Biobanking in the era of precision oncology

A biobank is essentially a collection of biospecimens that have been ethically collected, well-annotated, and stored using standard operating procedures (SOPs). The field of biobanking has grown tremendously in size and complexity over the last couple of decades, and is now considered an essential part of the healthcare infrastructure. In this era of precision (sometimes termed "personalized")[1] oncology, biobanks represent a highly valuable resource for biomarker translational research and cancer drug discovery. In the accompanying article, Vora and Thacker of Tata Memorial Centre, Mumbai, India, offer a comprehensive overview of the positive impact that biobanks have on cancer research.[2]

High throughput "-omics" technologies including next generation sequencing, circulating tumor cell characterization, single-cell RNA sequencing and circulating DNA analysis have exponentially increased our ability to interrogate the cancer genome precisely, quickly and cheaply. Correspondingly, the availability of a large number of well-annotated biosamples is crucial to fully exploit these technological advances by expeditiously testing hypotheses and identifying biomarkers. This can lead to the quicker development of new therapies and to tailor existing therapies to molecularly defined populations. The net effect will be improved standards of care of cancer patients and more efficient utilization of resources.

Currently, the geographical distribution of high-quality biobanks is heavily skewed in favor of resource-rich industrialized nations. There is an urgent need for also developing such banks in low-and middle-income countries,[3] given the high cancer burden in these regions, the need to identify clinically relevant variations among different ethnicities worldwide,[4] and because certain cancers are found more frequently in developing regions (such as mesothelioma in the Cappadocian villages of Turkey, liver cancer in Mongolia and China, bladder cancer in Egypt, and oral and gallbladder cancer in India).

The start-up cost-per-person for biobanking has been estimated to vary from US $10 (India) to US $850 (Iceland).[5]

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Quick Response Code:

Website: www.ijmpo.org

DOI: 10.4103/0971-5851.151767

Of course, this cost depends on various parameters such as the scale and structure of the biobank (central versus distributed), population contributing biosamples (healthy versus diseased) and the number and type of biosamples to be collected. Dried blood spot (DBS) microsampling is safe, easy, inexpensive, well-accepted by donors, and allows many types of traditional laboratory as well as modern "-omics" analyses to be conducted.[6] In conjunction with formalin-fixed paraffin-embedded (FFPE) tissue, DBS could be of interest in resource-restricted settings, although the latters' role in supplementing cancer research is not well-established and needs further investigation. Israel has demonstrated that it is possible to construct a modern, cost-effective biobanking infrastructure using a hub-and-spoke decentralized model.[7] Well-financed initiatives, on the other hand, collect blood as well as FFPE and frozen tissue from the primary and metastatic tumor.[8] Such serial collection of multiple samples from the same patient, although very expensive and logistically challenging, is likely to prove especially valuable.

While significant resources are indeed necessary for the long-term storage of biosamples, these infrastructure costs often turn out to be meager compared to the scientific and health benefits they bring to society. Kennedys' perceptive remark about the societal benefits that accrue from investing in high-quality infrastructure ("It is not our wealth that built our roads, but it is our roads that built our wealth") underscores this concept. The new National Health Policy (2015)[9] that is currently being drafted by the Indian government is an excellent and timely opportunity to focus policy attention and provide funding support for setting up high-quality biobanks across the country.

Governments can play a key enabling role by encouraging the development, publication, and uniform adoption of the policy, legal, and technical framework to govern biobanking, including:

1. Generic informed consent forms (including those for genetic analyses);
2. Generic SOPs for tissue collection, quality assurance (to reduce preanalytical variability), standardized annotation (baseline demographic and clinical data),[10] and IT-enabled biotracking (for audit as well as ensuring samples are only used for consented purpose);
3. Policy for access to biosamples for researchers nationwide and globally;
4. Guidance for protecting patient privacy and information;

5. Guidance for handling intellectual property rights in a fair, transparent, and uniform manner; and
6. Policy for trans-border shipment of biosamples to enable and encourage research and collaboration with global institutions.

Such a framework, together with appropriate stimulus for funding, can enable the setting up of high-quality biobanks, marking a paradigm shift in the quality of research being performed globally, with the cancer patient being the ultimate beneficiary.

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How to cite this article: Saini KS, Saini ML, Marbaix E. Biobanking in the era of precision oncology. Indian J Med Paediatr Oncol 2015;36:1-2.
Source of Support: Nil, **Conflict of Interest:** None declared.