supervised twice-weekly regimen of streptomycin and isoniazid was as effective as unsupervised daily administration of PAS and isoniazid, both in terms of initial success rate and relapse rates after that. ICMR-NIRT later carried out research that helped reduce the treatment duration for sputum positive pulmonary TB to six months from 12 to 18 months. These treatment modifications were the first few steps to shape the current TB treatment program, which revolutionized the treatment of the disease in India and globally.

Quite recently, to ensure that India's remote tribal areas get access to diagnostic services for TB, ICMR in collaboration with the Central Tuberculosis Division (CTD), launched 35 Mobile TB Diagnostic Vans (MTDVs) in 2017. These mobile TB diagnostic vans help in early diagnosis by visiting tribal populations who are now not forced to consult a local practitioner who may not be qualified to diagnose TB cases. This doorstep service also facilitates appropriate diagnosis and timely treatment. With this novel intervention, ICMR has taken another step towards reducing the incidence of TB in the country by 2030.

ICMR also recently completed the pan India TB Prevalence Survey, after 60 years to estimate the disease burden, covering a population of around five lakhs.

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India Tuberculosis Research Consortium (ITRC): A step towards end TB by 2025

Tuberculosis (TB) is one of the top ten causes of death in the world, making it a global public health crisis. In India alone, over 4.8 lakh people die from TB annually although the disease is treatable, when diagnosed and treated promptly. The government of India is committed to eliminate TB by 2025, five years ahead of the global targets and Sustainable Development Goals.

To achieve this goal, ICMR established the India Tuberculosis Research Consortium (ITRC), a one of its kind collaborative approach to address India's TB challenge. This flagship programme of ICMR aims to bring together diverse stakeholders to develop new tools – diagnostics, vaccines and drugs. The consortium will enable India to take a leadership role in fast-tracking translational Tuberculosis (TB) research and find solutions for the world. The program facilitates capacity building and thereby advancing research leads into the final product to tackle TB. Since its inception in 2016, the consortium has successfully supported partner agencies to strategize and build programs, facilitate translational research, encourage public-private partnerships paving the way for achieving India's target of eliminating TB by 2025.

BCG vaccine: The largest trial

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Bacillus Calmette–Guérin (BCG) vaccine is a vaccine primarily used against tuberculosis. Even though BCG had been in use for many years, it had always been the subject of controversy, as several scientific studies done all over the world had shown a widely varying protective value of BCG. Owing to the controversy over its protective effect and its extensive use in India it was felt necessary to undertake further field trials, wherein all shortcomings of previous trials could be eliminated. The Government of India took the decision to undertake a BCG trial in India. In 1968, the study was carried out in Chingleput district in Tamil Nadu (where no BCG vaccination was previously offered), under the auspices of ICMR in collaboration with WHO and the Centre for Disease Control (CDC), US Public Health Service, USA.

A large community based double blind, randomized controlled trial involving more than 3 lakh individuals which was later followed up for 15 years to evaluate the protective efficacy of BCG against bacillary forms of pulmonary TB was carried out from 1968-1986. As per relevant findings, it was concluded that BCG vaccination did not offer any protection against tuberculosis of the lungs. To address this, several expert committees appointed jointly by ICMR and the WHO went into the epidemiological aspects of the causation of tuberculosis under Indian conditions and concluded that BCG may not protect against tuberculosis of lung which occurs mostly in adults; it could provide substantial protection against childhood form of tuberculosis such as tubercular meningitis, tuberculosis of bones & joints etc.

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TrueNat: Point of care molecular diagnostics for TB

TrueNat tests use sputum samples from a patient for the diagnosis of disease. With this test, samples can be tested as soon as an individual shows symptom of the disease. It is essentially a chip-based, point-of-care, rapid molecular test for diagnosis of infectious diseases which uses the Real Time Reverse Transcription Polymerase Chain Reaction (RTPCR) chemistry which can be performed on the portable, battery operated Truelab Real Time micro-PCR platform. ICMR had earlier validated the indigenous TrueNat test for Tuberculosis keeping in mind that every year, millions of people with TB miss out on quality care, usually because their infection remains undiagnosed.

WHO prequalified Truenat is reliable and accurate for quick screening of TB patients, especially in low resource settings. The use of Truenat enabled molecular diagnostics is the today's gold standard test type – readily available in primary care settings that are more easily accessible for many people than a hospital or specialist TB centre.

Later, the TrueNat test was also validated by ICMR-NIV as a point of care test for Nipah virus disease and leptospirosis. In April 2020, following the invasion of COVID-19 virus, the TrueNat test was repurposed and used for COVID-19 diagnostics. ICMR played a nodal role in initiating the TrueNat based testing in Indian states for SARS-CoV2 detection. This helped reduce life-threatening delays in the diagnosis and treatment of SARS-CoV2.

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Supporting TB patients through nutrition supplements

Tuberculosis is an infectious disease that can infect vital organs like the lung (pulmonary), central nervous, lymphatic, circulatory, genitourinary systems, bones, joints, and skin. The typical symptoms of pulmonary tuberculosis are a chronic cough with blood-tinged sputum, fever, night sweating, weight loss, and chest pain. While nutritional need during the disease is emphasized, there was no documentary evidence that improved outcomes.

ICMR led a study to document the impact of nutritional deficiencies in the disease. Its institute - Regional Medical Research Centre, Bhubaneswar, carried out a study to assess the food supplementation outcomes with nutritional status for pulmonary tuberculosis patients in 5 districts of Odisha, covering 13 blocks. In the study, documentary evidence was developed to demonstrate the importance of nutrition by supplying ration for households if a family member was positive. This was helpful as usually; the entire household shared the food provided to the affected member. Additionally, door-to-door nutrition counselling was conducted that included an emphasis on utilizing local cereals and millets.

The patients were assessed on multiple parameters by using various research scales. The findings of the study highlighted a significant improvement amongst the affected patients. This study was key in revolutionizing TB treatment policies of the Government of India, which later included nutrition for TB-affected patients and their families as a significant component of their schemes.

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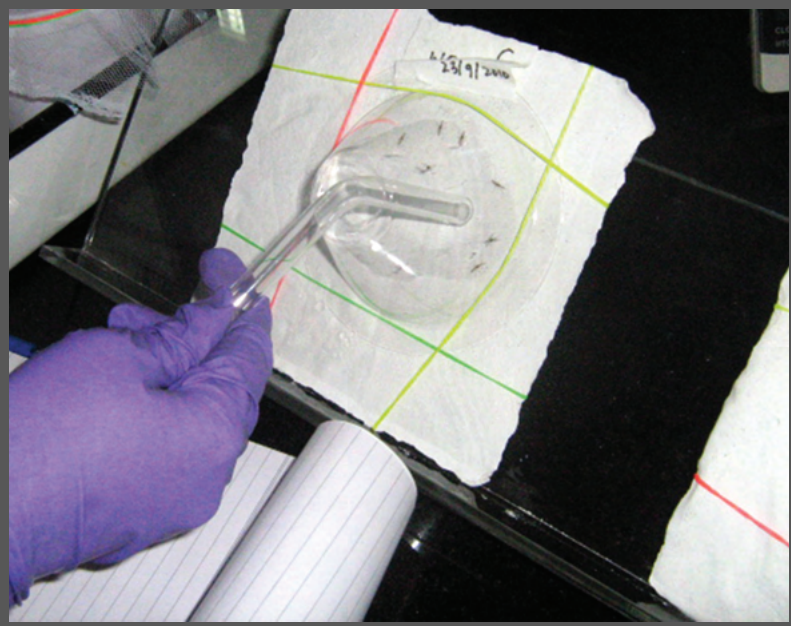
MERA India: Bringing together stakeholders for malaria elimination

Malaria is one of the highly prevalent infectious diseases and the most common cause of death after Tuberculosis. Malaria is caused by the protozoan parasite (Plasmodium species) and is transmitted from one human to another by the bite of infected Anopheles mosquitoes. Our country constitutes the largest population in the world at risk of malaria, with 85% living in malaria-endemic zones.

India has also developed a National Framework for Malaria Elimination (2016-2030) with a vision to eliminate it from the country and to contribute to improve health quality of life and alleviate poverty. WHO, Global Technical Strategy for Malaria (2016-2030) aims to reduce malaria by 90 percent and eliminate it from at least 35 countries by 2030.

To tackle this problem with cutting-edge research, ICMR established the Malaria Elimination Research Alliance (MERA) to identify, articulate, prioritize, and respond to the country's research needs in a coordinated, effective and collaborative manner to eliminate malaria from India by 2030. MERA-India launched in 2019, is a conglomeration of National and International partners like World Health Organization (WHO), National Vector-Borne Diseases Control Program (NVBDCP), and Medicines for Malaria Venture (MMV), medical colleges and several Multinational Companies working towards malaria control and elimination. The alliance is spearheaded by ICMR-National Institute of Malaria Research (ICMR-NIMR) which works with researchers at a global level and the team is working round the clock to eliminate malaria from India by 2030.



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Kheda Malaria Project: Connecting science with society

Kheda in Central Gujarat is known for Kheda Satyagraha, the second such movement after the Champaran initiative which was organized by Mahatma Gandhi in 1918 during British Raj after the region was hit by famine, cholera and plague which destroyed the agrarian economy. Kheda was later affected by a malaria outbreak in the 1980s affecting many villages and killing many people. An investigation effort was initiated soon after, which was led by ICMR. The Scientific evidence revealed the drug resistance in *Plasmodium falciparum* towards commonly used antimalarial the chloroquine and the insecticide resistance in the major malaria vector the *Anopheles culicifacies* against the commonly used insecticides in those time the DDT, BHC and the Malathion.

The situation was complex, and the challenge was tough. It was the great vision of then Director of ICMR-National Institute of Malaria Research, New Delhi (then Malaria Research Centre), who launched an innovative demonstration project on Gandhian way of life the '*Bio-environmental Control of malaria*' : an ecofriendly community based approach to control malaria in rural areas of central Gujarat (popularly known as Kheda Project) in a phased manner. Environmental management such as converting mosquito breeding sites into gardens, playground through levelling of ditches, etc; source reduction and interdepartmental collaboration were key components of this strategy. Other components included health education by arranging health camps in villages and schools to raise awareness about malaria parasites and control measures. IEC materials were also used to encourage early diagnosis and prompt treatment.

The efforts resulted in a significant decline in malaria morbidity and mortality and the project was a great success in controlling malaria as well as creating awareness among the society with the additional benefit of improving the environment and boosting the economy.

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Demonstration project for malaria elimination (Odisha and MP)

Odisha is a highly malaria endemic state in India with 46 million population at risk of infection. The interplay of various factors like favourable climate, geo-types, large forest coverage, difficulty in accessing remote and hilly villages and prevalence of efficient Anopheles mosquito vectors have resulted in persistent malaria transmission in different parts of the state. Despite various programmatic efforts initiated in the state following national guidelines for prevention and control of malaria, there was no significant decline in the malaria incidences for decades. The state continued to account for nearly 40% of the total malaria burden of India until 2017.

Under communicable diseases, malaria has been a focal area of research for ICMR. In 2013, the ICMR-National Institute of Malaria Research, New Delhi; National Vector Borne Disease Control Programme (NVBDCP) and Medicines for Malaria Venture, Geneva carried out a project 'Comprehensive Case Management Programme (CCMP)' in four districts of Odisha. The findings and learnings gave insights that persistence of malaria transmission occurs in remote villages/hamlets where there is poor surveillance and the presence of asymptomatic malaria cases (no fever but they test positive for malaria). These asymptomatic cases act as silent reservoirs for malaria.

