

100 Years of ICMR!



100 Years in the Service of the Nation
(1911-2011)

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The Indian Council of Medical Research (ICMR), New Delhi, the apex body in India for the planning, formulation, coordination, implementation and promotion of biomedical research, is one of the oldest medical research bodies in the world. Today, it is 100 years old and enjoys a pan-India presence with 31 dedicated research institutes and centres across the major disciplines.



ABOUT a hundred years ago, persistently declining population of undivided India was an issue of utmost importance and concern for British policy planners. Due to incessant famines and widespread epidemics, the death rate was exceedingly high at that time. Ironically, today India is struggling hard to stabilize its rapidly increasing population, which is a recognized constraint in the otherwise astounding development saga of the country.

Ironically, again, the rapidly increasing population of the country is due to breakthroughs in medical research, conducive policy interventions, and healthcare infrastructure. Today, an average Indian enjoys a life expectancy of 66.8 years at birth. Life expectancy at birth is a measure of the overall quality of life and can also be thought of as indicating potential return on investment in human capital.

Besides, medical research in India has not only saved countless lives but has also led to innovations that are today being utilized across the world.

Birth of Medical Research

Although India has had a glorious history of science and medicine since the Vedic period, modern medical research began only during the later part of the 19th century. During this period, some important contributions led to the enhanced understanding of tropical diseases. Surgeon-Major Ronald Ross (1897) worked in Secunderabad on the origin of malarial fever and proved beyond doubt that mosquitoes were responsible for the spread of malaria. Dr. Waldemar Mordecai Haffkine (1899) developed the prophylaxis vaccine for plague and Charles Donovan (1903) traced the cause of Kala-azar to a parasite known as *Leishmania donovani* in the spleen, and later in 1904, Leonard Rogers showed that the parasite was a flagellate.

Widespread epidemics of tropical diseases almost forced the British Government to initiate systematic and organized medical research for their prevention, control and management. Consequently, the Indian Research Fund Association (IRFA) was established in 1911 to address specific research requirements to tackle the peculiar medical problems of tropical India. Incidentally, it is one of

Automated DNA sequencing facility at National Institute of Malaria Research (NIMR)





ICMR has had a key role to play in improving rural health



ICMR has played a big role in goiter control

ICMR could successfully implement the Oral Rehydration Therapy in the 1970s, which drastically reduced the mortality rate of cholera.

the oldest medical research bodies in the world, preceding even the British Medical Research Council. After independence, the IRFA was redesignated as the Indian Council of Medical Research (ICMR) with considerable expanded scope of functions.

With a modest beginning in 1911, today ICMR enjoys a pan-India presence with 31 dedicated research institutes/centres across the major disciplines. ICMR's institutes are addressing themselves to research on specific areas such as tuberculosis, leprosy, cholera and diarrhoea, viral diseases including AIDS, malaria, Kala-Azar, vector control, nutrition, reproduction, immunohaematology, oncology, medical statistics, etc.

Regional Medical Research Institutes have been established to address regional health problems and also strengthen or generate research capabilities in different geographical areas of the country. ICMR also has Research Units or Centres to conduct research on specific problems, such as food and drug toxicology, viral diseases, handling micro-organisms of highly infectious nature, prenatal diagnosis for neonatal retardation etc. and supply of various animal models and feeds for experimental purposes.

Apart from conducting research, the Council also promotes and supports independent Extramural Research, through Centres for Advanced Research, task force studies and ad-hoc, open-

ended research schemes. Each of these has a different focus and works in a different manner.

Tackling Cholera, Diarrhea and Malaria

The high morbidity and mortality associated with classic cholera made it one of the most feared diseases of the 19th century. Despite several noteworthy accomplishments, diarrheal disease is one of the leading causes of illness and death in young children particularly in developing countries. Global deaths from diarrhea in children below five years of age are estimated to be approximately 1.87 million, annually. India alone contributes about 20% of all global under-five diarrheal deaths.

