JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

The Armenian SORT IT Course

Mind the gap: Improving the performance of the reference laboratory to end-tuberculosis in Armenia

Viktorya Cholakyans[1], Eduard Kabasakalyan[1], Olga Denisiuk[2], Kristina Akopyan[3], Karapet Davtyan[4], Maka Akhalaia[5], Alvard Mirzoyan[1], Armen Hayrapetyan[1], Rony Zachariah[6]

[1] National Tuberculosis Control Center of Ministry of Health of Armenia, Abovyan, Armenia
[2]Alliance for Public Health, Kiev, Ukraine
[3] Gerald and Patricia Turpanjian School of Public Health, American University of Armenia, Yerevan, Armenia
[4] Tuberculosis Research and Prevention Center NGO, Yerevan, Armenia
[5] Program Sciences and Technical Support, Global Health Population and Nutrition, Bishkek, Kyrgyzstan
[6] World Health Organization (WHO/TDR), Geneva, Switzerland

Abstract

Introduction: A one of the step towards achieving TB related targets is to ensure early and quality diagnosis of TB in national laboratories. WHO recommends that all national reference laboratories in TB burden countries strive to reach accreditation by 2025, based on ISO15189:2012 quality management system standard. To identify gaps, progress and evaluated the evolution in implementation QMS we performed a formal assessment of the national TB reference laboratory of Armenia, as well as estimates the specific quality indicators of NRL activity.

Methodology: This is retrospective study cross-sectional study using laboratory data from the National TB Reference Laboratory in Armenia. Quality Management System assessments was conducted twice a year, using TB SLMTA assessment checklist. The sputum rejection and culture rates for quality indicators are calculated and assessed monthly.

Results: Compared to the baseline in 2016, there was a quality improvement reflecting the progress from zero to a "one star" in 2018. Areas that reached half of the target score included document and records, management review and responsibilities, evaluation and audits. Sections as "client management and customer service" and "evaluation and audits" stagnated in terms of progress. In terms of NRL performace, all indicators improved except for culture positivity in smear negative tuberculosis.

Conclusion: Although a quality management system was introduced in the NRL there is now an urgent need to develop and implement an adapted roadmap for Armenia. This will be vital to hasten the much-needed pace towards accreditation.

Key words: QMS; tuberculosis; NRL; laboratory; GLP; SORT IT.

J Infect Dev Ctries 2019; 13(5S):010S-015S. doi:10.3855/jidc.10935

(Received 08 October 2018 – Accepted 08 February 2019)

Introduction

The Sustainable Development Goals (SDGs), adopted in September 2015, and the World Health Organization (WHO) End TB (tuberculosis) Strategy, have a common goal with respect to TB to end the Global TB Epidemic [1,2] An integral component is the 90-(90)-90 TB diagnostic and treatment targets [3,4] - diagnose and treat at least 90% of all people with TB; diagnose and treat at least (90%) of the key populations with TB; achieve at least 90% treatment success for all people diagnosed with TB [4].

A first step towards achieving these TB related targets is to ensure early and quality diagnosis of TB in national laboratories [5]. This would also foster rational TB treatments and build confidence of health workers, and the community in the TB control program.

In order to achieve high quality TB diagnosis, WHO recommends that all national reference laboratories in TB burden countries strive to reach accreditation by 2025 and have provided the appropriate tools [6].

Since 2016, Armenia has been making efforts towards improving the quality of its national TB reference laboratory (TB NRL). This was done through introduction of the TB Strengthening Laboratory Quality Management Toward Accreditation (TB SLMTA) [7]. This process allows clinical and public health laboratories to develop and document the ability to detect, identify, and promptly report TB in clinical specimens [8]. TB SLMTA includes a Quality Management System (QMS). The QMS uses a five-star tiered approach based on on-site audits of laboratory operating procedures, practices and performance. A

given laboratory could score between "no stars (0-150 point)" to a maximum of "five-stars (261-275 points)". To receive recognition and accreditation to international standards, laboratories need to achieve a five-star status. Points determine the star level and are based on a checklist containing 12 sections with each section having target points (Table 1).