As another initiative led by ICMR in the same context, the Malaria Elimination Demonstration Project (MEDP) was started as a Public-Private-Partnership between the Indian Council of Medical Research through National Institute of Research in Tribal Health, Govt. of Madhya Pradesh and Foundation of Disease Elimination and Control of India (a not-for-profit entity created by Sun Pharmaceutical Industries Ltd.) Operationalised in Mandla district of Madhya Pradesh, the project's goal was to demonstrate that malaria can be eliminated from a high malaria endemic district along with prevention of re-establishment of malaria and to develop a model for malaria elimination using the lessons learned and knowledge acquired from the demonstration project.

The project strategies were based on test, track, and treat technique and has resulted in over 80% decline in Malaria Burden in the respective geographies.

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Change in anti-malaria drug policy in North-East: Translating evidence to action

Malaria continues to be a public health threat across the world. In India and across the globe, malaria elimination efforts are being ramped up to eradicate the disease by 2030. The disease is highly endemic, especially in most parts of Northeast India. Malaria elimination efforts in this region have a significant role in the overall efforts of eradication of the disease in the country. The disease is highly complex and multi-faceted in the Northeast region due to the unique climatic and ecological conditions prevalent in the area. The first drug (chloroquine and sulfadoxine-pyrimethamine) resistance cases of malaria were reported in Northeast India, and Southeast Asia mainly has been a hotspot for the generation of drug-resistant parasites. A host of efficacy studies and relevant research was conducted under the guidance of ICMR to monitor anti-malarial resistance in the Northeastern region. ICMR-Regional Medical Research Centre (RMRC), Dibrugarh carried out the pioneering efficacy study on ACT (Artemisinin-based combination therapy). The study changed malaria treatment as it was also later introduced as the first-line antimalarial treatment in Northeast India.

The ACT treatment combines two or more drugs working against malaria parasites in different ways and is now the preferred treatment for chloroquine-resistant malaria. Overall, malaria control and elimination in the Northeast has got a boost from ICMR's efforts, and it will continue to be an essential step in India's efforts to eradicate the disease in the next decade.

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FILCO Movement:
A community-based approach for Lymphatic Filariasis

Lymphatic filariasis, commonly known as elephantiasis or filaria, is a neglected tropical disease by virtue of the fact that it most often affects individuals who face severe poverty, poor living conditions, and marginalization. Globally, almost 900 million people across 49 countries are at high risk of developing filaria. In India alone, nearly 1.2 million are affected by this preventable disease. A significant challenge that comes with this disease is deep rooted stigma associated with infected individuals. Though mass sensitization efforts have been led by ICMR, spreading awareness and bridging inequality is the way to go to ensure eradication of the disease especially from endemic regions.

ICMR-Vector Control and Research Centre (VCRC), Puducherry has played a critical role in this front and responded to the evident requirement for focussed efforts on filariasis control. The most important example is the unique People's Movement for Filariasis Control (FILCO) in Cherthala, Kerala. The central coastal part of Kerala has been the largest endemic tract of lymphatic filariasis caused by the parasitic agent *Brugia malayi* and resultantly the FILCO movement was brought to control brugian filariasis. ICMR-VCRC led an exhaustive set of campaigns and efforts to control the disease - this included an integrated vector management approach through de-weeding of ponds, composite fish culture of weed eating edible fishes in the domestic ponds, cultivation of leguminous plants ('sunhemp') and source reduction. The movement also focused on healthcare delivery by detecting and treating microfilaria positive cases, and facilitating mass drug administration to all subjects in the high risk of infection areas to reduce parasite load in the community.

This community-based approach resulted in the successful interruption in transmission of *B.malayi*, with no new infection in the age group 1 - 7 years and a drastic reduction of the parasite load (80.3%) in the community. As a by-product of these daily activities of the people, mosquito control was also achieved in the operational areas.

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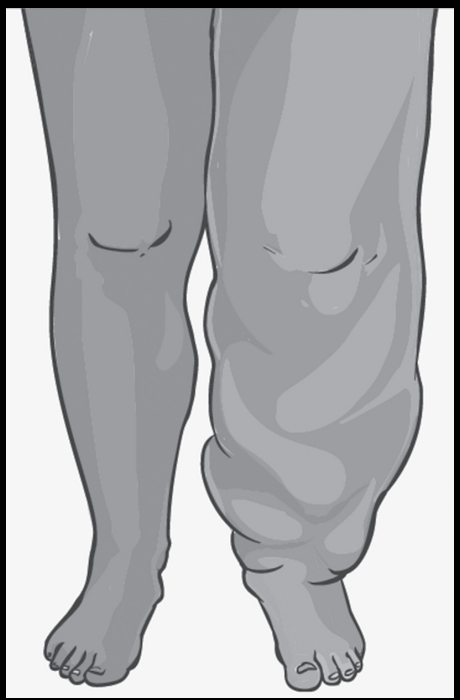
Triple Drug Therapy to escalate Lymphatic Filariasis elimination

Filariasis is the second-most disabling disease after mental health globally, according to the World Health Organisation. It is, however, preventable with the administration of anti-filarial drugs. The Government of India is committed to the elimination of Lymphatic Filariasis (LF). Annual Mass Drug Administration (MDA) is one of the key pillars of eliminating LF in India. To this end, India launched nationwide MDA in 2004 in endemic areas as well as home-based morbidity management.

MDA includes a single dose of DEC (Diethylcarbamazine citrate) and Albendazole for five years or more to the eligible population (except pregnant women, children below two years of age and seriously ill persons) to interrupt transmission of the disease. ICMR-VCRC led study trials to examine the efficacy and safety of the Triple Drug Therapy (TDT) to eliminate filaria, following which the council recommended a nation-wide rollout of TDT. ICMR also played a pivotal role in the development of the drug policy. An Accelerated Plan which includes Triple Drug Therapy (IDA) was launched in the Global Alliance for Elimination of Lymphatic Filariasis (GAELF) meeting held during 13th to 15th June 2018 by Hon'ble Union Health Minister and Hon'ble Minister of State.

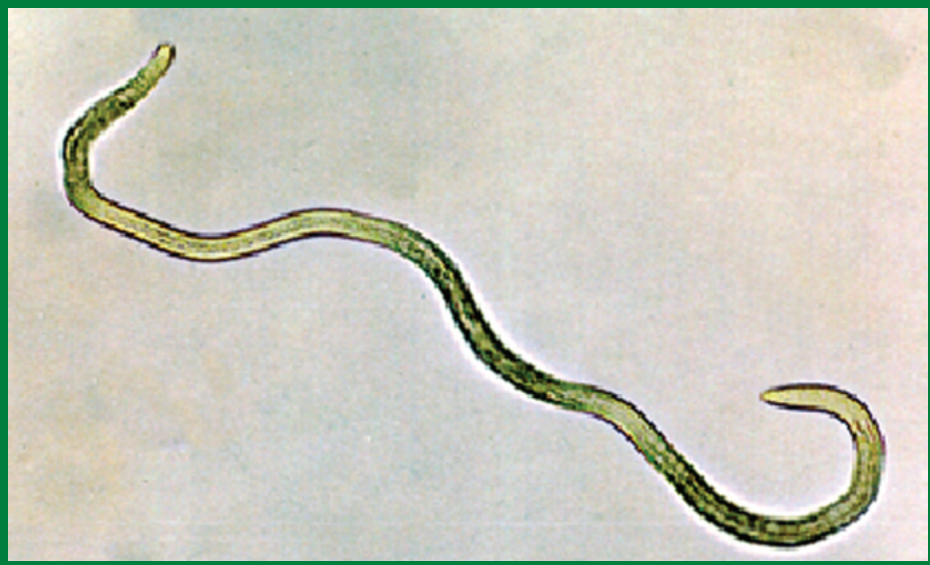


39

Diurnally sub-periodic Filariasis in Nicobar district and its management

In India, diurnally subperiodic filariasis, a specific kind of Lymphatic Filariasis (LF) is prevalent only in the Nicobar district of Andaman and Nicobar Islands. Studies undertaken at different points of time indicate that this form of filariasis is restricted to a small region in Nancowry group of islands where it is transmitted by mosquito *Downsiomyia nivea*, a day biting mosquito.

To address this challenge, a community-based study led by ICMR was carried out in this region where the local community and other stakeholders such as Andaman and Nicobar Administration, Community Health Centre/Primary Health Centre, Tribal Councils, Chieftains and local representatives were sensitised about the utility of double fortified salt in elimination of LF. The objective was to spread awareness among the communities that intake of double fortified salt clears filarial parasites and prevents disease transmission - the iodine in the salt helps in the development and functioning of human body and cognitive ability in children, and the salt does not alter the taste of the food and is safe for consumption by all members of the family including pregnant women and lactating mothers. Through door-to-door conversations, IEC activities and physical distribution of packets of double fortified salt over a period of time, the council was able to encourage positive behaviour change. This has a significant contribution by ICMR since the elimination of the disease from this region helped in preventing its spread to other regions.



L3 stage (infective stage) of the filarial parasite Wuchereria bancrofti in mosquito vector

40

Initiatives towards Kala-Azar elimination: Vaishali Model

Kala-Azar or Visceral Leishmaniasis (VL) or Black Fever is a parasitic disease that is endemic to the Indian subcontinent. India alone accounts for half of the global burden of the disease. Globally, Kala-Azar is also ranked as the second largest parasitic killer in the world – second only to malaria. The disease is transmitted through the bite of a female sand fly which manifests itself as fever, weight loss and swelling of spleen or liver. ICMR's Rajendra Memorial Research Institute of Medical Sciences (RMRIMS), in Patna, is at the centre of India's kala-azar elimination initiative – in multiple areas such as disease surveillance, diagnosis and treatment, prevention and vector management. RMRIMS's in-depth review of India's kala-azar control programme, has played a crucial role in understanding the strength and gaps in its design. This has thereby facilitated the improvement of policies to ensure effective kala-azar elimination. The institute has also led path breaking interventions, which have resulted in the reduction of kala azar cases in India. For instance, ICMR-RMRIMS pioneered the validation of a rapid diagnostic tool for kala-azar, *rK39* which has made testing for the disease easy and time efficient; the test can now be performed in just a matter of ten minutes! RMRIMS also revolutionized the treatment of kala azar and Post Kala-azar Dermal Leishmaniasis (PKDL) by demonstrating the efficacy of the first ever oral drug for the disease- Miltefosine, which had a 94% and 93% cure rate respectively with absolutely minimal side effects. RMRIMS also demonstrated single dose AmBisome (LAMB) as a safe and efficacious drug - presently used as a first line drug in the Kala-azar elimination program.

As a remarkable achievement, the institute was entrusted to implement an integrated control strategy for achieving VL elimination target of less than one case per 10,000 people at the block level in Vaishali district of Bihar which used to report more than 600 cases of this disease annually. As part of this, the spatio-temporal mapping of VL-case distribution, active case detection, chemical-based vector control using indoor residual spraying (IRS), community awareness campaigns, the training of IRS members, the training of medical doctors for effective treatment, etc. was performed. A modern compression pump was also used to maintain spray quality on different wall surfaces. All the blocks of Vaishali District achieved the VL elimination target in 2016 proving that the elimination of the disease is possible from all endemic blocks of Bihar if the integrated Vaishali VL control strategy is applied under strong monitoring and supervision.

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Fighting Fluorosis

Fluorosis is a crippling disease which results from deposition of fluorides in the body. The consumption of fluorides in small quantities is beneficial for the body such as preventing dental cavities and tooth decay; but when taken in significant amounts it could lead to a disabling disease that may cause weak teeth, stiffness of the muscles or joints and ultimately lead to crippling fluorosis. It is a well-known fact that groundwater is the most common source of drinking water across India, which includes naturally occurring mineral, fluoride, in large quantities.

