# Oncology workforce skills and competencies required for molecular medicine

Emma Groves

In the past decade, the costs associated with DNA sequencing technology, known as Next Generation Sequencing (NGS), have significantly declined.[1] The declining cost of technology and increased knowledge of the human genome have had a major impact within oncology. As an oncology pharmacist I have witnessed the growing number of targeted agents and immunotherapies available to patients. Recognising this, I completed a Masters qualification in genomic medicine and sit on the Newcastle Genomics Tumour Advisory Board (GTAB). However, I still find it challenging to maintain up-to-date clinical knowledge regarding the biology, prognostic impact and treatment implications of oncogenic gene mutations. The impact of 'personalised oncology' on the cancer services' workforce requires careful assessment and this editorial will address the challenges and subsequent training requirements for healthcare professionals working in oncology.

Cancer treatment is in a transition phase from where treatment decisions are organ of origin- or stage-based, to 'personalised oncology' where treatment is primarily molecular-based, as highlighted by the first European tumour agnostic licence for larotrectinib in September 2019. Recently, NGS gene panels have been introduced which allow the parallel evaluation of several clinically actionable genes which facilitate the selection of optimal therapy. The declining cost of sequencing technology and the increasing number of promising tumour agnostic therapies means that NGS testing at diagnosis for multiple cancer-related gene changes is increasing in clinical utility and could soon be mainstream practice. This may also be the cheapest and most efficient way of assessing a patient's tumour for multiple predictive biomarkers within a limited amount of tissue. Moreover, molecular profiling at disease progression may also add relevant information concerning tumour biology, enabling treatment with personalised therapies which consider the acquired and targetable resistance mechanisms.[2] Figure 1 illustrates the pathway from genomic test consent to treatment stratification for patients undergoing tumour molecular profiling. As NGS platforms become integrated into routine care it is vital that the workforce evolves to support the changing needs of patients.

First, equipping the cancer services' workforce with the skills to appropriately consent and counsel patients undergoing genomic and genetic testing will ensure that all patients have access to appropriate counselling, reducing the pressure on specialist genetic counselling services. From a legal perspective, patient autonomy and informed consent are an essential part of the medical decision-making process. Healthcare professionals must be appropriately trained to ensure that patients understand the medical information provided and are able to make an informed decision about their health. Genetics is a complex topic, and patients will vary in their understanding of the implication for their family's health. Lack of understanding can raise issues of capacity and ability to consent to genetic testing. Emphasis on consent and effective pre-test discussions are essential for non-geneticist practitioners, as genomic testing moves from specialist services to routine practice. Patients who undergo cancer whole-genome sequencing (WGS) will have a detailed base-by-base report of the unique mutations present in cancer tissue. As WGS becomes increasingly used in frontline investigations, pre-test discussions must include the potential for incidental findings including germline pathogenic mutations. Sensitive discussions about the type of information that might be discovered must be part of the initial consent process, as well as documentation of the patient's decline or acceptance of such results.[3] Targeted NGS gene panels have the advantage of only sequencing a pre-defined set of genes and therefore incidental findings are less problematic.

Second, developing broader workforce awareness of bioinformatics is essential as cancer medicine becomes increasingly rooted in complex science and interpretation of large data sets. Bioinformatics is the application of computational technology to analyse biological data. Practitioners who understand the process of bioinformatic analysis and the challenges associated with NGS data interpretation are needed. Some of the interpretation challenges include: technology limitations; differentiation between genuine mutations and sequencing artefacts; conceptualising the genomic results in the context of a clinical case; interpreting findings of uncertain significance; and validation of genomic findings. Healthcare professionals who undertake training in NGS data interpretation and are experienced in clinical practice have a significant role to play in bridging the gap between clinical and laboratory teams. These hybrid practitioners would be well placed to communicate tumour sequencing data to patients and discuss sequencing technology limitations and data interpretation challenges with the wider multidisciplinary team. Furthermore, it is important to manage expectations of NGS because only a minority of patients will test positive for targetable mutations and often the mutations found are of unknown clinical significance, as highlighted in the MOSCATO-1 trial.[4] This clinical trial evaluated the clinical benefit of genomic analysis for hard to treat cancers. In 2017 Massard *et al*[4] reported an actionable molecular alteration in 411 of 843 patients who underwent molecular tumour profiling. Only a small proportion of patients in the trial (approximately 20%) were treated with a targeted therapy matched to a genomic alteration because of limited drug access.

Finally, there is a unique opportunity for pharmacists in the multifaceted process of treatment stratification. At present NGS tumour data is evaluated and reviewed by the highly specialist GTAB which includes: molecular oncologists, clinical geneticists, bioinformaticians, pathologists, genetic counsellors and clinical scientists. A specialist genomic pharmacist should be part of the GTAB and be accountable for treatment stratification recommendations. Genomic pharmacists could make treatment recommendations in the context of complex molecular data and balance other factors such as: patient preference, patient co-morbidities, drug interactions and patient tolerability of side effects. Pharmacists are also well placed to discuss the barriers to precision medicine access such as: regulatory constraints, issues with

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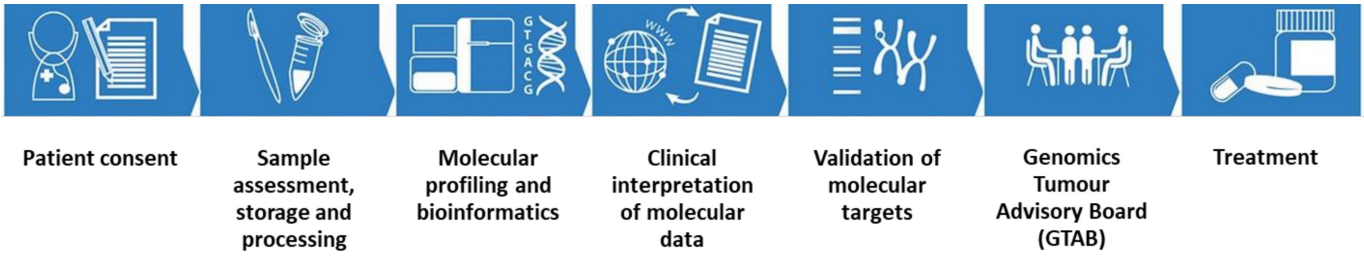


**Figure 1** Overview of patient consent to treatment stratification workflow. Following patient consent, the tumour sample is assessed by a pathologist. This is then followed by DNA extraction and NGS sequencing. Bioinformatical data analysis is followed by data curation and validation of molecular targets.[5] The resulting molecular alterations are then evaluated and reviewed at the GTAB meeting and treatment options for the patient determined. The outcome of the GTAB meeting is then reported to the relevant clinicians, the wider multidisciplinary team and the patient. Figure 1 was modified with permission from Horak *et al*.[5]

treatment funding and access to experimental therapy via clinical trials. Developing the expertise required to assess a patient's tumour genomic profile and subsequently determine the appropriate treatment stratification should not be underestimated. Advanced practice frameworks along with supervision and mentorship programmes are needed so that pharmacists can build their expertise and gain competency in oncogenic gene mutations in a structured and supportive manner.

Increasing the wider workforce knowledge and understanding of molecular medicine is an enormous task and requires significant investment. This editorial is aimed at raising awareness of the workforce configurations and new roles required to deliver molecular alteration-specific treatments. Individualised patient care has never been so important, and the cancer services' workforce must develop the capacity and expertise to keep pace with advances in technology in order to improve outcomes and support for patients with cancer.

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