Anecdotal evidence suggests that since the introduction of TB SLMTA, there have been improvements in laboratory performance, however this is yet to be formally assessed. Studies from Africa [9] and the Caribbean [10] have shown improvements in laboratory performance after introducing laboratory quality control measures. A PUBMED search revealed no such studies from East Europe or the Central Asian region which are high TB burden countries. Furthermore, in Armenia, we included additional general (sputum rejection rates) and culture quality indicators which were not covered in previous studies. A formal assessment of these laboratory performance parameters would help identify gaps and orient the way forwards towards achieving the desired laboratory quality by 2020.

In the TB NRL of Armenia, we thus assessed the evolution of a) the QMS score (points) in relation to TB SLMTA targets and b) sputum specimen rejection rates and specific quality indicators for culture.

Methodology

Study design

This is a retrospective cross-sectional study using routine reference laboratory data.

Study Setting

Armenian Highland is mountainous region of Southeastern Europe. The population of Armenia is about three million. There are 10 regions with diverse geographical features (plains, valleys, hills and high mountains) in which there are both urban and rural areas.

Armenia is among the 18 high priority countries fighting TB in the WHO European region [11].

Strengthening Laboratory Quality Management Toward Accreditation

The TB NRL in Armenia was built in 2001 and it is the only laboratory that performs culture and LPA molecular testing. TB specimens are collected from TB diagnostic sites and transported by a vehicle dedicated for this purpose on a scheduled base to the reference laboratory (once or twice a week). Feedbacks on the results are provided by telephone, e-mail or other means best suited to the clinical sites. All health facilities were trained on sputum collection and transportation procedures.

TB SLMTA was introduced in 2016 in the TB NRL. Laboratory staff was mentored on the TB SLMTA process by an experienced mentor, QMS assessments are conducted twice a year while sputum rejection and culture rates quality indicators are assessed monthly. For general TB laboratory indicators (sputum rejection and culture indicators) the reference was the WHO guidelines for providing technical support to TB laboratories in low- and middle-income countries [12].

The TB NRL is under annual External Quality Assurance (EQA) program related to drug susceptibility testing, which is leaded and supported by the Borstel Supranational Reference Laboratory (SRL). For the rest of 5 years, the EQA program approves the high level of the concordance (100% for the first line drugs and 99-100% for the second line drugs) of the NRL DST results.

Table1. TB Laboratory Quality Management Systems checklist for Strengthening Laboratory Management Toward Accreditation.

Section					Total Points
Section 1: Documents & Records					28
Section 2: Management Reviews					14
Section 3: Organization & Personnel					22
Section 4: Client Management & Customer Service					10
Section 5: Equipment					35
Section 6: Evaluation and Audits					15
Section 7: Purchasing & Inventory					24
Section 8: Process Control					32
Section 9: Information Management					21
Section 10: Identification of No Conformities, Corrective and Preventive Actions					19
Section 11: Occurrence/Incident Management & Process Improvement					12
Section 12: Facilities and Biosafety					43
TOTAL SCORE					275
No Stars	1 Star	2 Stars	3 Stars	4 Stars	5 Stars
(0–150pts)	(151–177pts)	(178–205pts)	(206–232pts)	(233–260pts)	(261–275pts)
< 55%	55–64%	65–74%	75–84%	85–94%	≥ 95%

Study site and population

The study site was the TB NRL located in Abovyan city. QMS data and TB laboratories indicators was collected in TB NRL. Sputum, urine and other specimens arrived at the reference laboratory from all regions of Armenia.

Study period

The study period on evolution of QMS was from 2016 to early 2018 while that on sputum rejection and culture quality involved the period 2015-2017.

Data collection and sources

Laboratory data related to the study objectives were sourced from the reference laboratory registers. The TB SLMTA checklist was used to collect QMS data and this was done by a dedicated and trained quality control assessment officer. Data was entered into a calculation sheet (Microsoft excel) and validated by a laboratory manager. Data of laboratory specimens were entered into a dedicated data base "Health Information System of Armenia" that links clinical and laboratory data and is accessible to clinical and laboratory managers. This data was entered from registers and cross-checked with laboratory doctors and a laboratory manager.

