Sample storage survey

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This survey was set up to try and find out how genetic testing laboratories currently store DNA. It is intended that this information be used to inform decisions about what level of standardisation in terms of tubes, barcodes, capping etc might be desirable or indeed possible across network laboratories. Some level of standardisation would have benefits in terms of sample exchange. In particular we are interested in the use of 2D barcoded tubes and other automatable tube identification systems. All CMGS and ACC laboratories were invited to take part although it was understood this would be less relevant to cytogenetics laboratories.

Introductory text

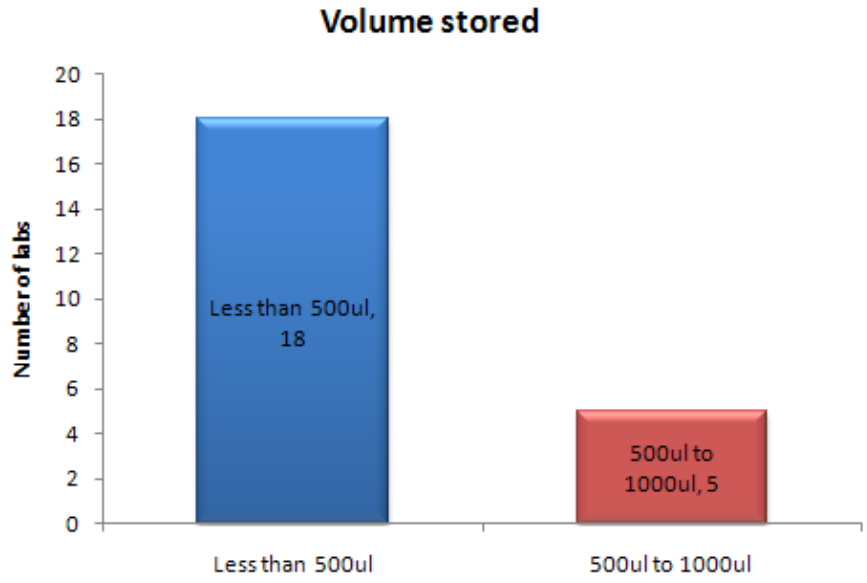
'There are a number of potential advantages in standardising (-at least some aspects of-) of DNA storage tubes across laboratories. The most significant of these would be a streamlined sample transfer system incorporating bar-coded tubes and electronic transfer of referral details. We are aware that a number of laboratories have adopted 2D bar-coded tubes, which is one option, but to help establish the full background, we would be grateful if you would complete the attached survey relating to DNA storage (http://www.surveymonkey.com/s/Q3QNJC9). This will only take a minute or so and will provide useful data on the range of current practice. The results of this survey will be published via the NGRL LISTSERVER, our web site and/or via BSHG news. Ultimately the aim is to determine what level of standardisation is feasible or indeed useful and what standard(s) could be adopted.'

Responses

Of the laboratories listed in the CMGS laboratory directory 22 /34 (67%) responded. A number of cytogenetics laboratories informed us that storage was handled by others but one did complete the survey. In all we had 23 respondents – ***Thanks to all.***