ICMR-National Institute for Research in Tribal Health (NIRTH), Jabalpur has been at the forefront of diagnosing and tackling fluorosis in India. It started its work in fluorosis in 1995 by correctly identifying it in the tribal hinterlands of Madhya Pradesh and providing customized solutions. Following an intensive door-to-door study conducted in villages of Madhya Pradesh, it was reported that deformities caused by fluorosis were further complicated by nutritional deficiencies. To overcome this, the Institute recommended the intake of a locally available shrub called *Chakoda Bhaji (Cassia Tora)*, which is rich in micronutrients essential for checking fluorosis –Calcium, Vitamin C, and Iron. ICMR-NIRTH also mobilized the supply of clean and fluoride-free drinking water in endemic villages by highlighting the need for renovating traditional wells, initiating the supply of piped water, and diluting fluoride-contaminated water with rainwater. Through these interventions the numbers of knock-knee cases reduced from 51 to 2.6%. Due to the highly successful nature of NIRTH's intervention models, they were adopted by UNICEF Bhopal and implemented in Dhar and Jhabua regions of Madhya Pradesh. Later, UNICEF also included this model in their 'International Learning Exchange Programme' from their Geneva office in 2007 and 2008.

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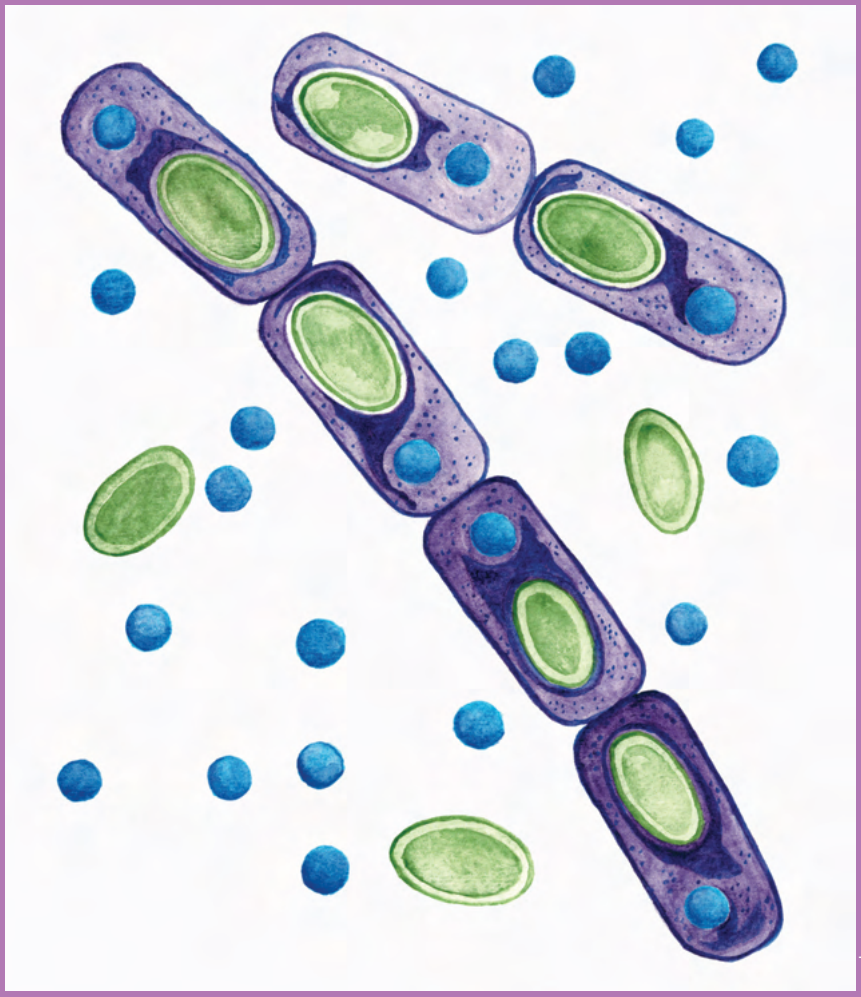
Green Mosquito Control Technology: Success Story of Bti

Vector-borne diseases like malaria, filariasis, dengue, chikungunya, etc., continue to impact public health. To address this problem, efforts made over several decades have led to developing an array of vector control tools and methods, including several chemical insecticides. Although these tools have played a decisive role in combating vector-borne diseases for the last eight decades, insecticide resistance and health hazards due to overuse and eco-toxicity pose a significant challenge to environmental health and vector control operations. To prevent these negative impacts, efforts were made during the late 70s to develop alternate tools, and several eco-friendly biological agents were explored. ICMR-Vector Control Research Centre, Puducherry, joined global efforts and initiated research exploring biocontrol agents of mosquitoes. Following a breakthrough in 1980, a team of scientists in ICMR-VCRC developed indigenous technology to produce *Bacillus thuringiensis israelensis* (a group of bacteria) using locally available and agro-based raw materials. The aqueous suspension is successful against various mosquito vectors, and the formulation is majorly imported and used in public health programs in large volumes. This provided an impetus to tackle the menace of vector-borne diseases not only in India but globally. The Bti technology has now been transferred to Hindustan Insecticides Limited (HIL) for mass scale production and use.



The bacterium Bacillus thuringiensis israelensis is commonly referred to as Bti

Publichealthlandscape.com

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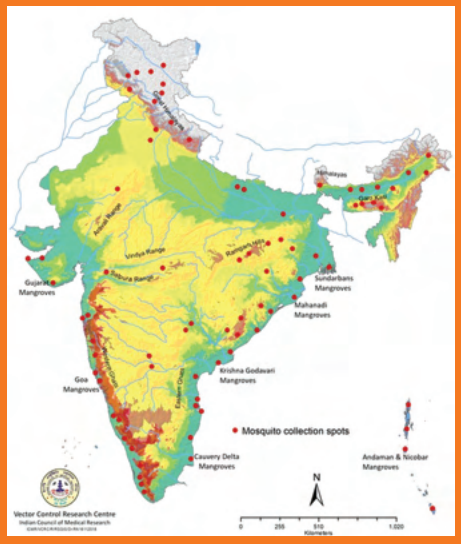
Mosquito Museum: Collection of rare species of mosquitoes

India's biological diversity is one of the most significant in the world. Among the general fauna, mosquito biodiversity helps understand the spatial distribution of vector species and their impact on mosquito-borne diseases. The study is essential as environmental degradation, rapid urbanization, industrialization, deforestation, overall land use pattern, and developmental projects coupled with climate changes and global warming have caused changes in mosquito diversity over the past few decades.

Against this backdrop, ICMR - Vector Control Research Centre, Puducherry, established a Culicid Biodiversity Cell in 2000 to collect mosquitoes and identify, curate, catalog, and deposit in the Centre's mosquito museum. Since then, periodic addition of species, updating of records, and publications of the mosquito specimens in the museum have been adding to the knowledge of mosquito biodiversity and species distribution in India.

At present, the museum has 22 genera comprising 312 species of mosquitoes. The collection consists of 43,388 adult specimens, of which 36,816 are individually mounted on insect Minuten pins, while the rest are held in stock vials. It also includes 3979 male and female genitalia and 14,131 larvae, larval exuviae, and pupal exuviae mounted on microscope slides. This is one of the largest and well-preserved collections of mosquitoes and their parts in the country.

The repository serves as reference material for species confirmation and provides a database on the geographical distribution of mosquitoes. The museum facility is extensively used by research scholars, scientists, and students from across the country.



44

Protecting industry workers by combating Silicosis

Silicosis is a disabling & irreversible disease caused by inhalation of dust containing silica. Though completely preventable, it is one of the oldest occupational diseases and still possesses a high morbidity & mortality among people of weaker socio-economic backgrounds in developing and low-income countries. In India, an estimated 11.5 million workers continuously inhale dust while working and develop silicosis after a varying period of 2 - 15 year or more. The deadly disease silicosis continues to silently affect thousands of workers and hundreds of these die before reaching the age of 40.

ICMR-National Institute of Occupational Health (ICMR-NIOH), Ahmedabad, has been leading the charge to counter the disease. The Institute completed studies among workers of slate pencil industry, agate industry, quarts grinding, sand grinders, stone quarries, mica processing units, etc. After the agate workers' study of ICMR-NIOH the Gujarat Government Factory Rules were amended and the industry, primarily a cottage industry was brought under the legislation, improving the lives of hundreds of workers. Recently, ICMR-NIOH identified Club Cell Protein (CC16) which appears to be a promising biomarker which is released when the lung is damaged due to silica or any other dust or irritant/s. This biomarker once in use will be key to help in early detection of the disease and control its impact.

Photo: Alireza Naseri/unsplash.com

Keeping Asbestosis under check

Asbestosis is yet another common occupational lung disease. Exposure to asbestos, which is a naturally occurring fibrous silicate mineral, causes asbestosis, lung cancer and mesothelioma - an aggressive and deadly form of cancer. Significant and prolonged occupational exposure to asbestos occurs mainly in asbestos cement factories, asbestos textile industry and asbestos mining and milling. The ICMR-NIOH (National Institute of Occupational Health) has played a pivotal role in this sphere; the research institute has carried out studies and generated baseline data on silicosis in these industries. It has also led environmental epidemiological studies in four asbestos cement factories located in Ahmedabad, Hyderabad, Coimbatore and Mumbai. The findings show that the level of asbestos fibres was above the permissible levels in two of these factories. Since the production of asbestos yarn and ropes is performed mostly in the unorganised industrial sector with very poor safety measures, the average levels of airborne asbestos fibres had been found to be much above the permissible levels. In response, automatic asbestos fiber feeding, health education and personal protective measures were implemented as preventive measures. As a result of the studies and consequential interventions, the levels of asbestos fibers in Ahmedabad and Hyderabad asbestos cement factories, which were higher than permissible levels, were significantly reduced.

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Cooling Jacket: For easing the heat stress

Heat stress atmosphere which is prevalent particularly in sectors or areas like mines, construction, chemical plants, iron and steel foundries, brick and ceramic plants, etc., pose a major challenge for workers. It reduces one's efficiency to do work by causing the body to become fatigued and distressed in addition to physical challenges. The stress also causes diseases which can cause illnesses or in worse cases death. To combat the challenge, ICMR-National Institute of Occupational Health (ICMR-NIOH), Ahmedabad came up with an interesting innovation - 'cooling jacket'. The jacket is a battery operated "personal cooling garment" developed as an affordable device to protect individuals from heat-related injuries. The patented technology provides two hours of cooling duration which can be extended by replacing ice and battery. This garment comprises a water-recirculating three-layered vest of cotton fabric lined with a two mm diameter latex tubing and inter-spaced coating of rubberised solution. The silicone tubing system can be fitted to any garment, be it a casual half shirt, or a jacket. To ensure mass production and commercialisation for public use, the technology was later transferred to private setups.

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Nutrifying India: Recommending nutrient requirements for all

The importance of nutrition on humans' various physical and mental health has long been documented and researched. In India, the ICMR-National Institute of Nutrition (ICMR-NIN), Hyderabad has been leading the research in the area and has successfully contributed to improving nutrition parameters since the country's independence.

Recognizing the rapidly changing food habits, physical activity patterns, nutrition transition, and health status of various groups, ICMR-NIN has regularly been updating and developing the Nutrient Requirements for Indians and Recommended Dietary Allowances (RDAs). In 2020, the report for the first time included the Estimated Average Requirements (EAR) and Tolerable Upper Limits (TUL) of nutrients alongside RDAs. While RDAs are daily dietary nutrient intake levels that would be sufficient to meet the nutrient requirements of nearly all healthy individuals, EARs are the average daily nutrient intake levels of the population. These recommendations are the basis for defining the nutrient levels in policies and programs. The EARs and TUL help evaluate peoples' nutritional status, determine food fortification and nutrient supplementation regulation, etc., for the entire country. The updated guidelines will impact nutritional outcomes and help India achieve its targets outlined in the Sustainable Development Goals.