Ethics approval

Permission for the study was obtained from the National TB control center and ethics approval was obtained from the center for medical genetics and primary health care, institutional review board, Yerevan, Armenia. As the study used aggregated data, the issue of informed consent did not apply.

Results

Quality management points and stars for the reference laboratory (2016 -2018)

Table 2 shows the trend in achieving desired quality management points and stars. Compared to the baseline in 2016, there was an overall increase of 39 points (from 137 in 2016 to 176 in 2018) reflecting progress from zero to a "one star" in 2018. Areas that only reached ≤ 50% of the target score included document and records, management review and management responsibilities, evaluation and audits. Some sections completely stagnated in terms of progress comparing the baseline in 2016 with achieved targets in 2018. These included "client management and customer service" and "evaluation and audits".

Sputum specimen rejection rates and specific quality indicators for culture (2015-2017)

There was a progressive improvement in sputum rejection with the proportion of rejected sputum specimens dropping progressively from 6.6% in 2015 to 2.9% in 2017 (Table 3). However, in terms of culture indicators for Mycobacterium Tuberculosis Complex (MTBC), all indicators improved between 2015 and 2017 except for culture positivity in smear negative TB.

Culture positivity for non-tuberculosis mycobacteria (NTM) varied between 2015 and 2017 but since there are no WHO thresholds we were unable to assess this parameter against any desired standards.

Discussion

This is the first study from the Eastern Europe and Central Asia region that has assessed progress of a TB

Table 2. Quality management points and stars for the national tuberculosis reference laboratory, Armenia (2016 -2018).

QMS variables	Allocated target points	QMS target points achieved by year [a]		
		2016 N (%)	2017 N (%)	2018 N (%)
Document and records	28	9 (32)	13 (46)	14 (50)
Management review and management responsibilities	14	3 (21)	4 (29)	4 (29)
Organization and personnel	22	5 (23)	11 (50)	15 (68)
Client management & customer service	10	6 (60)	6 (60)	6 (60)
Equipment	35	19 (54)	20 (57)	20 (57)
Evaluation and audits	15	1 (7)	1 (7)	1 (7)
Purchasing and inventory	24	20 (83)	23 (96)	23 (96)
Process control	32	22 (69)	21 (66)	21 (66)
Information management	21	15 (71)	17 (81)	17 (81)
Identification of non-conformities, corrective and preventive action	19	3 (16)	5 (26)	11 (58)
Occurrence management and process improvement	12	6 (50)	8 (67)	8 (67)
Facilities and biosafety	43	28 (65)	35 (81)	36 (84)
Total points	275	137	164	176
Stars[b]		0	1	1

[a] The baseline for a QMSs scores is 2016; [b] A range of 261-275 points is considered as 5 star.

NRL towards achieving desired international accreditation. It shows that after introducing a foundation for quality control in 2016, the pace of progress until 2018 has been much slower than desired. Of the 12 areas in the QMS check list, three areas showed ≤ 50 % progress to achieving targets while in two, there was complete stagnation.

These findings herald a red flag and is a call for urgent action to enhance the pace of progress so that Armenia can achieve the WHO recommendations of achieving laboratory accreditation by 2020. The current pace of having achieved one star after two years implies that it will take more time than WHO recommendation to achieve the desired five-star laboratory status.

The strengths of the study are that data stemmed from the only national TB NRL in Armenia and is thus representative of the national situation; we used the standardized and validated TB SLMTA check list allowing harmonized comparisons of progress by year; and we adhered to STROBE guidelines for the reporting of observational studies [13] The main study limitation was that we did not know the exact reasons for the slow overall progress and complete stagnation in some specific areas. The apathy merits specific programmatic investigation including qualitative research at the laboratory level.

