

Biobanking in India and its importance in cancer research

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BIOBANKING

Biobanking is developing as a new branch of science which has a key role in biomedical research and precision medicine. It is very broad and diverse and includes sample collection, storage, research, education, funding, publishing, biobanking services, analytical services and others. Biobanks play an important role in the precision medicine, patient diagnosis and treatment, follow-up, and therapy monitoring and optimization. As per the time magazine published in 2009, biobanks are on the list of '10 Ideas Changing the World Right Now'. Biobanks are the home of biospecimens where biosamples are collected and stored in organized way with their clinical, social and pathological information for research, new drug discoveries and drug development. Human biospecimens stored at biobank are a precious and critical resource for the process of discovering new mechanisms causing cancer or in determining its progression, resistance or response to treatment, and clinical outcome.

Most of the biobanks are established in developed countries (~95%) especially from North America and Europe while developing countries like India struggle with the impacts of disease on a massive scale (Figure 1). Nowadays biobanking is an integral part of medical research and treatment. Due to lack of biobanks in less

developed countries, most of the epidemiological and genetic research results published from high-income countries are more beneficial for developed countries than low and middle-income countries. Some developing countries, including Jordan, Mexico, China, Gambia, and South Africa work very hard to build biobanks and networks. In last a few years, the inclination to open a biobank has increased in private and government hospitals in India to support the dramatic development by research in diseases prevention, prediction, diagnosis and treatment. Indian government has also started to provide initial funds to start biobanks for cancer, liver and rare diseases. Currently, there are total ten different biobanks in India in which six are tumor biobanks including, National cancer Tissue Biobank and Tata Medical Center Biorepository (Figure 2A). Southern part has four biobanks while there is no biobank in northeast and central region of the country (Figure 2B).

INDIA: A RICH SOURCE OF CANCER RESEARCH MATERIAL

Cancer is a major cause of morbidity and mortality in developing and developed countries. In India, there is a regional variation in cancer incidence and mortality.

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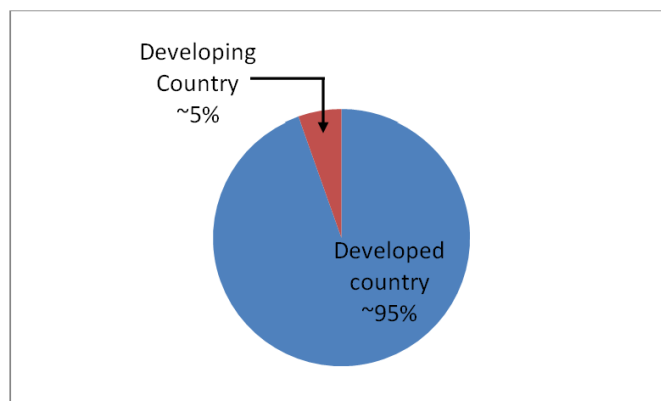


Figure 1: Biobanks in developing and developed countries.

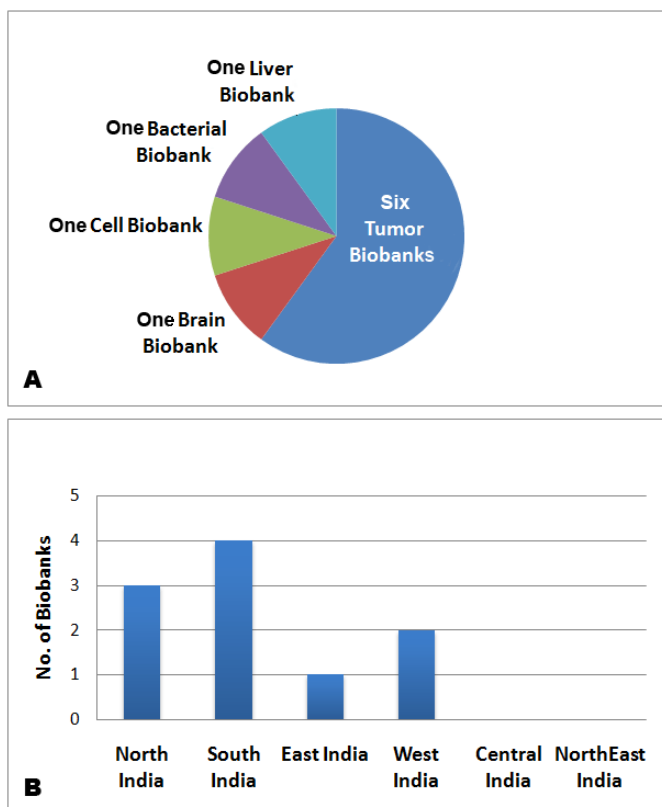


Figure 2: (A) Biobank in India, and (B) Region-wise biobank in India.

