



getting it sorted! - managing large sample collections with small compact automated storage

For any biobank, sample archiving is a time consuming process. Whilst the efficiency of sample retrieval can be dramatically improved by pre-sorting samples prior to storage, this requires significant upfront effort that can rarely be achieved with limited resources. Here we describe how the MRC Epidemiology unit (Cambridge, UK), implemented TTP Labtech's arctic -80°C automated store to streamline their workflow to provide a highly organised archive of samples for efficient retrieval.

background

The MRC Epidemiology unit currently runs several population based studies investigating the determinants of diabetes, obesity and related metabolic disorders from which, a wide range of data and sample types are collected.

Typically, blood and urine samples are collected and processed (centrifuged and aliquoted) at several remote locations. Generally, 32 aliquots are prepared per patient in 2D barcoded tubes (fig. 1). These are deposited in a single rack with different cap colours to represent sample type (fig. 2). Racks are stored temporarily in freezers before shipping on dry ice. Each week the MRC unit in Cambridge receives multiple racks from each centre.



Fig.1 2D barcoded tubes

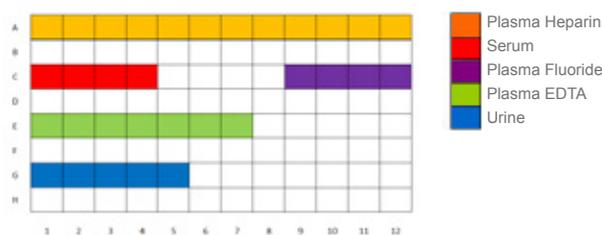


Fig.2 Multiple aliquots with sample type identified by cap

original workflow

On receipt at the MRC, samples from 3 patients would be condensed to fill 1 rack. These racks would then be placed into ULT freezers for long term storage.

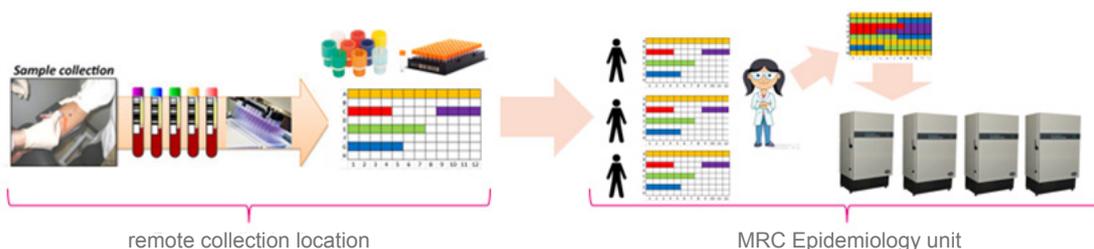


Fig.3 Overview of sample collection and archiving workflow

bottlenecks and risk

Although the original workflow was simple and robust, there were two particular causes for concern. Firstly, all aliquots collected from an individual at a specific time point were being held in a single rack in a single freezer. Should that freezer fail, this would represent the loss of time point samples for more than a thousand patients. Secondly, sample retrieval time was proving significant. For example, it is not unusual for researchers to request access to the whole cohort set of a particular sample type (e.g. serum). In practise, this meant just 3 samples were being picked per rack from thousands of archived racks. It would take several months of one person's time to complete the order (fig. 4) resulting in long lead times.



Fig. 4 Sample retrieval is particularly time consuming and with such a large cohort could take several months to fulfil researcher's requests.

Even sample requests for smaller subsets would take several weeks or months.

arktic provides the answer!

“ At the MRC, use of TTP Labtech’s arktic as a reception store and sorting device has alleviated these concerns. On arrival, samples received from remote locations are loaded directly into arktic. Worklists generated by the LIMS (laboratory information management system) direct arktic to sort samples into groups based on sample type, such as plasma heparin, using the tube barcode. Specified sample types from 96 different patients may then be retrieved from arktic into racks. Racks are transferred to ULT freezers for storage.



Fig. 5 Multiple aliquots from a single patient are stored in arktic. Racks of 96 individual patient samples, grouped by sample type (denoted by different colours above) are sorted for manual storage.

highly efficient retrieval and lower risks

Requests for samples can now be handled rapidly. For full cohort studies, whole racks of pre-sorted samples can be retrieved from storage with in a matter of days compared to several months previously. The MRC also store 1 aliquot of each sample type per patient (per time point) in the arktic. This means that requests for smaller groups of samples can be rapidly picked, usually within a few hours or even minutes depending on the number of samples requested. Care is also taken to spread the sorted racks of samples across several freezers, so that a single patients aliquots are never held together in a single freezer, removing the risk of losing precious samples should an archive freezer fail.

conclusion

By identifying specific bottlenecks in their workflow and risks to their samples, the MRC sought a solution that could bring massive efficiency savings to their operation. Hundreds of hours of technician time per year have been saved through the incorporation of arktic into their workflows, enabling much better use of valuable FTE time. Researchers can now access requested samples within days rather than months and the risk of losing all specific time-point samples from patients has been completely removed.

This has all been achieved with a modest budget and without infrastructure changes, simply by implementing a small automated store in combination with existing ULT freezers.