Above: *Diet survey in progress late 1970s*

Facing page: *Training in Diet Surveys for Participants of Training Programmes 1970s*

Fortifying salt for improved health

The control of nutritional deficiencies to improve public health has been one of the primary objectives for India over the past few years. Micronutrient deficiencies, especially in cases of iodine and iron are the two preventable public health problems that have been prevalent across the country for decades, which severely affect young children and women of the reproductive age.

During the 1970s, ICMR's National Institute of Nutrition (NIN), Hyderabad was one of the first research institutes in India to identify common salt as an appropriate vehicle for micronutrient fortification. Over the years, ICMR-NIN worked towards developing the technology to fortify salt with two micronutrients – iron and iodine – leading to the path breaking invention of Double Fortified Salt (DFS). NIN carried out extensive studies on stability, bioavailability, acceptability, safety and impact (including in community) of DFS. Two large scale human trials were conducted with NIN DFS to establish the efficacy in improving iodine status and reducing prevalence of goitre and anaemia and public acceptance. Endemic goitre is an iodine-deficiency disease that occurs in areas where the iodine content of the soil is so low that insufficient iodine is obtained through food and water.

Considering the success of this strategy, the Government mandated its use in Government sponsored food and nutrition programmes like the Mid-Day Meal Programme in 2011. Additionally, guidelines specifying the approved standards for manufacturing DFS were brought out by the Food Safety and Standards Authority of India (FSSAI). In a recent addition to the acclaim of the technology, DFS was selected as one of the leading innovations by the National Innovation Foundation for exhibition of the Technology in New Delhi in March 2015.

Particularly in the case for goitre, in India, the disease was widespread and endemic in the Himalayas, where the Indian goitre belt extended over a distance of 2400 km along the southern slopes of the Himalayas and the adjoining plains.

To address this challenge, the Government of India, in collaboration with the state government of Punjab and ICMR, set up a prospective study in 1954 to evaluate the effectiveness for preventing goitre through small physiological doses of iodine added to the common salt consumed in the endemic areas. The study was to include a comparison of the effectiveness of potassium iodide and potassium iodate in amounts supplying equal quantities of iodine. The results pointed to the fact that intake of iodized salt led to a decline in goitre prevalence.

This study resulted in the Government of India launching the National Goitre Control Programme (NGCP) in 1962. The program now provides iodized salt in place of common salt to all the identified and notified goitre endemic areas across the country. This has resulted in a substantial decrease in goitre cases and an increased intake of iodized salts, especially amongst low-income groups.

Tackling Vitamin-A deficiency

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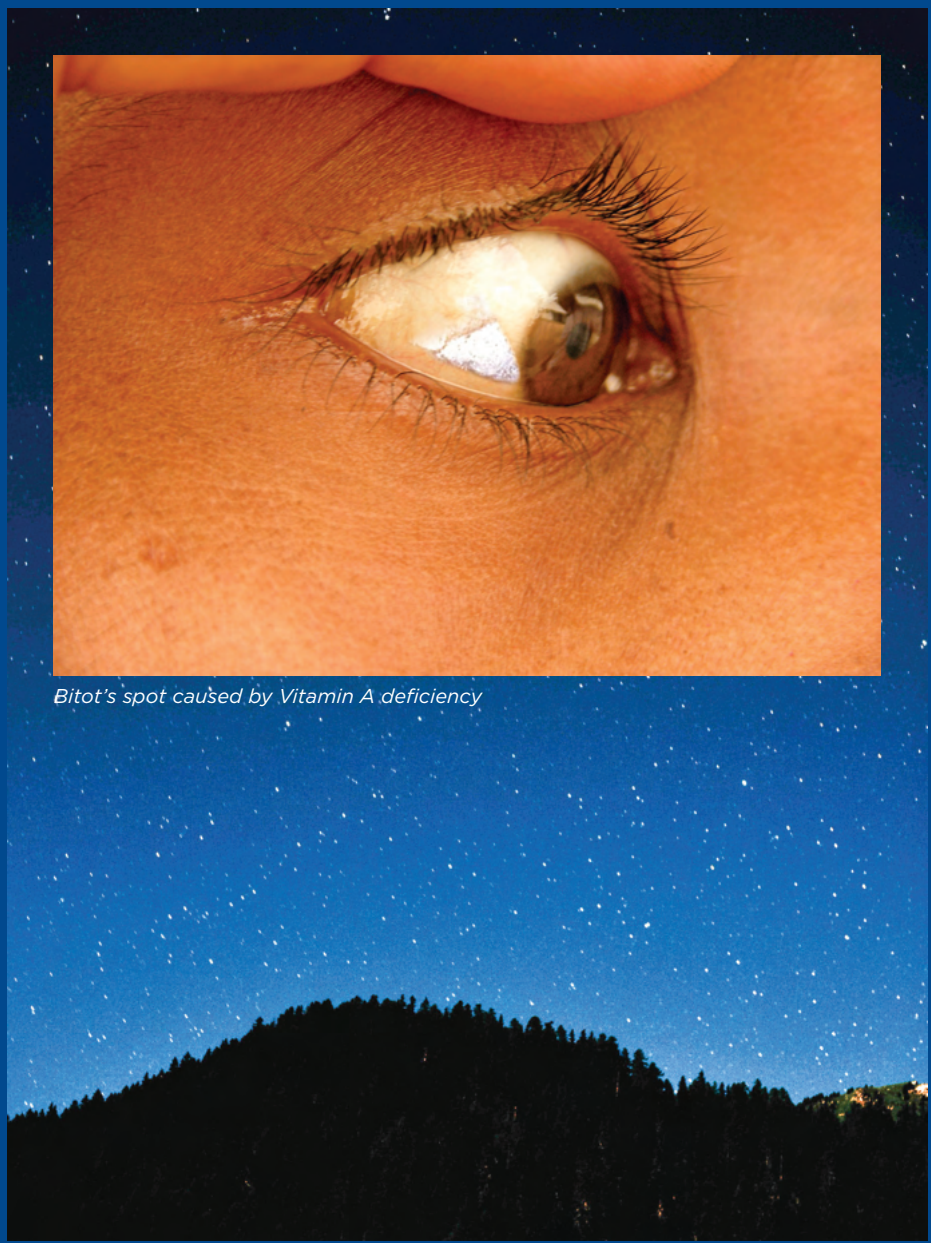
To tackle the country's nutritional deficiencies during the 1960s, the ICMR-National Institute of Nutrition conducted and spearheaded studies on vitamin deficiencies. In those days, Keratomalacia - an eye (ocular) condition usually affecting both eyes that results from severe lack of vitamin A, was one of the most common diseases seen in ophthalmic hospitals in South India and Bengal.

After some preliminary clinical trials on the effect of oral administration of a large dose of vitamin A on serum vitamin A levels, a field trial involving 2500 children was launched. In this study, 300,000 IU vitamin A was administered orally once a year to the children, and its effect on nutritional blindness was monitored over five years.

However, considering the logistical and operational issues, ICMR-NIN recommended the administration of 200,000 IU each at six-monthly intervals instead of further reducing immediate toxic manifestations and providing effective and consistent cover against Vitamin A deficiency. The pioneering program over the years has effectively reduced Vitamin A deficiency and related diseases among the vulnerable population.



Bitot's spot caused by Vitamin A deficiency

National Nutrition Monitoring Bureau:

An insight into nutritional status and health of the population

ICMR has played a nodal role in spreading awareness and driving initiatives to ensure the right kind of nutrition for India's population. The Council has also ensured timely and sustained assessment of the status of health and nutrition across regions. The extensive national health and nutrition surveys provide national-level information on different domains of health.

Among many large-scale and household-level surveys implemented in the country, the National Nutrition Monitoring Bureau (NNMB) was established by ICMR in 1972 in 10 States with the ICMR-National Institute of Nutrition, Hyderabad, as the coordinating centre. The mandate of the survey was to collect and generate good-quality data on the diet and nutritional status of the communities in the urban, rural and tribal areas. Another objective of the bureau was to assess the ongoing national nutrition programs regularly. NNMB has carried out several repeat surveys in the key areas in all the States that were surveyed the first time to assess time trends in diet and nutritional situations. NNMB was the only organization that gathered information on the actual dietary intake of households altogether, along with individual members of the family belonging to different age and physiological groups. These surveys have provided vital information and statistics for the country for policy formulation of RDAs and also for fixing the national norms for supplementary nutrition programmes (ICDS and MDM). The data generated has been used to identify the prevalence and risk factors and effectively combat the country's diseases, nutrition and health challenges. NNMB was further expanded to 16 states in 2012 and the last rural survey was published in 2012. It had even collected urban data before it was closed down in 2015 and subsequently a report was released.

Photo: Nutrition Bureau

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Busting the myth of protein energy malnutrition

Malnutrition among pre-school children due to protein/ energy deficiency has been a common research topic since it was first identified among pre-school children in 1947. The clinical forms of protein-energy malnutrition – Kwashiorkor and Marasmus – were extensively studied during the 1950s.

Clinical trials and studies with protein-rich foods to address the nutritional needs of malnourished children with kwashiorkor and marasmus showed no positive findings. Surprisingly, the significance of the high level of energy requirement for treating the Protein Energy Malnutrition (PEM) cases was missed entirely.

Around this time, ICMR carried out a careful examination of the dietary intake in an urban-rural multi-centric community study on the diets of pre-school children to assess their energy and protein intake.

The study revolutionized nutrition research, and in an unexpected revelation, it was concluded that the protein concentration of the children's diet was nearly adequate, however, the average energy intake was grossly deficient. This analysis paved the way for a new hypothesis that malnutrition among underprivileged children was due to energy deficiency and not solely due to protein deficiency, thereby busting the myth around protein.

This breakthrough result was followed by large-scale community studies initiated to test this hypothesis that WHO and UNICEF later amplified globally.

Photo: Edmund Lou/Unsplash.com

Improving the tribal health

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Staying true to ICMR's goal of better health for all, the council has led significant research and interventions in the field of health problems prevalent among tribal populations. There are some indigenous tribes who reside in forest areas and are therefore prone to other diseases like hemoglobinopathies in addition to malaria and communicable diseases like leprosy, maternal and child health, etc. The hemoglobinopathies are a group of inherited disorders in which there is abnormal production or structure of the hemoglobin molecule. Sickle cell disease (SCD) is one such blood disorder caused by the abnormal hemoglobin that damages and deforms red blood cells.

The ICMR-National Institute of Immunohaematology (NIIH) in Maharashtra has led extensive work on sickle cell gene and other hemoglobinopathies and their interaction in various tribal populations mainly in west, central and north-eastern parts of India. Research and development of molecular technology for detection of hemoglobinopathies, robust technology to detect sickle cell disease in remote areas and diagnostic studies to understand the trends of morbidity and mortality in sickle cell disease was led by the institute.

Apart from this, ICMR-NIIH also undertook a study where over 15,000 individuals from 14 ethnically and geographically distinct primitive tribal populations from 4 states - Gujarat, Maharashtra, Odisha and Nilgiri Hills in Tamil Nadu were taken into account to examine their nutrition levels. The objective of the study was to determine the extent of nutritional anaemia, the general health status and the prevalence of sickle cell disease, other hemoglobinopathies and G6PD deficiency prevalent among these tribes. This study was instrumental in the development of inclusive health programs to ensure better and improved health outcomes for India's marginalized populations.