ICMR could successfully implement the Oral Rehydration Therapy (ORT) in communities and hospitals in the 1970s, which drastically reduced the mortality rate of cholera. ICMR scientists also discovered a highly virulent epidemic strain of *Vibrio cholerae* of a novel serotype O139 that caused major cholera outbreaks in India and Bangladesh during the 1990s.

ICMR is also providing technical inputs to information programmes designed for mothers and supplemental training for health care providers emphasizing the importance of ORT, increased fluid intake, continuing feeding including breast feeding, zinc supplementation and



ICMR's efforts have led to an increase in life expectancy of the average Indian

discouraging indiscriminate use of drugs in treating childhood diarrhea. If ORT and other sound diarrhea management measures are administered early and correctly, mothers could prevent up to 90% of diarrheal deaths. Zinc supplementation combined with correct use of ORT can reduce the child's chance of death by 50%. Research findings of ICMR's National Institute of Cholera & Enteric Diseases, Kolkata are recognized the world over.

Modern research on malaria can rightly be said to have begun with the milestone discovery of Sir Ronald Ross who exposed the role of the female mosquito in the transmission of malaria and laid the foundation for malaria research and its control in 1897 (he won the Nobel prize for his research). Prior to this, malaria had been thought to be associated with harmful vapours that arose from marshes and stagnant water.



Active surveillance for malaria in tribal settlements



Insectary



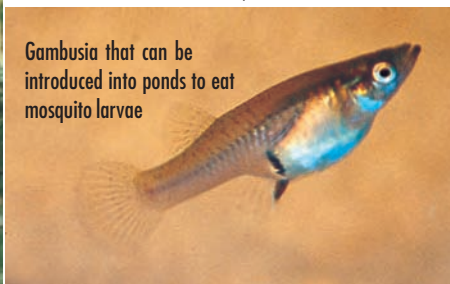
Spraying of insecticides for control of adult mosquitoes

Larvivorous fish ready for release into the breeding habitats



Before independence, IRFA sponsored numerous studies that gathered a good deal of information on the transmission cycle of the parasite, on the methods applicable for breaking this cycle at different levels, and also on the role of various anti-malarial drugs in the cure and prophylaxis of the disease. Encouraged by these studies, 30 million people were covered under the anti-malaria programme by the year 1952. In 1953, the National Malaria Control Programme (NMCP) was launched covering a population of 45 million residing in the malarious areas in India. This programme had tremendous impact on the malaria

Gambusia that can be introduced into ponds to eat mosquito larvae



cases in 1976. In response to the challenge of re-emergence of malaria, ICMR reviewed the malaria situation and identified priority areas of research. Time bound research projects in specific fields of malaria were funded from the extra-mural grant of ICMR.

Without any further delay, in the same year, ICMR established the Malaria Research Centre (MRC) in Delhi with the objective of conducting basic and applied research, undertaking field research in Malariology and helping to develop trained manpower in the country. Upgraded as the National Institute of Malaria Research, it has played a vital role in controlling malaria in some of the severely affected regions of the country such as Betul in Madhya Pradesh, Vishakhapatnam in Andhra Pradesh, and Nainital in Uttarakhand.

Curtailing Deformities

Crippling poliomyelitis could attract attention of the general public, medical faculty and the public health authorities only in the year 1949 when it broke out in an epidemic form in and around the city of the then Bombay. IRFA immediately swung into action by establishing a Polio Research Unit in the metro with an allocation of merely Rs. 12070/-

The Polio Research Unit is credited with the introduction of the oral poliovirus vaccine (Sabin) in India. In 1961, oral poliovirus vaccine trial was undertaken in three districts of Andhra Pradesh using vaccine imported from USSR and Canada. Over 120000 doses of OPV were administered in one week. This trial was followed by OPV administration in Gujarat, Rajasthan and Bombay. After the successful trials in Andhra Pradesh the demand for OPV increased progressively.