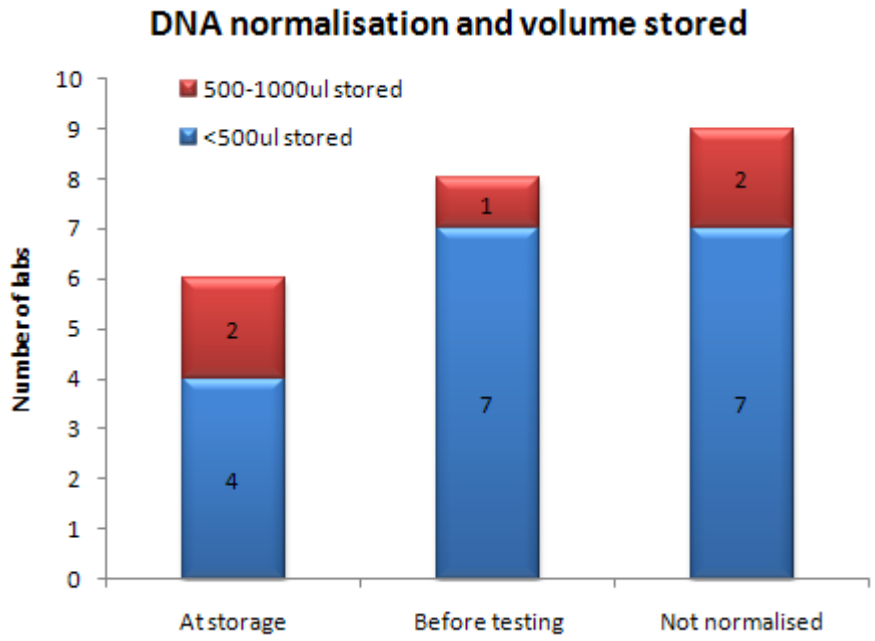
Q1. Typically, how much DNA do you currently store per sample?

The survey showed that the majority of labs (78%) store less than 500ul DNA. None of the labs stored more than 1000ul DNA.



Q2. Please indicate the scheme of DNA concentration normalisation that best describes your normal practice.

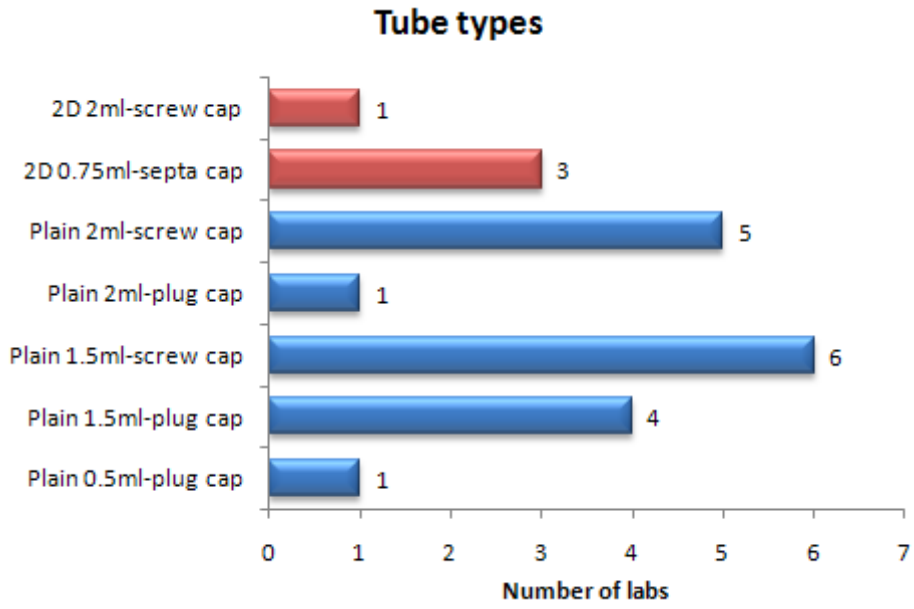
It has been suggested that the quantity of DNA stored may be related to the normalisation procedure within the laboratory – Those normalising before storage would require more storage volume. Analysis of normalisation practices in relation to the quantity of DNA stored does appear to bear this out, although 2 labs where normalisation at storage is practiced did manage to store >500ul DNA. Proportionally more labs normalising at storage stored 500-1000ul than labs normalising before tests or not normalising (33%, 13% and 22% respectively).