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Pioneering research on Hepatitis E

ICMR has been at the forefront of research on enteric diseases. Amongst the numerous enteric infections, Hepatitis E was demonstrated to be an important public health problem in India, with more than half the adult cases of jaundice caused by the virus. The disease disproportionately caused high mortality in pregnant women in outbreaks. The virus is also a major cause of fulminant hepatic failure in adults, leading to mortality among sporadic cases occurring in adult men and non-pregnant women.

In a breakthrough, the ICMR-National Institute of Virology (ICMR-NIV), Pune, identified the enterically transmitted virus, which was later named hepatitis E virus (HEV). Post its identification; the ICMR-NIV worked on various aspects of HEV - successfully developing diagnostic assays and visualizing its particles. Further research studies led by the Council have raised the possibility of creating a vaccine against HEV. The vaccine candidates have undergone testing in animals and have shown promising results suggesting the need for further assessment in humans. These research studies and breakthroughs have enabled ICMR to etch its name globally in the area of enteric diseases.

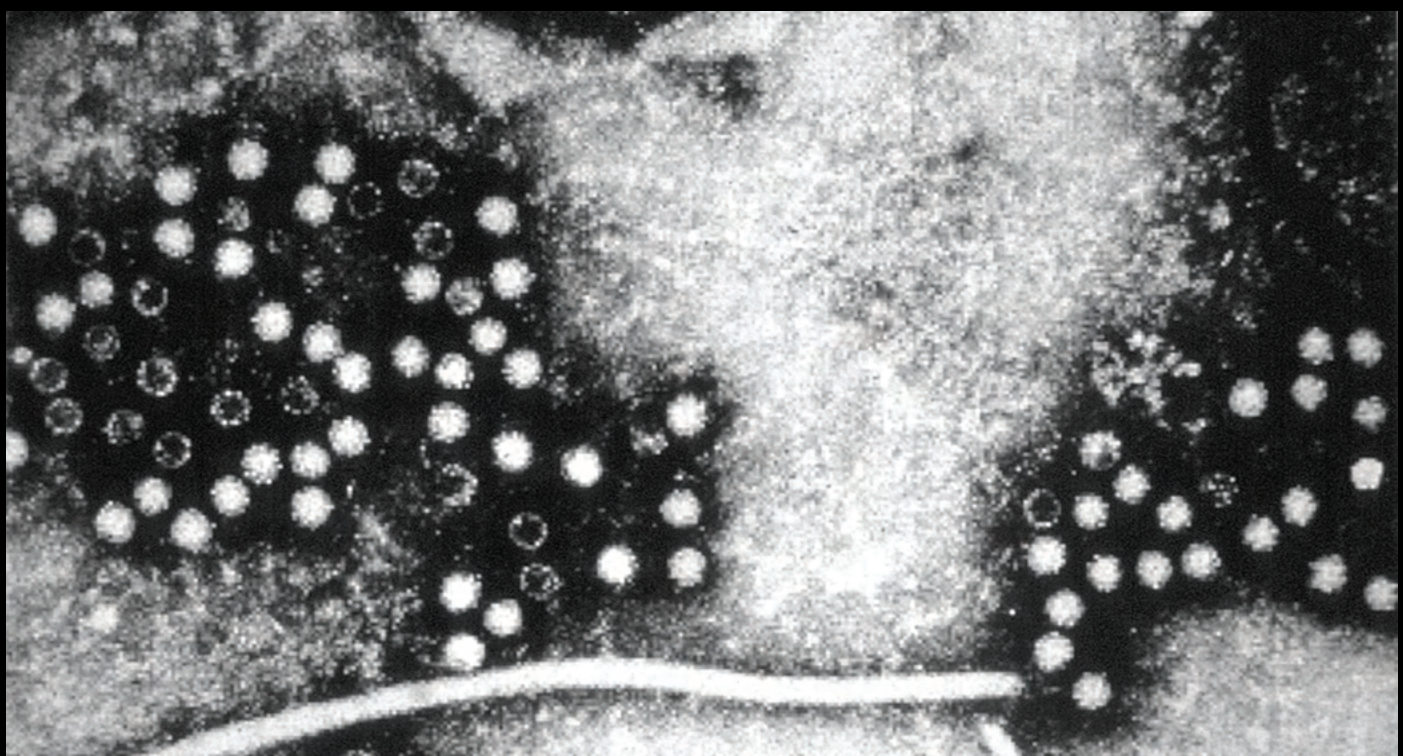

Photo: Wiki Commons

Hepatitis E virus

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Leading the HIV/AIDS control in the country through ICMR/NARI

ICMR played a crucial role in identifying that the HIV & AIDS pandemic had entered India. In 1985, the task force on AIDS established by ICMR documented no cases of AIDS in India at that time but recommended initiation of sero-surveillance using the latest testing techniques. For this, ICMR established a network of research laboratories across India and began surveillance for HIV in India through targeted testing among asymptomatic populations at high risk of HIV and vulnerable persons. India was the first country to initiate a systematic national sero-surveillance for HIV under the aegis of ICMR. The Council led this during 1986-91 and subsequently helped identify that unsafe blood transfusions by professional donors were driving the spread of the epidemic in India. This was confirmed when in 1989, intravenous drug use in Manipur caused an explosion in HIV/AIDS cases, and ICMR urgently rallied the necessary focused interventions to curb it. The work of ICMR helped the Government of India identify HIV/AIDS as a threat to India and established a vertical program for prevention and control of the disease in India (NACP-I) in 1992.

The Council set up a dedicated institute – ICMR-National AIDS Research Institute [NARI], Pune, in 1992 to lead the national research response against HIV/AIDS. ICMR-NARI leads HIV/AIDS response in the country through quality multifaceted research providing direction to India's public-health response to HIV in India. Clinical trials conducted at ICMR-NARI led to change in HIV treatment guidelines by WHO and Indian Government; pivotal to the current 'Treat all Policy' in India. The apex laboratory helped standardisation of quality HIV-diagnosis, CD4 and viral load testing and test-kits in India. HIV virus-bank, a national resource, also led to identification of recombinant HIV strains, and cohort studies identified risk factors in India. HIV Drug Resistance laboratory not only guides surveillance for drug resistance in India but also other South East Asian countries.

ICMR-National Institute of Medical Statistics (ICMR-NIMS), New Delhi also provides periodic national and subnational HIV/AIDS burden which are crucial for policy making, local level planning and progress monitoring of HIV prevention, diagnosis and treatment in India.

ICMR studies also focussed on social-behavioral interventions, identifying risk groups like injectable drug users, sex workers, MSM etc. as well as diagnostic and therapeutics like Anti-retroviral therapies (ART). All these interventions helped in significantly reducing the HIV/AIDS burden in the country.

55

HIV prevention among injecting drug users in Manipur

Churachandpur, also known as Lamka, is a small town nestled in the hills of north-east India in Manipur. The practice of heroin injection in this town began in the early 1980s and there are numerous groups of Injecting Drug Users (IDU) residing here. According to an ICMR report, over 80% of the IDUs in Manipur were estimated to be HIV-positive in addition to 1% of antenatal mothers who were screened in maternity clinics. This posed a challenge for the intervention targeting IUDs supported with risk reduction information and materials.

A collaborative project between ICMR and WHO was initiated to address this challenge. As part of this, community outreach intervention which included an advisory committee and door to door intervention aimed at interpersonal communication was instrumental in driving positive behaviour change. The outreach workers who are the front-line soldiers in the fight against HIV/AIDS were trained in basic medical facts and epidemiology about HIV/ AIDS, the importance of prevention of HIV/ AIDS among IDUs and their partners, HIV antibody testing issues, etc. The training that was imparted also focused on communication skills for effective social interactions. The concerted efforts and initiative paved the way forward for north-eastern states of India and also for the rest of the country geared towards containment of injecting drug use mediated HIV transmission.

56

Safeguarding Parenthood: National Guidelines for Assisted Reproductive Technology/ART Bill

Infertility affects up to 15% of reproductive-aged couples worldwide. According to the World Health Organization estimate the overall prevalence of primary infertility in India is between 3.9 to 16.8%. There has been an increased demand for Assisted Reproductive Technology (ART), which has resulted in mushrooming of infertility clinics in India.

Photo: Aditya Romansa/unsplash.com

Assisted Reproductive Technology (ART) includes medical procedures used primarily to address infertility. Owing to the prevailing laws and the moral responsibility associated with such technology, ICMR has put in place - National Guidelines for Accreditation, Supervision and Regulation of ART Clinics in India. These guidelines have been evolved after detailed discussion and debate by experts, practitioners of ART and public. The literature involves selection criteria and possible complications emerging from ART, code of practice, ethical considerations and legal issues associated with the process, details on providing ART services to the Economically Weaker Sections (EWS) of the society and more. Post the birth of the first scientifically well documented test tube baby in 1986 in India, the number of IVF clinics in the country increased manifold. The services offered by some of the clinics were questionable because of lack of ART guidelines as well as legislation, no accreditation, supervisory and regulatory body and no control of Government. It was here that the ICMR developed a draft National Guidelines for Accreditation, Supervision & Regulation of ART Clinics in India in 2002.

On 8 December 2021, the parliament passed the Assisted Reproduction Technology (Regulation) Bill to regulate and supervise assisted reproductive technology clinics across the country.

57

Innovative Mobile Phone Technology for Community Health Operations (ImTECHO): Improving Maternal Health Services

India has made rapid strides to improve maternal, neonatal, and child health services in the past few decades. However, monitoring and evaluating these services, especially in the absence of technology, has remained a challenge. ICMR launched an innovative web-based application called Innovative Mobile-phone Technology for Community Health Operations (ImTeCHO) to tackle this issue. The tool serves as a technical aid to the government's Accredited Social Health Activists (ASHAs) and Primary Health Center (PHC) staff to improve coverage of MNCH services in rural tribal communities of Gujarat.

The technology has revolutionized the tracking mechanisms and streamlined the work of ASHA workers in the state. The technology has enabled ASHA workers to digitally track pregnant women and infants' health, schedule home visits, notify stock of drugs and vaccines, and maintain records. ImTeCHO has enabled better decision-making, increased accessibility of health services, and has led to an overall improvement in the state's health program.

58

Human Reproductive Research Centres: Addressing national and local concerns

ICMR has been addressing the reproductive health issues of the country by conducting cutting-edge research and guiding policy reforms in the area. The Council regularly tracks global and national technological advances, analyses new and upcoming reproductive health issues, and disseminates the research findings to relevant stakeholders. However, finding relevant data for major reproductive problems faced by the population across the country has been a challenge. Since medical colleges tend to patients across a large area, it becomes imperative to have region-specific data to identify trends and cases of incidence for research findings.

To investigate this missing local-level data, ICMR set up a total of 31 Human Reproductive Research Centres (HRRC) in different medical colleges spread across the country. The primary task of these centres has been to help identify the magnitude and prevalence of reproductive diseases. The data generated through these centres gives direction to the kind of reproductive care services and diagnostics needed at the local, state, and national levels. ICMR has also set up research protocols and methodology for these centres, facilitating segregation of regional and national levels. These research centres have helped ICMR move toward addressing existing, emerging, and evolving reproductive health concerns to ensure improved health conditions for the Indian population.

Photo: unsplash.com/Reproductive Health Supplies Coalition

Selection of reproductive health supplies: pills, diaphragm, condoms, vaginal ring, IUD, implant, dmpa, emergency contraception, contraceptive pills

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Research on newer contraceptives and facilitating good reproductive health for all

ICMR has always been at the forefront of addressing the various issues of reproductive health in accordance with the national needs and priorities. Over the years, the council has led several clinical trials for assessment of safety, efficacy and acceptability of various contraceptive methods and microbicides. ICMR's National Institute for Research in Reproductive Health (NIRRH) situated in Mumbai has undertaken numerous research studies that have impacted policy change at a national level and have been critical in revolutionizing reproductive health in India.