Gradually, the Unit was upgraded as the Enterovirus Research Centre in 1981 and, seven years later, the World Health Organization declared global polio



Orissa tribals in malaria endemic areas

Malaria Research Centre was established in Delhi with the objective of helping to develop trained manpower in the country.

Modern research on malaria can rightly be said to have begun with the milestone discovery of Sir Ronald Ross who exposed the role of the female mosquito in the transmission of malaria.



Reimpregnation of bednets

eradication. The Centre has contributed significantly to initiation of the vaccination against poliomyelitis, polio vaccine production and introduction of newer formulations of the vaccine to address the remaining issues in the last stages of polio eradication. The Centre has been in the forefront in documentation of progress of polio eradication in India through various scientific investigations. Currently the Centre focuses on developing strategies to ensure that polio eradication in India is complete. These include disease surveillance requirements and maintaining high population immunity in the post-eradication era.

Until the late 1940s, leprosy patients were treated with Hydrocarpus (Shaulomoogra) oil derivatives all over the

world. This treatment did sometimes produce good results, but it had its own limitations. The effectiveness of this treatment was inconsistent, which ultimately discouraged medical researchers to go ahead. With the introduction of sulphones in the treatment of leprosy, interest in the problem was revived.

IRFA aided many enquiries that led to the working out of treatment schedules with the commonly used sulphone drugs. The response of different types of leprosy to the sulphone drugs was also investigated. The results were very encouraging. ICMR therefore first recommended the use of sulphones not only for treatment, but also for checking the spread of infection, based on the

observation that in all the patients treated, there occurred a gradual reduction in the bacterial content. The Council has an institute called the National JALMA Institute for Leprosy & Mycobacterium Diseases located at Agra.

Nutrition for Health

ICMR has played a key role in the development of public health activities in the country, in the field of nutrition. Research efforts of the Council almost eliminated the first vitamin deficiency disease called Beriberi from the country in the late fifties with a simple intervention: 'use a varied diet, do not restrict the diet too rigidly to machine milled rice'.

Similarly, ICMR studies busted the Protein Energy Malnutrition myth convincingly. Studies of pre-school children were made to gauge their energy and protein intakes. It indeed turned out to be a surprising revelation that the protein concentration of their diets was nearly adequate contributing to about 10% of their energy. However, the average energy intake was grossly deficient. This analysis paved the way for a new hypothesis that the malnutrition among underprivileged children was due to energy deficiency and not solely due to protein deficiency, thus busting the protein myth. Large-scale community studies were initiated to test this hypothesis and the view was soon endorsed by United Nations organizations like WHO and UNICEF.

Iron deficiency leading to nutritional anemia is most frequently encountered among the malnourished population of India. After a series of studies on the stability and bioavailability of iron in common salt



Social mobilization for filariasis control

Despite substantial progress made on many fronts, there are still areas of concern. Maternal and Infant Mortality are still unacceptably high in several areas, infectious diseases continue to remain a threat to public health.

fortified with iron employing different iron compounds and wide range of stabilizing agents, a successful process for fortification of salt with iron was developed. At present, technologies of double fortified salt (DFS) and fortification of wheat *atta* with iron and other essential nutrients have been transferred to industries.

In yet another important development, studies on administration of massive dose of vitamin A to avoid nutritional blindness among children, paved the way for a nation-wide vitamin A prophylaxis programme with its inclusion in the Fourth Five-year plan. The ICMR had also evaluated the National Anemia Prophylaxis Programme and the shortcomings of the programme were brought out. Similarly, studies on goiter control programmes in coastal Andhra Pradesh established that there was irregular supply of iodized salt, lack of iodine content in salt and absence of quality control measures to ensure iodine content in salt.

Treating Tuberculosis

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis*, a slow growing bacterium, which evolved from soil bacterium more than 10,000 years ago. The history of this disease is very old, but its prevalence was rare. The number of cases of TB increased rapidly after the 19th century mainly as a consequence of growing population density and industrialization.