The study findings have a number of policy and practice implications. First, laboratory areas with 50% or lower progress to achieving desired targets included "document and records, management review and management responsibilities as well as evaluation and audits". All these areas are labor-intensive but staffing has remained static. Despite of having supervision and support from the TB laboratory network manager, one of the other limitation factor is that the routine quality management responsibilities were assigned to a microbiologist who only started work towards the end of 2016 (October) in NRL as well as she also have to share common work with quality management. This delayed the take-off of the QMS on an operational level. In terms of data entry and record keeping, there was even a reduction in numbers of the two available staff - one left the service and another went on maternity leave. The duties of these individuals were simply added to the existing responsibilities of already busy laboratory staff. The logical way forward would be a formal assessment of overall health staffing needs in each of the 12 sections of the laboratory, address the staffing gaps and ensure that this is reviewed and fine-tuned on a yearly basis.

Second, the two areas that made "zero progress" since 2016 included "client management and customer service" and "evaluation and audits". These gaps are important pointers towards the lack of formal and objective assessments of progress in laboratory activity. From a laboratory perspective, the lack of evaluations would translate into "reduced or no formal feedback" on laboratory staff performance which may lead to staff demotivation. From a health facility perspective, lack of assessments of "client management and customer service" may hinder overall health worker confidence in the activities of the reference laboratory. A laboratory quality manager who is not overloaded with routine laboratory activity may be needed to make progress in these two areas of stagnation.

Third, there was a progressive improvement in sputum rejection rates which is a favorable finding indicating improvements in sputum collection and transport. This is likely to be the fruit of trainings and the introduction of standard operating procedures. It may serve as an example for other areas that are lagging behind. Studies from Kenya [14], Ethiopia [15] and the African region [9] have highlighted the critical role of mentorship, onsite and offsite coaching and training activities for making rapid progress towards accreditation. The presence of strategic and corrective

Table 3. Sputum rejection rate and culture quality indicators for the national tuberculosis reference laboratory, Armenia (2015 -2017).

Indicators	WHO targets in %[b]	QMS target points achieved by year		
		2015	2016	2017
General quality				
Sputum rejection rate	< 1	6.6	6.6	2.9
Quality indicators for culture[a]				
Culture positive for MTBC and NTM	15-20	6.8	9.7	10.8
Culture positive for MTBC	10-15	6.5	9.2	9.6
AFB smear positive that were culture positive for MTBC	95-98	75.6	82.7	93.8
AFB smear negative that were culture positive for MTBC	20-30	2.8	4.4	4.0
Culture positive for NTM	NA	0.3	0.5	1.2
AFB smear positive that were culture positive for NTM	NA	2.3	2.1	1.3
AFB smear negative that were culture positive for NTM	NA	0.2	0.4	1.2
Contamination rate	8-10	2.1	6.2	9.2

[a] Number and proportion of diagnostic specimens (new and relapse); [b] Culture on liquid media.

work plans has shown to catalyze progress towards TB SLMTA targets in Kenya and this could also be considered in Armenia [14].

Finally, although culture positivity for NTM varied between 2015 and 2017, we had no thresholds to assess this parameter against any desired standards. Guidance by WHO in proposing thresholds in this domain is needed.

Conclusion

The introduction of quality management measures in the national TB reference laboratory is laudable but there is now an urgent need to develop and implement an adapted road map for Armenia. This will be vital to hasten the much-needed pace towards accreditation.

Acknowledgements

This research was conducted through the Structured Operational Research and Training Initiative (SORT IT), a global partnership coordinated by the Special Programme for Research and Training in Tropical Diseases at the World Health Organization (TDR). This specific SORT IT uses on-line videos http://www.theunion.org/what- we-do/courses/online- and- multimedia- training/sort- it %20 developed jointly by the International Union Against Tuberculosis and Lung Disease (The Union) and Medécins sans Frontières (MSF). The specific SORT IT program that led to these publications included a partnership of TDR with the European Tuberculosis Research Initiative (ERI-TB) at WHO Regional Office for Europe and was implemented by: Tuberculosis Research and Prevention Center Non-Governmental Organization, Armenia, the Republican Scientific Medical Library of Armenia, National Tuberculosis Control Center of the Ministry of Health of Armenia, Fund for Armenian Relief USA, Center of Medical Genetics and Primary Health Care, Yerevan, Armenia, Alliance for Public health, Ukraine, Médecins Sans Frontières, Luxembourg (LuxOR), Sustainable Health Systems, Sierra Leone, Narotam Sekhsaria Foundation, Mumbai, India. We are also grateful to the FMD K&L Europe for providing the venue and on-site logistics services free-of-charge.