Specifically, ICMR- NIRRH has been at the helm of development of clinical, operational guidelines and information, education and communication material on priority areas for use in the national programs for reproductive health. One of its key innovations include a comparative evaluation of Copper IUDs followed by the recommendation CuT 200 was a safe and effective contraceptive with relatively few side effects and complications; a study in collaboration with WHO on use of low dosage Combination Pill as oral contraceptives among urban low-income group population; clinical tests of various drug combinations by various routes for non-surgical methods of termination of pregnancy, and more. Through continued and concerted efforts, ICMR is committed towards the realization of the national objective of 'Good Reproductive Health for All'.

Photo: unsplash.com/Reproductive Health Supplies Coalition

IUD (intrauterine device)

60

AV-Magnivisualiser

Cervical cancer screening made easier

Despite being preventable and treatable, cervical cancer is one of the leading causes of cancer-related deaths among women in India. ICMR played a nodal role in developing the first indigenous device for screening and early detection of the disease, which kills over 74,000 women in the country every year. Designed and developed at National Institute of Cancer Prevention and Research (NICPR), working under ICMR, the low-cost 'AV-Magnivisualiser' device aimed to help in the early detection of cervical cancer among adolescent girls and women and contributing to saving many lives. The cost-effective device was initially rolled out in the district and sub-district community health centres (CHCs) and subsequently in the primary health centres (PHCs). The technology used in this device has been transferred by ICMR-NICPR to the industry for wider use and commercialization. AV-Magnivisualiser revolutionizes cervical cancer screening in remote areas where pathology laboratories and pathologists are not available. In a noteworthy fact, the instrument could be used in place of a colposcope, especially in low resource settings.

61

Tackling Human Anthrax: A One health strategy for its elimination

Anthrax is a zoonotic disease affecting scores of people in India, with Odisha contributing significantly to the tally in the recent past. The leading causes of such high incidence in the state and repeated occurrence of the disease are low levels of awareness and limited coverage of livestock vaccination against anthrax.

ICMR – Regional Medical Research Centre (RMRC), Bhubaneswar, initiated a pilot intervention study using the 'One Health' approach for eliminating human anthrax cases in the Koraput District of Odisha. The study focused on setting up a robust surveillance system, strengthening the inter-departmental coordination between the health, veterinary, forest, and other allied institutions at the district, block and *Gram Panchayat* level, and building awareness at the community level through Information Education and Communication (IEC) activities. The pilot study launched in the year 2020 is paving the way towards inching the nation close to eliminating human anthrax.

62

Dealing with Natural Disasters: Health Impact Assessment during Tsunami

On 26th December 2004, a massive earthquake measuring 9.0 on Richter scale struck the west coast of northern Sumatra, triggering an unprecedented tsunami in the Indian Ocean - easily classified as one of the world's worst natural disasters. The giant waves slammed into the coasts of India, Indonesia, Sri Lanka, Maldives, Malaysia, Myanmar, Thailand, the Seychelles and Somalia destroying thousands of kilometers of coastline and the communities that depended on them. It took more than 10,000 lives in India and left several thousand missing and displaced.

The affected areas (especially the coastal regions of India, mainly the east peninsular region) were highly vulnerable to the outbreak of epidemic prone diseases. The establishment of a surveillance system for identification and prompt response of such diseases posed to be a major challenge. Through the various institutes and centres ICMR was able to assist the state authorities in establishing emergency disease surveillance systems in the tsunami affected states of Tamil Nadu, Andaman and Nicobar Islands, Pondicherry, Kerala and Andhra Pradesh. These emergency surveillance systems were helpful in identifying upsurges and outbreaks of measles, rotaviral diarrhoea and malaria in some of the disaster affected areas. Early detection of these outbreaks also helped the state governments in initiating prompt action for control of these upsurges.

Apart from this, there were specific ICMR institutes which rose to the occasion to provide scientific aid and support to the affected areas. The ICMR- NIE (National Institute of Epidemiology) was involved in the rapid assessment of temporary shelters for people while ICMR-NIRT (National Institute for Research in Tuberculosis) led counseling of school going children in the affected areas. Efforts related to medical relief, surveillance and outbreak investigation were also carried out by ICMR in a significant way.

Devastation caused by tsunami

63

Research support in Bhopal Gas Disaster

The night of 2-3 December 1984 saw the "largest chemical disaster in the history of this planet"- the Bhopal gas tragedy. Approximately, 40 tons of highly toxic Methyl Isocyanate and its reaction products (MIC/Toxic Gas) stored in a stainless-steel tank located in a pesticide plant owned by an American company Union Carbide Corporation, suddenly escaped in the atmosphere in gaseous form. Within no time the poisonous gas spread in the city and people started dying within hours. Inhalational deaths occurred instantly at home, in streets and in hospitals. ICMR estimated that out of a total 8, 32,904 population of Bhopal, around 5, 21,262 (62.58 percent) were exposed to the MIC and other toxic gases while only 311642 (37.42 percent) being fortunate enough to escape from the effect of the toxic gases.

The council along with the medical community of Bhopal took it on themselves to address this challenge and tackle the threat caused to human and animal lives because of this disaster. ICMR initiated a research set up at Bhopal and within a month, they were able to visualize the long-term impact of exposure to the toxic Gas (es). Following this, ICMR geared up its resources to undertake the colossal task of identifying the chemical compounds and studying their effect on human health. To address the issue of limited human and technical resources like infrastructural facilities, the council established the Bhopal Gas Disaster Research Centre (BGDRC) at the Gandhi Medical College to coordinate the research activities.

In due course of time, ICMR published two technical reports related to 'Health Effects of the Toxic Gas Leak from the Union Carbide Methyl IsoCyanate Plant Bhopal'. These entailed epidemiological and clinical studies related to the tragedy and serves as a reckoner for insights and details of the disaster.

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Cholera: A local pitcher to the rescue

Cholera is an acute diarrhoeal disease that can kill within hours if left untreated and severe cases of the disease need rapid treatment with intravenous fluids and antibiotics. ICMR has led intensive studies and research in diagnosing the causes and trends of this disease and also executed successful interventions to address the challenges associated with cholera.

As per research findings, the lack of a clear correlation between the water supply and the causation of the disease, as well as the pressure of a large number of apparently infected persons in a single community led to the hypothesis that person-to-person transmission through contamination of domestic food and water, owing to poor hygienic practices, might be responsible for the maintenance of infection in endemic areas. This was when the successful interruption of transmission of cholera at the level of families through innovative point-of use intervention was carried out. A narrow-necked earthenware pitcher or water storage vessel (locally termed *sorai*) was used. Since each 'sorai' had a narrow inlet and a spout, into which a hand could not be placed, the source of contamination of water that is being used for drinking and domestic purposes, could be prevented. This innovation has been highlighted by the WHO and has drawn attention of and been adapted by public health professionals in and outside India as well. In addition to this, as part of sustained behaviour change to prevent this disease, ICMR-NICED has regularly engaged in advocacy for maintaining healthy personal behaviour and household hygiene and contributing to the reduction of diarrhoeal disease burden. The institute has also worked to educate the mothers of young children to improve their knowledge, attitudes and practices for ensuring personal as well as household hygiene.

Photo: WikiCommons

The Sorai an earthenware vessel with separate openings shown by the arrows for inlet and outlet

JALMA Flap: Pioneering treatments for Leprosy induced muscle atrophy

Leprosy is an infection caused by slow-growing bacteria called *Mycobacterium leprae* and can affect the nerves, skin, eyes, and nose lining. The disease has been a significant public health challenge for a long time in the country. The National JALMA Institute for Leprosy and Other Mycobacterial Diseases in Agra was established by Japan as India Centre for Japan Leprosy Mission for Asia (JALMA) to serve leprosy patients in India. The institute later came under the purview of ICMR. Since then, the institute has contributed to creating awareness, understanding the disease, and leading remarkable initiatives to address the challenges that come with the disease.

One of the pioneering initiatives launched by the institute to tackle the disease is the JALMA flap. The initiative is reconstructive surgery for restoration of volume of first web space in muscle atrophy associated with ulnar palsy in leprosy. This initiative has been helping in addressing the stigma and hesitation associated with this disease. ICMR has also been leading the research on vaccines for the disease and providing clinical treatment for the patients of the disease.

These efforts of ICMR have resulted in a substantial decrease in the case load of Leprosy in the country. ICMR has now established its leadership in leprosy research globally.

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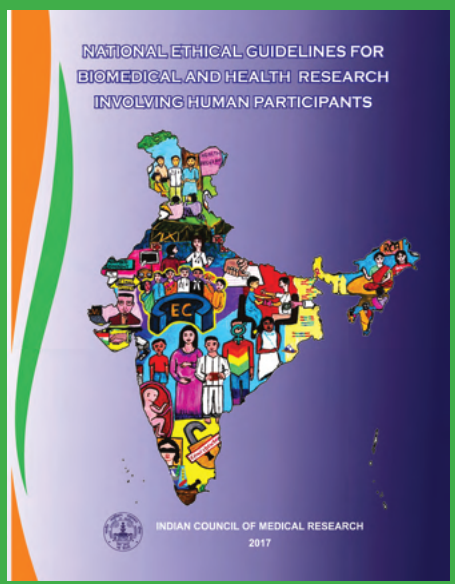
Protecting the rights, safety, and well-being of research participants: Strengthening Bioethics

Health Research requires the highest standard of ethics while protecting the rights, safety, and well-being of research participants through equity, diversity, and inclusion. ICMR has been at the forefront of championing the cause for highest ethical standards in the conduct of biomedical research. The first guideline – The Policy Statement on Ethical Considerations Involved in Research was published in 1980, and thereafter it has been updated with guidelines, which are in tune with rapid advances, released in 2000, 2006, 2017. ICMR has also addressed Guidelines for Research in Children and Do Not Attempt Resuscitation Consensus Guidelines. It has now become mandatory to follow the National Ethical Guidelines for Biomedical & Health Research and to register ethics committees with Department of Health Research under the New Drugs & Clinical Trial Rules, 2019. In April 2020, India became one of the first countries in the world to release the ICMR Guidelines for Ethics Committees reviewing research during COVID-19 Pandemic. The ICMR Bioethics Unit at NCDIR, Bengaluru was awarded the WHO Collaborating Centre for Strengthening Ethics in Biomedical Research, as the first centre in WHO-South East Asia Region. All efforts are synergized with the vision for ICMR to strengthen robust research.



Ethical research journals of ICMR

67

Leprosy Vaccine: Field trials as a step towards reaching the last mile

ICMR- National Institute of Epidemiology (NIE) has conducted several leprosy studies including prophylactic vaccine trial, chemotherapeutic trials for evaluating different regimens and disease modelling for transmission and control thereby contributing significantly to global and national leprosy control programmes.

A landmark leprosy vaccine trial in South India was designed to assess the prophylactic efficacy of the then available four candidate vaccines [BCG + Killed M. leprae (KML), BCG, ICRC (a vaccine developed by Indian Cancer Research Centre), Mycobacterium. w (M.w) or placebo (normal saline)] against progressive and serious forms of leprosy. The trial area had a population of 300,000 which belonged to 264 contiguous villages from erstwhile Chingleput district of Tamil Nadu, South India. Of them, 171,400 volunteers who were free from leprosy were screened for intake during 1991-93. The trial population was followed-up during 1993-95, 1997-98 and 1999-2002 to identify new cases of leprosy. All the examinations were conducted by trained field investigators who were blinded to prior clinical or vaccination status.