IN CONVERSATION

E-mail interview with Dr. V.M. Katoch, Secretary, Department of Health Research & Director General, Indian Council of Medical Research, New Delhi

The canvas of medical research in India seems to be extensive and broad due to diverse climatic conditions and socio-economic factors. In such a scenario, what are the research priorities of ICMR?

Our main goal and objective is reduction in the total burden of disease in the country and to promote health and well being of the population by bringing in modern technologies for the people. As per our policy, the Council's research priorities coincide with the National health priorities which include control and management of communicable diseases, fertility control, maternal and child health, non-communicable diseases, control of nutritional disorders and developing alternative strategies for health care delivery systems.

Beyond this, we have specific research programmes on environmental and occupational health, mental health and drug research, research on traditional remedies, oral health, health systems research and social behavioral aspects and several other relevant areas.

Currently we are witnessing an era of cutting-edge technologies that are poised to revolutionize scientific research scenario in various sectors. What is the situation in medical research in ICMR?

ICMR is also embracing frontier and cutting-edge technologies such as nano-medicine, molecular medicine and stem cell therapy. The Council is promoting research in these frontier areas though intramural as well as extramural research. In fact, the Council has several schemes to encourage innovations related to diagnostics, treatment methods and prevention vaccines. Translation of the innovations into products and processes by facilitating evaluation and testing in synergy with other departments is one of our major objectives. We are also trying to introduce these innovations into public health service through health systems research.

In the new scenario, ICMR will continue to be the fulcrum of the new Department of Health Research.

In a classic study by ICMR, famous as the 'Madras Study', it was found that it would be appropriate to treat infected patients in their own homes. This revolutionized the TB treatment methods followed all over the world and resulted in reduction in the need for beds in sanatoria and hospitals for TB patients, reduction of the cost of treatment for both the patient and the provider (for the cost of treating one patient in a sanatorium, 100 patients could be treated

on an out-patient basis) and the treatment was more acceptable socio-culturally. This also paved the way for integrating TB services into primary healthcare.

Rifampicin, an anti-TB drug, was discovered in 1967 and is hailed as one of the greatest achievements in the history of development of anti-TB drugs. With the availability of two well-tolerated and highly effective drugs – rifampicin and pyrazinamide – the clinical trials of short-



Recently we have seen a spurt of Government policies, bills and guidelines on health related issues. These are being debated in various public forums as well. What is the role of ICMR in formulation of these?

ICMR, through its vast network of 31 research institutes and centres, is a major player in formulation of various policies and guidelines related to public health issues. The Council provides technical inputs duly supported by scientific researches for deliberations, thus facilitating the decision making process. For instance, based on ethical guidelines for experiments on human subjects, a draft bill on Biomedical Research on Human Subjects has been prepared. Similarly, ICMR has made significant contributions in the preparation of the National Health Policy and Knowledge Management Policy of the Department of Health Research. The guidelines developed by the Council for assisted reproductive technologies are at the core of a draft bill on the subject.

Does ICMR play a role in health management of the affected population during natural calamities or man-made disasters?

Yes, ICMR and its institutes always rise to the occasion and lend a supporting hand to the authorities by providing required medicare facilities and expertise in natural and manmade disasters. The Council has shouldered research investigations into the Bhopal Gas disasters, Orissa cyclone, and

Marathwada and Bhuj earthquake disasters. The ICMR focused on mental health consequences with special reference to mental health service needs and service delivery models for the earthquake affected populations in Marathwada and Gujarat. During the devastating tsunami in 2004, ICMR assisted the state authorities in establishing emergency disease surveillance systems in the affected states of Tamil Nadu, Andaman and Nicobar Islands, Pondicherry, Kerala and Andhra Pradesh. Assessment of post-traumatic stress disorder among the adults in the tsunami-affected areas was also undertaken. Similarly, we had set up a specialized research set-up at Bhopal within a month of the Bhopal Gas Tragedy to study the far-reaching impact of the toxic gases. Ultimately, ICMR came out with three technical reports that became a source of reference for further research studies.

What are the major challenges before ICMR and how do you plan to tackle these?