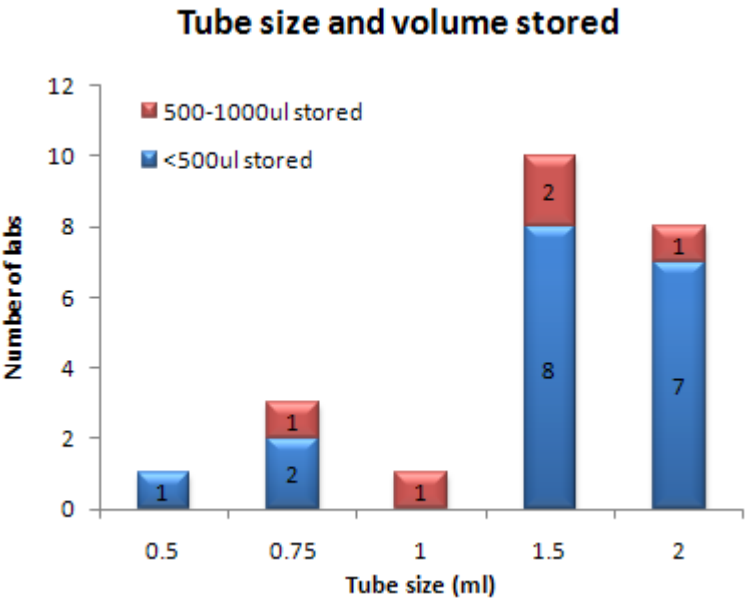


Q3. What tubes do you currently use to store DNA

A wide variety of tubes are used for storage including eppendorfs, cryotobes, Microfuge tubes, and 2D barcoded tubes. Cap types include plugs, screw caps and septas, whilst tube sizes range from 0.5ml to 2ml. To analyse these data we categorised tube type into plain (i.e. no bar code) and 2D (i.e. 2D barcoded tube) and caps into plugs (i.e. solid attached), screw caps and septas (i.e. separate rubber plugs including split septas for direct access without cap removal). 19/23 labs (83%) do not currently use 2D barcoded tubes. Cost may be influential here as plain tubes cost between 2-18p each compared to 2D tubes which cost 19-36p (including storage racks).

We also looked at the size of tube used compared with the quantity of DNA stored. The majority of labs (18/23) use tubes with at least 1.5 ml capacity but only 3 of these reported storing more than 500ul of DNA.

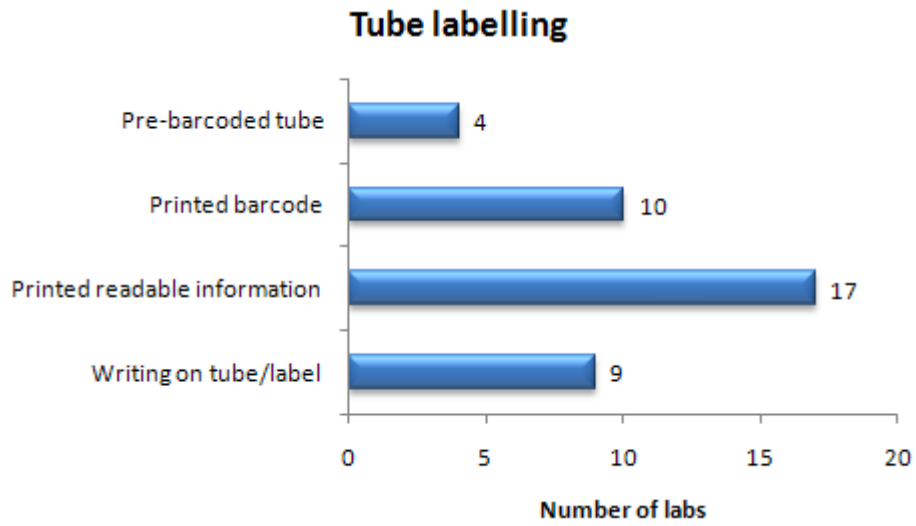




Q4. How are your DNA tubes referenced / labelled? (please choose all that are relevant)

