Tumour Profiling using Next Generation Sequencing (NGS)

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The project aims to use our existing staff knowledge and experience of Next Generation Sequencing (NGS) to validate the Qiagen GeneRead Tumour Actionable Mutations panel for the analysis of Formalin-Fixed Paraffin-Embedded solid tumour samples. This tumour profiling will direct treatment options for patients based on the presence/absence of specific genetic mutations within the tumour. Such genetic analysis is currently performed using a less sensitive technology, thus this technology transfer ensures that an increased number of patients will potentially gain access to stratified medicine.
Figure 1

A flow chart titled 'NGS tumour service workflow, depicting the following sequence:

- FFPE samples
- Isolate genomic data
- Gene of interest  
- Perform multiplex PCR-based targeted enrichment  
- Prepare library  
- One library per sample  
- Sequence libraries using illumine MiSeq  
- Analyse

End of description.

This Project Supports Prudent Healthcare

**Achieve health and well-being:**

- The primary outcome of this health technology is to improve patient health and well-being.  
- The use of NGS is beneficial to patient health as it increases the sensitivity of mutation detection compared to the currently utilised technology. This means that low level mutations in tumour samples can be identified, providing more patients the opportunity to benefit from available stratified medicine treatments.

**Effective use of resources:**

- This health technology identifies cancer patients that are most likely to benefit from the administration of specific anti-cancer drugs, so these drugs can be targeted to those patients with the greatest need.  
- The use of NGS has distinctive benefits over the current technology in terms of effectively utilising skills and resources. The same NGS pipeline will be used for the analysis of all lung and colorectal solid tumour samples received by the laboratory, thereby removing the need to perform multiple different analyses for each tumour sample. This streamlined workflow will allow significant savings to be realised in terms of staff time.

**Do no harm:**

- As already mentioned, the aim of the genetic analysis of tumour samples within the laboratory is to identify patients most likely to benefit from anti-cancer drugs. Conversely,
the genetic analysis performed allows the identification of patients for whom treatment should be avoided as, given the patient’s tumour genotype, such drugs are unlikely to hold any benefit and could in fact simply cause adverse side-effects.

- The GeneRead NGS panel requires significantly less DNA compared to the currently utilised pyrosequencing technology therefore ensuring that precious tumour sample DNA is preserved, as well as allowing more patients the opportunity to have their tumours genotyped and potentially benefit from available stratified medicine treatments.

Consistency:

- All lung and colorectal solid tumour samples will be analysed using the same NGS technology and utilising the same analysis pipeline, therefore ensuring consistency within the solid tumour service and uniform analysis for cancer patients throughout Wales.

Anticipated Outcomes

- One of the major benefits of NGS is the high throughput nature of the technology, which allows large numbers of samples and/or genes to be investigated simultaneously in an efficient manner, unlike the current pyrosequencing technology based around single gene assays for a small number of patients. The increased capacity of NGS is well-suited to cope with the large volume of samples within the solid tumour area of the laboratory. As well as this benefit, NGS uses less DNA and is more sensitive than the currently utilised technique, therefore this technology transfer ensures that an increased number of patients will potentially gain access to stratified medicine.

- This service will remove the need to perform repeat analyses and as such will result in a consistency in the reporting times of samples. Currently ~20% of patients fail for at least one of the pyrosequencing assays performed as part of the testing strategy and these need to be repeated at a cost to the laboratory. Therefore the technology transfer will be time-saving to staff and will result in a faster result to many patients.