The rapidly growing economy has thrown unique challenges in the health sector: a population that is divided into an increasing number of middle and upper middle class and the marginalized segment of society. The health challenges continue to be huge, and complex. We have, at the same time, serious problems of malnutrition, both under-nutrition among children and growing problem of obesity in school going and adolescents, continued

infectious disease burden among the poor to rising cardiovascular disease and diabetes disease load among the rich. What is more, 'development' – rapid industrialization of India, use of pesticides and fertilizers for improving crop yields—are rapidly degrading the environment, causing air and water pollution resulting in several health problems from chemicals in breast milk to increasing cancers in different communities.

Today, the ICMR stands out as a formidable and strong structure having 31 national and regional institutes and more than 100 field stations under its fold. More significantly, the Council has been able to successfully access the strong medical college system across the country and support/collaborate with other national research institutions.

It is, therefore, imperative that ICMR be further strengthened by continuous modernization of its own institutions as well as by opening of new centres focused on the new emerging communicable and non-communicable diseases, cutting-edge basic science like transplant immunology, genomics, proteomics etc., strengthen infrastructure for animal experiments, clinical pharmacology, critical health policy issues, health systems research, socio-behavioral science research etc. In the new scenario, ICMR will continue to be the fulcrum of the new Department of Health Research, dedicated to taking modern health technology to the people.

Non-Communicable Diseases including cancers, affect sizeable numbers of our population.

course chemotherapy (SCC) regimens made it possible to reduce the length of treatment from 12 to 6 months. The introduction of SCC regimens was a milestone in the Council's fight against TB.

ICMR was also instrumental in development and implementation of the internationally recommended TB control strategy i.e. DOTS (Directly Observed Treatment Short Course), which promotes diagnosis by sputum smear microscopy, direct observation of treatment, standardized regimens, recording and reporting of notified cases and treatment outcomes. DOTS services are now available in 563 districts of 26 states/union territories.

Improving Reproductive Health

Reproductive health is a crucial part of general health of a person and is also a central feature of the development of a human being. The research on this important aspect was initiated in the earlier days of IRFA, but the studies mainly focused on problems associated with maternal morbidities. Now, ICMR has made deep in-roads in various research areas, such as fertility regulation, infertility and reproductive disorders,

reproductive tract infections, maternal and child health, unsafe abortions, menopause and osteoporosis, adolescent health, reproductive cancers and stem cell biology.

NATIONAL HEALTH PROGRAMMES

- National Malaria Eradication Programme
- National Filariasis Control Programme
- National Leprosy Control Programme
- Diarrhoeal Diseases Control Programme
- National AIDS Control Programme
- Iodine Deficiency Disorders (IDD) Programme
- National Cancer Control Programme
- Universal Immunization Programme
- National Tuberculosis Programme

TO CURB SUICIDES....

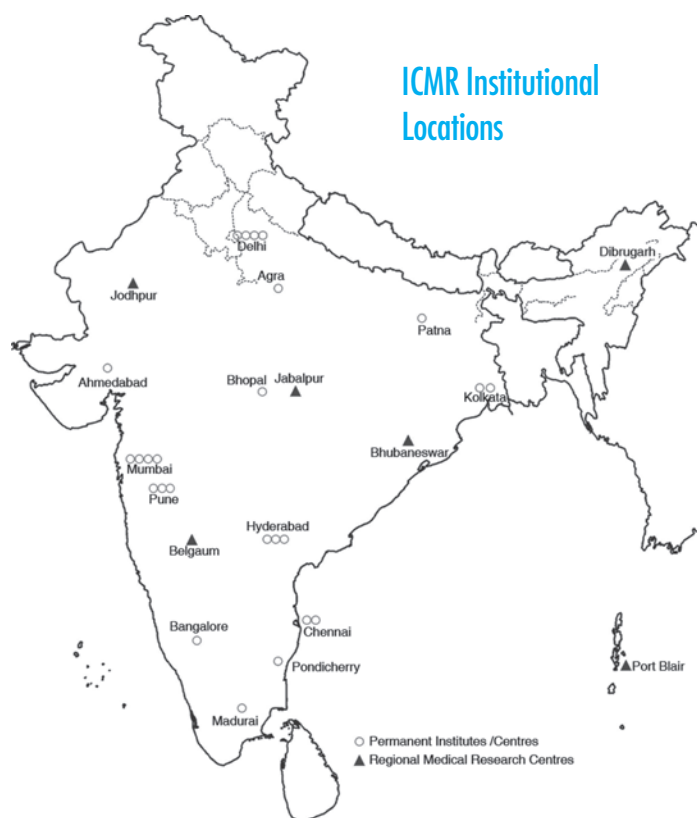
Suicide has emerged as a leading cause of death the world over and in India as well. Considering the increasing number of suicide cases, studies on suicide behaviour were carried out on suicide attempters, who were brought for management to various hospitals. A more comprehensive project with community-based and hospital-based components has been initiated to study the entire range of suicide behavior from suicidal ideation to suicide attempts.