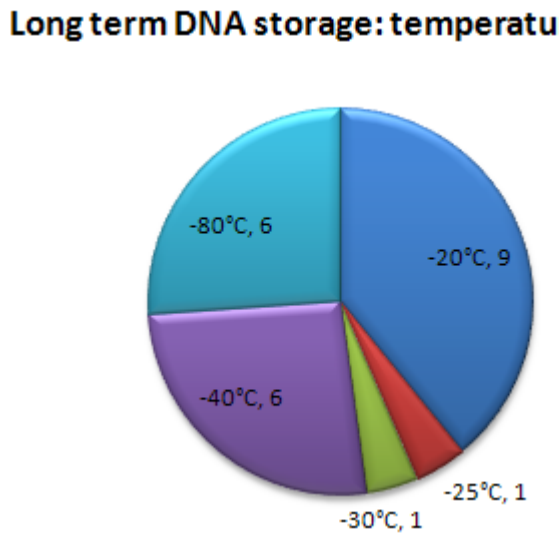
The most common form of tube labelling was printed readable information, used by 17/23 labs. However, most labs used more than one type of identification and various different combinations were reported. The full breakdown is given below.

Reported labelling	Number of labs
Printed barcode	1
Printed barcode, Pre-barcoded tube	1
Printed readable information	5
Printed readable information, Printed barcode	4
Printed readable information, Printed barcode, Pre-barcoded tube	3
Writing on tube/label	4
Writing on tube/label, Printed readable information	4
Writing on tube/label, Printed readable information, Printed barcode	1



Q5. How are your DNA tubes stored?

The most common DNA storage temperature is -20°C although there is a reasonably even split between -20°C, -40°C and -80°C. We did not ask how many DNAs were stored or if a dedicated freezer was used so the relevance of the temperature used cannot be fully assessed.



Q6. Do you have plans to change your DNA storage system in the future?

10/23 labs indicated that they were planning to change the way DNA is stored in the future. Of these two already use 2D barcoded tubes – one plans to move some long term storage to a dry storage system and the other is looking at moving from 2ml 2D barcoded vials to 0.75ml [matrix] 2D barcoded tubes. Five of the remaining eight indicated moving toward 2D barcoded tubes. The full list of planned actions is given below:

- still evaluating
- Plan to move some of long term store to a dry storage system
- Not decided - prefer 2D barcode on base; 0.5ml; screw-cap external thread - but don't believe this combination exists, so compromise at some level required
- smaller volume tubes or 2D Matrix
- storage tubes equivalent to 96 well plate format
- 2D barcoded tubes in 96 well plate format. In discussion with other Scottish labs to sort out format and tube type for use across Scotland
- 0.7ml 2D barcode tubes
- 0.75ml Matrix 2D barcoded tubes
- Under discussion
- Current feasibility study for switching to Matrix 2D barcoded tubes (0.75ml)

Q7. Please use the following box for any other comments or suggestions

Comments as follows:

- Having recently met with the Thermo reps, I would be happy to go with Matrix screw cap tubes. I still maintain that for lab performing a lot of manual setups, the plug cap is too fiddly. Our final volume requirements may change with the validation of our extraction robot.
- Would consider moving to barcode only
- barcoding would be useful but no money
- I was slightly horrified by the price of a single tube which I hadn't actually worked out before!
- Small lab with mixed genetic and non-genetic tests therefore genetic tests have to have a manual numbering system outside non-genetics.
- Barcode on label currently used only in extraction process
- Ongoing discussions between Scotish labs about standardised tube types. Currently prefer Nunc manufactured tubes and associated racking systems. Would be delighted to join in a wider discussion with other UK labs.
- We are looking at moving storage to 4oC in future
- We are changing from written labels to printed labels, generated by Starlims.
- Standardisation of tubes for sample transfer (if not storage) would be useful.
- We have seen a number of bar-coded tubes sent from other laboratories and prefer larger screw cap tubes to the smaller tubes with a bung (?Matrix) although appreciate the space-saving element of these.
- Standardisation across network would be useful.
- We now extract DNA for the local microarray service provided by Cytogenetics. Previously frozen DNA seems to be problematic for this analysis. I'd be interested to know if this is a general concern
- Our samples are DNA/Cell lysate preparations which used for QF-PCR aneuploidy analysis and are stored for up to 18 months only.
- DNA concentration is assessed where necessary but the majority of our extractions are done on the Qiagen M48 or EZ1 instruments and used neat in PCR.