All the candidate vaccines were found to be safe for human use and there were no instances of serious toxicity or side effects subsequent to vaccination. A single-dose of BCG + KML and ICRC offered moderate protection against leprosy among both general population and household contacts even at the end of 10 years meeting the requirements of public health utility. BCG+KML offered significant protection for those with prior BCG vaccination. Till date, the trial remains one of the largest ever and pioneering field trials that set scientific and ethical standards in the field of leprosy. Mw, also known as MIP, is now under trial for use as a vaccine against Tuberculosis. The initial clinical trials have been conducted in Gujarat.

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Clinical Trials Registry-India (CTRI): Streamlining Clinical Trials

ICMR has been leading clinical trials across public health research issues for various public interventions and tools. These clinical trials hold enormous potential for benefiting patients, improving therapeutic regimens, and ensuring advancement in evidence-based medical practice. Due to unforeseeable circumstances, some of these trials are abandoned or are not published due to unfavorable results. To address such challenges, ICMR launched the Clinical Trials Registry - India (CTRI) in July 2007. The registry is being managed by the ICMR-National Institute of Medical Statistics, New Delhi, India. The CTRI (www.ctri.nic.in) is an online, free and searchable system for the prospective registration of all clinical studies being conducted in India. The portal also registers clinical studies conducted in countries that do not have a primary registry of their own. While it was initiated as a voluntary measure by ICMR, registration of all clinical trials is now mandated by the stakeholders like the Drug Controller General of India, Ethics Committees and journal editors.

Today, any researcher who plans to conduct a trial involving human participants of any intervention must register the trial in the CTRI before enrolment of the first participant. The registry also requires submission of ethics and regulatory body approvals. The registry has built transparency, accountability, and accessibility of clinical trials and a regularised system for streamlining approvals for them.

Photo: Satheesh Sankaran/Unsplash.com

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Anti-Microbial Resistance: Monitoring Trends

Antimicrobial Resistance (AMR) occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines making infections harder to treat thereby increasing the risk of disease spread, severe illness and death. The non-availability of nationwide data on estimates of the extent of drug resistance was a hindrance towards concerted response against AMR in India. To this end, ICMR initiated the Antimicrobial Resistance Surveillance & Research Network (AMRSN) in 2013 to collate nationally representative data across the country. The goal was to understand the molecular mechanisms of bacterial resistance, how bacteria evolve and how they acquire and transmit antibiotic resistance. As part of AMRSN, a network of hospitals was established to monitor trends in the realm of antimicrobial susceptibility and transmission dynamics to develop relevant strategies to battle the challenge. The AMRSN network is now recognized nationally and internationally.

A nationwide Antimicrobial Stewardship Programme (AMSP) was also initiated by ICMR to facilitate the judicious use of antimicrobials and improve the diagnostic stewardship and infection control practices. ICMR-National Institute of Cholera and Enteric Diseases (NICED), Kolkata, has become a hub of research on antimicrobial resistance. The hub focuses on research on developing alternatives to antibiotics, such as bacteriophage. As part of the hub, NICED developed the first of its kind repository of antibiotic-resistant bacteria strains for research, which is enabling cross country collaboration and knowledge exchange to help India overcome antimicrobial resistance.

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National Rotavirus Surveillance Network: Facilitating Rotavirus vaccine rollout

Rotavirus is a virus that spreads easily among infants and young children. It can cause severe diarrhoea, vomiting, fever, and abdominal pain. This virus was first discovered as the cause of acute gastroenteritis in 1973 and was first reported from India in 1977. In the following three decades of rotavirus research in India, several studies on rotavirus disease had been conducted across different parts of the country.

In 2001, ICMR and the Centers for Disease Control and Prevention (CDC) in Atlanta, USA, began strategizing and planning for a network for surveillance for rotavirus in different parts of India. The 'National Rotavirus Surveillance Network' (NRSN) was established in December 2005 by ICMR-NIE to initiate a sustainable surveillance platform to estimate and monitor the disease burden in children under five years of age hospitalized for Diarrhoea. With four laboratories and ten hospitals spread across seven different regions of India and using standardized protocols for enrolment and diagnostic evaluation, NRSN generated valuable data on rotavirus disease burden for the period of 2005-2009. The analysis of surveillance data involving over 7000 children demonstrated both the high prevalence of rotavirus disease in India as well as the circulation of a diverse range of rotavirus strains. All the findings led by ICMR clearly demonstrated the need for not only rigorous implementation of measures to improve environmental sanitation, water supply and food hygiene, but also seriously consider the effective prevention option of introduction of rotavirus vaccine in the national health system. Based on these recommendations, Government of India introduced the Rota-virus Vaccine (RVV) in 2016 as part of the Universal Immunization Program becoming the first country in the WHO-South East Asian region to launch a Rotavirus vaccine developed indigenously. In 2019, India became the first country in the region to scale-up the Rotavirus vaccine nationally across 29 states and 8 union territories, with domestic funding.

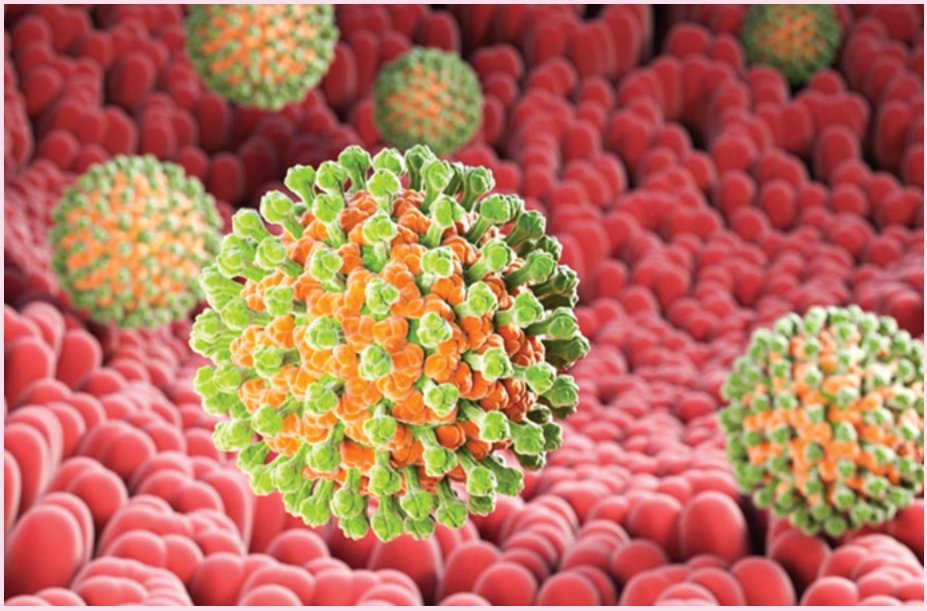

Photo: GHS Archives

In 2019, India became the first country in the region to scale-up the Rotavirus vaccine nationally

Photo: GHS Archives

Health Diplomacy: India-Africa Health Science platform

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India and Africa both face similar challenges in health, including commonalities in disease burden, similar demographics and environment, limited resources to run large scale public health programmes, and a strong desire to attain self-sufficiency in disease management. Recognizing this, ICMR partnered with the African Union in 2019 to strengthen South-South collaboration in advancing health sciences research; enhance local capacity and ownership; and established an India-Africa health sciences collaborative platform. The collaboration focuses on training and strengthening capacity of health professionals, researchers, regulators and industry staff; support research collaborations for developing preventive tools and improved diagnostics for diseases.
Through various strategic activities, the initiative focuses on capacity building, research collaborations for developing preventive tools and improved diagnostics for diseases which are regional priorities in India and Africa. India has taken significant strides in extending healthcare cooperation to the African region including pharmaceutical trade and product development.

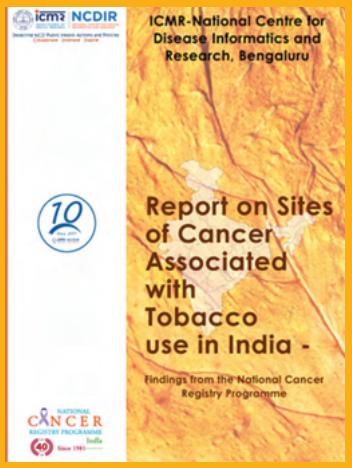
Prior to this, ICMR partnered with the Ministry of External Affairs and other key Indian Ministries (Health and Family Welfare; Science and Technology; Commerce and Industry; Chemicals and Fertilizers) and several African regional scientific and research agencies to organize the first India Africa Health Sciences Meet (IAHSM) in September 2016 at New Delhi. The deliberations highlighted the need for India and Africa to conduct joint biomedical and health research to address diseases of common concern through indigenous development of affordable drugs, diagnostics and vaccines, and also enable knowledge sharing and capacity strengthening.

... the initiative focuses on capacity building, research collaborations for developing preventive tools and improved diagnostics for diseases which are regional priorities in India and Africa.

Cancer Registries: Estimating nationwide cancer burden

ICMR initiated a network of cancer registries across the country in December 1981, called the National Cancer Registry Project which was re-named as National Cancer Registry Programme (NCRP) in 1986. NCRP registration is aimed to generate reliable data on the magnitude and patterns of Cancer, providing a database for developing appropriate strategies to aid in the Cancer Prevention and Control efforts and developing human resources in cancer registration. Active NCRP registration started in January 1982 with 3 Population Based Cancer Registries (PBCR) at Mumbai, Chennai and Bengaluru; and 3 Hospital Based Cancer Registries (HBCR) at Dibrugarh, Chandigarh and Thiruvananthapuram. PBCRs collect data on all new cancer cases in a well-defined population to assess the magnitude and pattern of cancer in the population. HBCRs record information on cancer patients in a hospital to plan for hospital services and infrastructure. Together, both inform cancer prevention and control efforts in the country. Currently, there are 38 PBCRs covering about 11% of the population of India and 268 HBCRs. The NCRP data is used extensively for cancer control planning and policy development. It helped Ministry of Health & Family Welfare, Government of India to plan for national level screening of oral, breast and cervical cancers and establishment of Regional Cancer Centres (RCC)/Tertiary Care Cancer Centres (TCCC)/State Cancer Institutes (SCI), development of ICMR cancer management guidelines, several Parliamentary related matters and framing of national cancer policies and programs. Many states made cancer a notifiable disease for public health benefit based on NCRP. NCRP data has been used for cancer research in Burden of Diseases studies and by WHO International Agency for Research on Cancer (IARC) for studies/databases like GLOBOCAN, CONCORD, SURVCAN and Cancer Incidence in Five Continents (CI5). As NCRP celebrates its 40th year of cancer registration in India, the initiative remains committed to synergising actions for control of cancers in India.