Research studies of the ICMR have helped developed a simple tool for use by general physicians to identify persons with suicidal risk as it was found that a large proportion of persons attempting suicide were in contact with a treatment facility for some time before suicide attempt. A community-based task force project on suicide behaviour has now been undertaken for the first time. It is expected that the ongoing research on suicide behaviour will help in evolving strategies for suicide prevention. A multicentric project on urban mental health has been initiated to develop strategies for early identification of mental health problems and appropriate services for early intervention.

The Council also initiated studies in the area of mental health indicators. Task force projects were undertaken to develop tools of measurement for quality of life at individual level, family level, and community level. A short instrument was developed to measure psychosocial stress. The Health Modernity Education Project developed the concept of health modernity, developed and evaluated health educational intervention to enhance health modernity of tribal population in Jharkhand.

The birth of India's first scientifically documented test-tube baby was possible through the research endeavors of scientists working at ICMR's labs and the KEM Hospital, Mumbai. The scientists of the Council have developed simple, cost-

effective and accurate methods for the diagnosis of fertility status. Some of the successful technologies have been transferred to industry with a view to developing appropriate kits for wider use.



TAMING HEALTH HAZARDS IN FIELDS

ICMR undertook several studies to examine health and safety of workers in agriculture. Research on the problems of the agricultural work force tries to resolve problems of the work environment, to alleviate rigors at the workplace and to improve performance ability of the workers. Emphasis has been given on the principles of ergonomics, i.e., work simplification and workload classification, modification of work methods and manually operated tools and implements.

Occupational health problems associated with tobacco cultivation are known as "Green Tobacco Sickness" (GTS). It is a mild and acute form of nicotine toxicity that affects tobacco workers who have direct dermal contact with tobacco plants during cultivation and harvesting. Headache, nausea, vomiting, giddiness, and loss of appetite, fatigue, weakness and sometimes fluctuations in blood pressure or heart rate characterize it. GTS was first reported from U.S.A. in 1970.

Later, it was also reported by the National Institute of Occupational Health in Indian tobacco harvesters in 1979 and 1986. In tobacco harvesters, nicotine gets absorbed mainly through the skin of the hands. Gloves would, therefore, be the most logical solution. Two types of gloves were provided to non-Virginia tobacco harvesters who suffered from green tobacco sickness (GTS).

Use of both the types of gloves showed significant reduction in prevalence of GTS and in nicotine absorption as reflected by nicotine and creatinine excretion rate in urine. It was found that with respect to GTS, the use of rubber gloves afforded protection to 93% of the subjects, while with cotton gloves the proportion was 78.5%. Both the types of gloves were found saturated and encrusted with thick plant sap during harvesting and they were difficult to wash and clean after short-term use. Different types of gloves are now being tried for testing their acceptability and efficacy.