Summary

Of the 23 labs who responded in this survey 11 do not, and have no plans to use 2D barcoded tubes. However, three of these labs do use printed barcode identification for DNA storage tubes. Of the remaining 12 labs two indicate that they are considering changes to the way DNA is stored and this may include 2D barcoded tubes, six indicate that they are planning to move to 2D barcoded tubes but that the exact format has not yet been decided and four either already do, or plan to use 0.75ml Matrix 2D barcoded tubes.

The main issues of concern for those trying to decide whether to use 2D tubes or which 2D tubes to use were cap type (three labs expressed a preference for screw caps), storage volume, standardisation across labs (four labs expressly supported this) and cost. One lab expressed a preference for Nunc tubes but no particular reasons were given.

Discussion

There are two main reasons for considering the standardisation of tubes (or more specifically barcoding system) used for storage and sample transfer across labs. Firstly to enable electronic exchange (import / export) of basic sample information (demographics). In outline the system would work as follows. Samples for send away would be put in tubes that are electronically identifiable (i.e. bar-coded). This bar-code would be assigned to an electronic export of sample information from the local LIMS. Strictly speaking it is not necessary to label the sample tube in any other way although it is likely that human readable information would be used as well. At the receiving end the tube bar-code would be read and the correct sample specific information would be imported into the local LIMS. To prevent possible ambiguity the main requirement of this system is that a single bar-coding system is used across labs and unique codes are generated for each sample regardless of its source or destination. This can be achieved in many ways and is not dependant on the format of the bar code (e.g. linear, 2D etc). For example each lab could use a specific prefix (SAL= Salisbury, EXE= Exeter etc) and number their send-aways sequentially – this number could be printed as a barcode and stuck to the appropriate tube. Another simple and secure way of doing this is to use pre-barcoded tubes form a single source to ensure code uniqueness or if different suppliers are used, lab specific prefixes could be employed to generate unique numbers.

However, whilst in the process of designing such a system, it is worth considering other potential benefits. The second reason for considering standardisation of tubes for both storage and send away is that it would eliminate additional sample transfers in the receiving lab where an internal standard storage method / tube is used. This not only saves work but is more secure in terms of sample tracking both in terms of physically moving the sample and the number of different reference IDs that are associated with sample. Whilst, many laboratories may store incoming DNAs in the tube in which they arrive (whatever that is), the use of standard tubes and 2D bar codes internally is extremely beneficial for automation of sample processing and tracking.

There are different levels of benefit depending on the uptake of standard tubes.

- Most benefit would be gained by labs using the standard tubes for both send-aways and storage. Here electronic data could be sent and received and sample receipts could be stored as received with minimal processing (assuming standard tubes are used for send-aways).
- Labs not using the standard for internal storage could still potentially benefit from electronic data transfer assuming they are capable of importing and exporting suitable files (most probably xml). If an internal standard for sample storage is used then samples would need to be transferred before storage but this would not change the current situation.
- Labs that cannot import or export electronic data could not benefit but it would still be desirable for them to use the standard tubes for send-aways to facilitate other laboratories use of the system. This need not be an additional cost as export tubes could be provided by receiving labs (who would need to buy tubes anyway).

The following proposals for have been based on the responses to the recent survey on sample storage taking into account current usage, proposed usage and major concerns.

