Stability of Xpert MTB RIF reagents in sub-optimal storage conditions. Evaluation based on three year's experience in the DRC

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Background

Since 2012, the Democratic Republic of Congo (DRC) has performed 23.227 GeneXpert MTB/Rif tests. The “cartridges” are the main consumables for this technology. These plastic boxes contain all the reagents necessary for the Polymerase Chain Reaction (PCR). In the context of the South-Kivu province of DRC, these cartridges have been stored, after reception, in sub-optimal environmental conditions where temperatures cannot be fully controlled.
Based on international standards, medical laboratories must implement procedures permitting to control that quality of reagents is not affected when the storage conditions demanded by the manufacturer are cannot be strictly respected.
The objective of this study was to determine the “real” climatic conditions present in DRC affected the quality of reagents.

Methods

Data collection

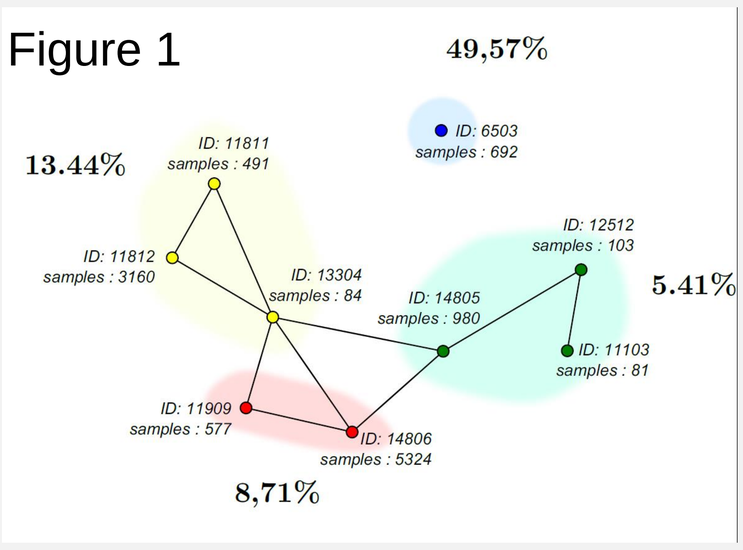
Data was collected from 8 GeneXpert (34 modules) located in the South-Kivu Province using the GenXchange (UCLouvain, Belgium; NTP, DRC) and XpertSMS (IRD, Pakistan) technology.

Quality criteria

We considered as a defective a lot of cartridges which presented an abnormal error rate. We performed hypothesis testing between each pair of lots. A two proportion z-test compares the proportion of anomalies between two lots. We defined communities of cartridges based on the Louvain algorithm (Figure 1).
We further verified, among valid test results (i.e. negative or positive) the stability of the internal quality control by analyzing the distribution of the SPC Ct.

Results

Figure 1



In Figure 1, each node represents a lot of cartridges and the edges link lots with similar proportion of not-valid results (p<0,05). Four communities of cartridge lots were identified.
A first group (green), considered as “optimal”, presented a mean proportion of not-valid results of 5,41%. Two intermediate groups (red and yellow) presented higher rates, but could not be definitely separated from the optimal group. One lot of cartridges (blue) presented 49,7% of not-valid results.

We did not observed significant increase of no-valid results in time.

Figure 2 is a data histogram representing the proportion of Ct for each possible SPC value based on all tests performed for which a value was available. The empirical probability density function of SPC Ct was obtained by fitting a distribution to the data histogram. The Ct values of SPC ranged between 23 and 37, with a mean value at 27,3. We observed a normal distribution of these values, although Kernel density estimation further improves the fitting process.

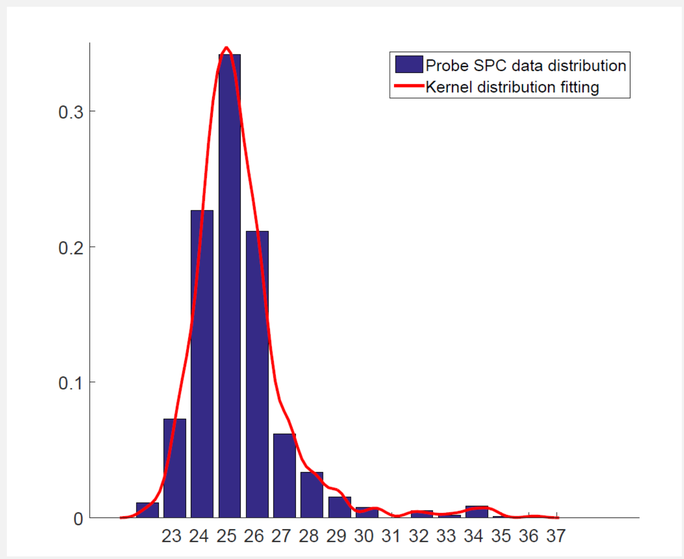


Figure 2

Conclusions

In our experience, quality assessment for the Xpert MTB/Rif assay could be performed for a network of laboratories using connectivity software. We show that quality assesment of Xpert MTB/Rif reagents should include three aspects : error rates per cartridge lot, evolution of error rates in time for each lot and distribution of internal quality controls.
A least one lot of cartridges presented major quality issues and its early identification permitted rapid replacement.