As anemia and toxemia were found to be the primary reasons for morbidity and mortality of this vulnerable group, the Council provided support for conducting research on them. The studies showed that while the administration of 5 grains of ferrous gluconate prevents the development of anemia in approximately 60% cases, the combination of the above with 5 mg folic acid could prevent the development of anemia in almost 80% cases. Thus, the administration of iron along with folic acid was found to be helpful in the prevention of occurrence of anemia during the pregnancy period.

Studies conducted by ICMR were helpful in formulation of various policies and guidelines related to the family planning programme of the Government of India. In 1977, the Government of India recognized the need to review its national programmes on population stabilization and welfare of the families. This assessment resulted in a major paradigm shift. The focus was shifted from "family planning" to "family welfare".

Cancers and Cardio-vascular Health

ICMR is vigorously engaged in the preparation of the Cancer Atlas of India including most regions of the country to facilitate policy planning and prevention strategies. Cancer patterns vary not only throughout the world but also between different population groups within the same country. The preliminary and subsequent reports of the National Cancer Registry Programme (NCRP) have shown that cancer of the stomach is a consistent leading site of cancer among males in Bangalore and Chennai, whereas it is lesser so in Bhopal, Delhi or Mumbai. Similarly, cancer of the gall bladder is a leading site of cancer especially among women in Bhopal and Delhi, but is hardly seen in Bangalore and Chennai.

Cardio-vascular Diseases (CVD) cover a wide array of disorders, including diseases of cardiac muscles and of the vascular system supplying the heart, brain, and other vital organs. These diseases accounted for less than 10% of the global disease burden in the beginning of the 20th century, but by the turn of the century the figure had reached 30% with replacement of rheumatic heart disease by primarily ischemic heart disease, stroke and congestive heart failure. Importantly, about 80% of the CVD disease burden occurs in low and middle-income countries.



The first KFD vaccine developed by National Institute of Virology (NIV) being administered to a patient

Among the other CVDs, ischemic heart disease (IHD), manifested mainly as angina and acute myocardial infarction, is the leading killer in age group ≥ 60 years globally. The currently available interventions for CVDs are expensive and their demand as effective healthcare tools is increasing in India exerting major pressures on the healthcare system. ICMR, through its network and expertise, is vigorously pursuing various key aspects of CVDs to minimize the incidence of CVDs and devise cost-effective treatment for the large population of the country. Prevention strategies are also being formulated.

Combating HIV/AIDS

HIV Infection was first reported among female sex workers in Chennai in 1986. In the same year, the first case of AIDS was reported in Mumbai. With great foresight, the Indian Council of Medical Research had initiated surveillance for HIV in 1985 and established a network of surveillance centres across the country. The data generated from these centres revealed that India had an imminent HIV epidemic at hand. The data generated by this first network of surveillance centres provided evidence for initiation of the National AIDS Control Programme that was implemented by the newly established National AIDS Control Organization. This was also followed by the establishment of research institute by ICMR fully devoted to research on HIV/AIDS—the National AIDS Research Institute in Pune.

The ICMR, through its network of Institutions across the country, has made impact on the HIV epidemic through generation of important data that has helped in shaping policies. ICMR is also

working towards the prevention of HIV infection through research on vaccines, microbicides and other biological and behavioural strategies. Providing care and support through research on newer drugs and treatment regimes, increasing adherence to ART and prevention of HIV drug resistance emergence and providing psychosocial support to those already infected is central to the agenda on care and support.

Research on immunology, molecular biology and virology of HIV infection will continue to help put in place pieces of the jigsaw puzzle of the biology of HIV infection in context with HIV-1 subtype C. And, most importantly, the operational research that complements the National AIDS Control Programme will remain the cornerstone of HIV research under ICMR.

Despite substantial progress made on many fronts, there are still areas of concern. Maternal and Infant Mortality are still unacceptably high in several areas, infectious diseases continue to remain a threat to public health. Non-Communicable Diseases including cancers, cardio-vascular diseases, diabetes and mental illnesses affect sizeable numbers of our population. ICMR is making all-out efforts to provide due support through strategic and demand-driven medical research across the board.

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