Proposals for send-away standardisation

1. **Matrix 0.75 ml 2D Barcoded, V Bottom Tubes with sepra seal caps (plugs)**
   Max net capacity 600ul incl. pipette tip displacement

   Potential advantages:
   4 labs already use or plan to use this system, it has been in use in the HTSF in Salisbury for >5 years without any problems.
   Potential disadvantages:
   manual handling of the capping system may be more 'fiddly' than a screw cap system, some have questioned the potential for leakage of a plug type cap (although this has been satisfactorily tested by Wessex HTSF before implementation and tubes are individually tested by the manufacturer).

2. **Micronic 0.75 ml 2D Barcoded, V Bottom Tubes - plug or screw caps**
   Max net capacity ~450ul incl. pipette tip displacement

   Potential advantages:
   Either plug or screw caps could be used in the same tube with this system
   Potential disadvantages:
   4 labs already use the Matrix system – storage systems may not be compatible with changing tubes
   There may be a cost implication for screw cap tubes (depending on negotiated deal).
   Capacity may be low.

3. **Use bespoke bar-code numbering system with either printed labels or pre-barcoded tubes (e.g. SAL001, EXE001…etc)**

   Potential advantages:
   No major benefits over use of pre-coded tubes – possible marginal cost saving
   Potential disadvantages:
   No internal lab level benefits realised (e.g. support for internal sample tracking, eliminating need for transferring incoming samples)

4. **Some other system**
   Please specify

5. **Do not agree a standard of any sort**

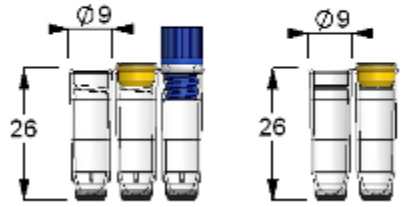
   Potential advantages:
   No time/effort required for implementation
   Potential disadvantages:
   Lack of co-ordination between labs. Potential opportunity for improved sample traceability and reduced workload missed.

Some major systems

Micronic http://www.micronic.com/products/44/0-75ml-tube-range-in-96-well-format

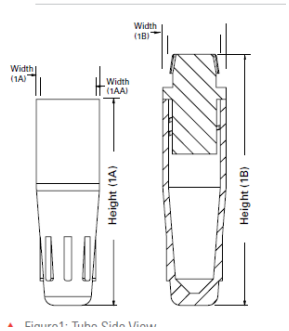
0.75ml Tube Range in 96-well format

Specifications



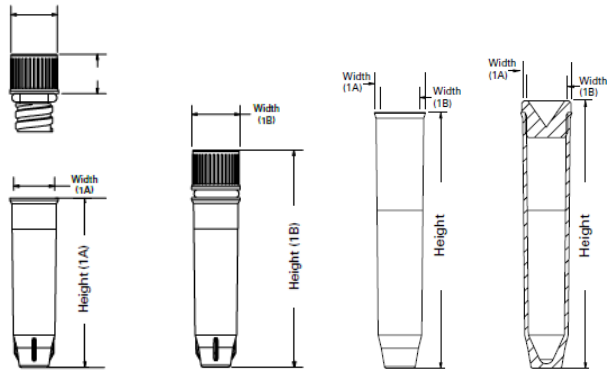
Material	: Highest purity Polypropylene
Gross volume	: 0.75ml
Net volume	: 0.52ml when used with Plug Style cap
	: 0.44ml when used with Screw Cap
Inner bottom	: U-shape or V-shape

ABgene http://www.matrixtechcorp.com/storage-systems/product.aspx?id=97



codes unique w.r.t. matrix tubes
0.5 and 1ml (gross volume) in screw capped
0.3, 0.65 and 1.2 ml (gross volume) in plug capped

Matrix http://www.matrixtechcorp.com/storage-systems/tubes.aspx?id=63



codes unique w.r.t. matrix tubes
0.5 and 1ml (gross volume) in screw capped
0.5, 0.75 and 1.4ml (gross volume) in plug capped