It is caused by both internal factors (such as inherited mutations, hormones and immune conditions) and external factors (such as environmental/acquired factors). Environmental factors, lifestyle, diet are also associated in cancer development. Only 5–10% of all cancers are due to an inherited gene defects and that the remaining 90–95% cancer occurs due to environmental effects. The burden of cancer is increasing worldwide despite the dramatic progress in detection and treatment options. Completion of the Human Genome Project has provided a force for biomarker discovery and clinical trials in cancer research. Developing countries which have more population and diversity have a significant role in cancer related research.

India is a gold mine for cancer research and tumor biobanking. It is the second largest populated country so some of the biggest projects in terms of samples can be found in India. The existence of heterogeneous pattern of cancer, owing to diverse ethnic populations in India, provides a highly attractive source for research materials. It is a land of enormous genetic, geographical, cultural and linguistic diversity. It can be divided into five physiographic regions. They are the Northern Mountains, Indo Gangetic Plains, the Peninsular Plateau, the Island, and the Coastal Plains. With the exception of Africa, India harbors more genetic diversity than other comparable global regions. It is well documented diversity in cultural and social beliefs. The Indian population is

culturally stratified, broadly into tribal and non-tribal. There are 461 tribal communities in India, constitutes 8.08% of the total population, and are the original inhabitants of India. Contemporary, non-tribal population of India tend to belong to overall Hindu religious fold and are hierarchically arranged in four main cast classes, viz. Brahmin (priest class), Kshatriya (warrior class), Vysya (business class) and Sudra (menial labor class). All four classes have different living, eating conditions due to social habits and economical conditions. In addition, there are several religious communities founded in India, practice different religions, for instance, Islam, Christian, Sikhism, Buddhism, Jainism and Judaism.

ROLE OF BIOBANKS IN CANCER RESEARCH

In recent years, the arrival of new technologies opens unique opportunities to researcher to focus on human genome, its expression and interaction of biomolecules. Human biobanks are the foundation of three rapidly expanding domains these are molecular and genetic epidemiology, molecular pathology and pharmacogenomics/ pharmacoproteomics. Conventional method of diagnosis and treatment are based on the symptoms manifest in which cancer/disease may emerge later due to overlook of risk factors. The importance of biobanking lies in its connection to precision medicine which are leading towards patient-centred and multifaceted diagnostics. Precision medicine facilitates customized medical treatments based on individual patterns of disease and susceptibility, which are possible by analysis of individual genomic and epigenomic analyses with associated data. It is necessary to collect and analyse high quality of biosamples to obtain information on the morphological, genetic, proteomic and epigenetic background for molecular pathology based diagnosis. Establishing a biobank would facilitate molecular and genetic cancer research which would be helpful in primary care and allow clinicians to create best individualized treatment for patients.

Biobanks play key role in the biological sciences from laboratory discovery to medical application. It facilitates to study connection between an individual patient's genotype or phenotype and response to drug treatment, molecular based classification, innovation of diagnostic procedure and to assess the genetic and environmental source of cancer in population as well as in individual and their family. Treatments of cancer depend on the availability of medicine based on individual diagnosis. Progress in development of medicine depends on human biological specimens and associated data, innovation, development, and the translation of laboratory findings into clinical practice.

Biobanks networking from different part of India would play a multidirectional flow of information, expertise, and biological materials between cancer centres

and research institutions. It is important for networking biobank to adoption of common technical standards for specimen collection, storage, and annotation, and for data collection and management. Networking facilitate to collect more sample of rare cancer type and also play important role in establishment of multicentre research projects involving cancer centres, academic medical centres, and diagnostic and healthcare facilities.

CONCLUSION

Establishing biobanks in developing countries like India presents a different set of challenges. These challenges are scarcity of designated research budget, lack the research capacity, infrastructure, reliable electrical supply, ethical, legal, social, political barriers and lack of awareness among people and researchers. Cancer is one of the leading causes of deaths in India and it is expected to rise five-fold by 2025. Therefore, there is urgent need to establish regional cancer biobanks in different region for rapid, exciting and valuable discoveries and uniform diagnosis and treatment protocols across the country. Developed countries have approximately 95% of total biobanks while the remaining 5% is in developing countries. There are only 10 biobanks all over India among which six are tumor biobank. Southern India has most of the biobanks, Northern, Western and Eastern region come second, third and fourth respectively while Northeast and Central India do not have any biobank.

Keywords: Biobank, Cancer, Precision medicine, Resource for research

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