Photo: Drew Hays/Unsplash.com


ICMR-National Centre for Disease Informatics and Research, Bengaluru
Report on Sites of Cancer Associated with Tobacco use in India -
Findings from the National Cancer Registry Programme


Cancer Registry ABSTRACT
CRAB
The Newsletter of NCRP
Volume XVII Number 1
November 2012


Cancer Registry ABstract
CRAB
THE NEWSLETTER OF NCRP
VOLUME XVIII NUMBER 1
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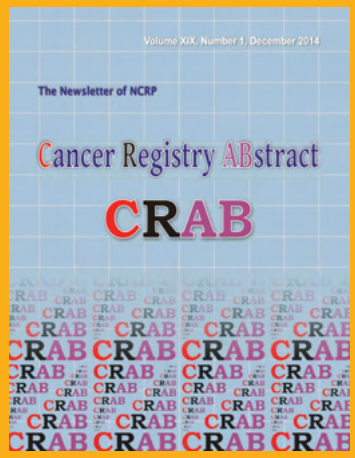
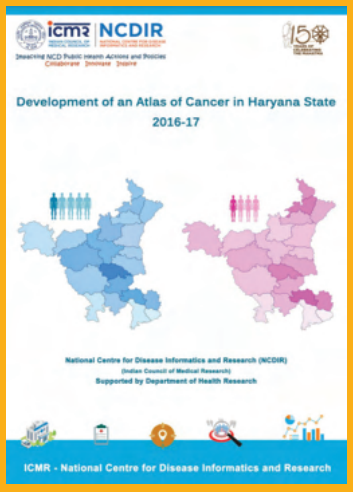
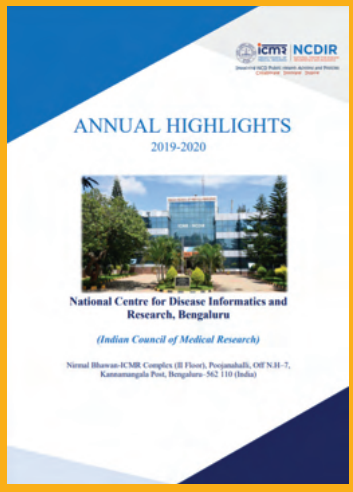
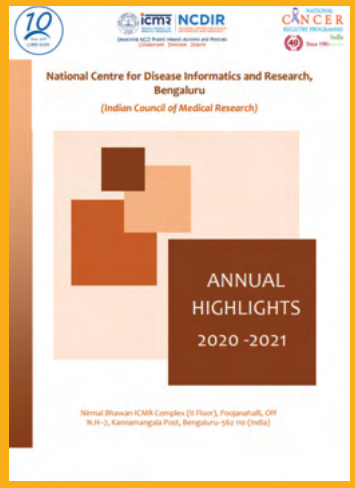

Volume XIX, Number 1, December 2014
The Newsletter of NCRP
Cancer Registry ABstract
CRAB

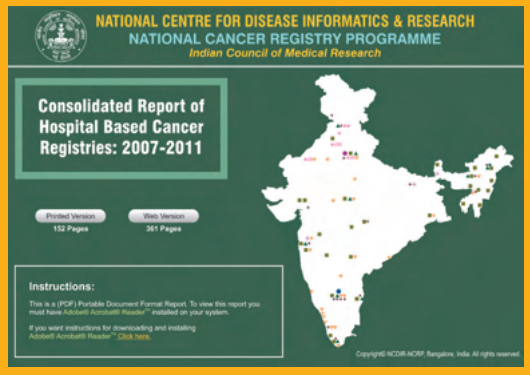

Development of an Atlas of Cancer in Haryana State
2016-17
ICMR - National Centre for Disease Informatics and Research

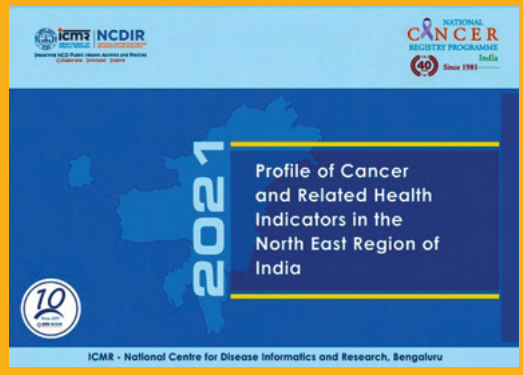

ANNUAL HIGHLIGHTS
2017 - 2018
National Centre for Disease Informatics and Research, Bengaluru
(Indian Council of Medical Research)


ANNUAL HIGHLIGHTS
2019-2020
National Centre for Disease Informatics and Research, Bengaluru
(Indian Council of Medical Research)


National Centre for Disease Informatics and Research, Bengaluru
(Indian Council of Medical Research)
ANNUAL HIGHLIGHTS
2020 -2021


NATIONAL NONCOMMUNICABLE DISEASE MONITORING SURVEY
(NNMS) 2017-18
NNMS
2020

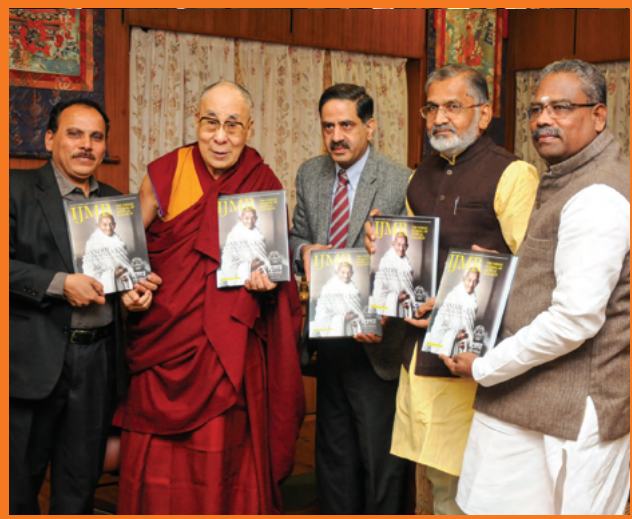

NATIONAL CENTRE FOR DISEASE INFORMATICS & RESEARCH
NATIONAL CANCER REGISTRY PROGRAMME
Indian Council of Medical Research
Consolidated Report of Hospital Based Cancer Registries: 2007-2011
Instructions:


2021
Profile of Cancer and Related Health Indicators in the North East Region of India
ICMR - National Centre for Disease Informatics and Research, Bengaluru

Gandhi and Health @ 150: Celebrating 150th birth anniversary of Mahatma Gandhi

For India, Mahatma Gandhi has always been an embodiment of Indian cultural heritage and as a nation, India has upheld his philosophy and teachings. However, Gandhi was well-documented in all the areas of research except health. On the occasion of the 150th birth anniversary of Mahatma Gandhi, ICMR took on this daunting task. The rare health records of Mahatma were procured from National Gandhi Museum, New Delhi and were studied in great detail by experts along with other available literature. The findings were published in a collector's edition of Indian Journal of Medical Research (IJMR) focusing on Gandhian principles of health which was titled, '***Gandhi & Health @150***' and was launched in Dharamshala by His Holiness the Dalai Lama in March 2019. Other than his health records, ICMR activities in line with Gandhi's principles were also published in this edition. A two-day symposium in New Delhi was also organised by ICMR and the National Gandhi Museum.

The Gandhian way of life adopts preventive health not as a choice but as a way of life. Keeping with this ideal, in 2019, ICMR rolled out ***Mission SHAKTTI*** (School based Health Awareness, Knowledge Test and Training Initiative) in collaboration with National Gandhi Museum and Directorate of Education, Government of Delhi with an objective to create health awareness among school children through innovative and educational means. A museum dedicated to the theme 'Gandhi & Health' was also set up at ICMR headquarters which had interesting exhibits on display – replicas of his belongings, his health records, posters with Gandhi's photographs along with his famous quotes related to health, access to Gandhi's original speeches and more. The ICMR-National Institute of Research in Tribal Health also rolled out Mission SHAKTTI programme in different schools of Jabalpur, Madhya Pradesh to disseminate Gandhian virtues and philosophy of good health and to create health awareness among school going children.



Students take part in Mission Shaktii (School based Health Awareness, Knowledge Test and Training Initiative) rolled out by ICMR in collaboration with Gandhi Museum and Directorate of Education, Government of Delhi in 2020


Timeless Inspirator
MOHANDAS K. GANDHI
ALL MEN ARE BROTHERS
GANDHI
LIFE AND THOUGHT OF MAHATMA GANDHI
R. N. MITTAL
VILLAGE SWARAJ
M. K. Gandhi
NON-VIOLENT RESISTANCE
(Satyagraha)
The Essential Gandhi
MAHATMA GANDHI
THE OFFICIAL COLLECTOR'S EDITION
GANDHI
HIS LIFE, LESSONS & LEGACY TODAY
MAHATMA
GANDHI
NONVIOLENT POWER IN ACTION
DENNIS DALTON
Path-way to GOD
The WORDS of GANDHI
INDIAN HOME RULE
THE GITA
GANDHI
Satyagraha in South Africa
The Wit and Wisdom of

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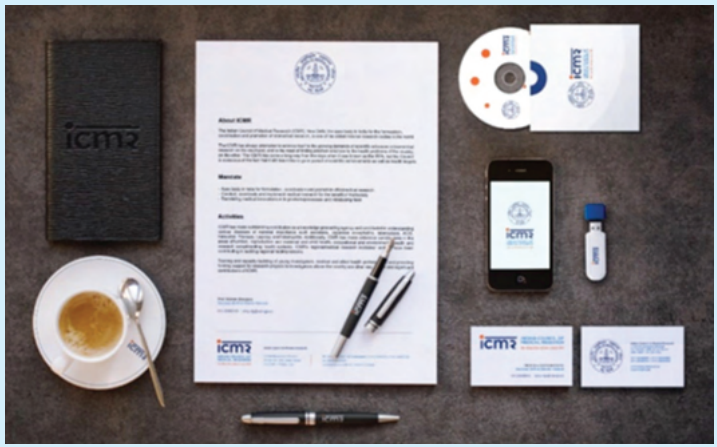
Establishing a health communication ecosystem – Information dissemination across all sections

In accordance with the overall vision of ICMR, effective communication is significant in translating research into action for improving the health of the population. Inculcating a culture of research in academia, and in turn the country, requires ICMR to communicate the significance and impact of its research on public health.

To strengthen the communications capacity at the ICMR headquarters in New Delhi and initiate a nodal centre for all communication efforts, a Communication Unit (CU) was set up in ICMR in 2017 to serve as the hub for all communications activities for the council and its 27 institutes. Each having a Nodal Communications Officer (NCO) to coordinate with the CU for communication related activities. Over the years CU has been instrumental in organizing various capacity building programs in media training, crisis and risk communication, social media best practices and developing branding guidelines, ICMR's history timeline as well as finalizing the COVID-19 timeline.

The system was designed as a 'hub-and-spoke' model, where the CU was responsible for coordinating all communications-related activities for ICMR at the national level. Since the inception of CU, ICMR has been leading the way in communicating information about disease trends and risk factors, outcomes of treatment or public health interventions, patterns of care, and data on outbreaks. The setting up of CU paved the way for ICMR to become the focal point during the COVID-19 pandemic. This proactive information sharing has made ICMR a household name in the country.

Many of the research outcomes were disseminated to media, policymakers and other stakeholders through policy briefs, press releases, op-eds and other channels for translation into implementation.



Ensuring Support to Ayushmann Bharat for moving towards Universal Health Coverage

Ayushman Bharat National Health Protection Scheme is a national health insurance initiative that aims to provide free access to healthcare for low-income households in the country. ICMR supports the scheme and ensures a sustainable and cost-effective model through its ongoing programs like health technology assessment (HTAIn), standard treatment workflows (STW), and a national list of essential medicines and diagnostics (NLEM). These programs serve as a critical tool to prioritize national health spending and provide a uniform guideline to ensure quality healthcare services across the nation.

HTAIn has helped the scheme evaluate the appropriateness and cost-effectiveness of the available and new health technologies in India to access quality healthcare at minimum cost. This, in turn, facilitates and ensures transparent and evidence-informed decision-making in the field of health.

The STW program collaborated with nearly 300 experts across government and private hospitals to prepare standard treatment protocols for 100 common illnesses, ranging from kidney diseases and infections in children to cardiac diseases. The workflows have been incorporated in National Health Agency Treatment Guidelines.The national essential diagnostics and medicine list are helping India to ensure that quality diagnoses and drugs are provided at all levels of healthcare facilities.

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