Also, we would like to express special words of thanks to the management staff of the National TB Control Center and National TB reference laboratory team for uninterruptible and quality work during the time of data collection, to director of FMD K&L CRO - Kirit Velani and all staff that facilitated organization SORT IT program, especially to Tony Reid.

Funding

The program was funded by the Special Programme for Research and Training in Tropical Diseases at the World Health Organization (TDR) and supported by implementing partners.

References

1. United Nations (2015) Transforming our world: the 2030 agenda for sustainable development. Gen Assem 70: 1–35.
2. World Health Organization. The end TB strategy. (2015). WHO, Geneva, Switzerland. Available: http://www.who.int/tb/post2015_TBstrategy.pdf. Accessed: 23 April 2018).
3. World Health Organization (2017) Global tuberculosis report 2017. Geneva:Available: 250p. www.who.int/tb/post2015_TBstrategy.pdf Accessed: 27 April 2019
4. Stop TB Partnership (2015) The paradigm shift 2016-2020 Global Plan to End TB. Geneva: UNOPS 200 p. Available. http://www.stoptb.org/assets/documents/global/plan/globalplantoendtb_theparadigmshift_2016-2020_stoptbpartnership.pdf Accessed: 27 April 2019
5. World Health Organization (2015) Implementing tuberculosis diagnostics. Geneva: WHO 39 p. Available: https://apps.who.int/iris/bitstream/handle/10665/162712/9789241508612_eng.pdf?sequence=1 Accessed: 27 April 2019
6. World Health Organization (2016) Framework of Indikators and Targets for Laboratory Strengthening under the End TB Strategy. Geneva: WHO 19p.
7. Strengthening Laboratory Management Toward Accreditation (2015) Training Materials. Available: https://slmta.org/tool-kit/english. Accessed: 27 April 2019
8. Onceptualization C, Hemes RET, Berner M, Maedche A, Mueller B (2012) Stepwise laboratory quality improvement process towards accreditation (SLIPTA) checklist. Geneva: WHO 48 p. Available. https://who.insomnation.com/sites/default/files/pdf/slipta-checkist0711.pdf Accessed: 27 April 2019
9. Albert H, De Dieu Iragena J, Kao K, Erni D, Mekonen T, Onyebujoh PC (2017) Implementation of quality management systems and progress towards accreditation of National Tuberculosis Reference Laboratories in Africa. Afr J Lab Med 6: 1–8.
10. Guevara G, Gordon F, Irving Y, Whyms I, Parris K, Beckles S, Maruta T, Ndlovu N, Albalak R, Alemnji G (2014) The impact of SLMTA in improving laboratory quality systems in the Caribbean Region. Afr J Lab Med 3: 1–9.
11. World Health Organization (2017) Tuberculosis country brief, 2016: Armenia. Available: https://www.medbox.org/tuberculosis-country-brief-2016-armenia/download.pdf Accessed: 27 April 2019
12. Global Laboratory Initiative (2015) Guide for providing technical support to TB laboratories in low- and middle-income countries. Geneva: WHO 96 p. Available: http://stoptb.org/wg/gli/assets/documents/guideforprovidingtechnicalsupport_gb_web.pdf Accessed: 27 April 2019
13. von Elm E1, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative (2008) The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. Clin Epidemiol 61: 344–349

14. Maina RN, Mengo DM, Mohamud AD, Ochieng SM, Milgo SK, Sexton CJ, Moyo S, Luman ET (2014) Progressing beyond SLMTA: Are internal audits and corrective action the key drivers of quality improvement? Afr J Lab Med 3: 1–7.
15. Sisay A, Mindaye T, Tesfaye A, Abera E, Desale A (2015) Assessing the outcome of Strengthening Laboratory Management Towards Accreditation (SLMTA) on laboratory quality management system in city government of Addis Ababa, Ethiopia. Pan Afr Med J 20: 314.

Corresponding author
Viktorya Cholakyans, BS, MS
Microbiologist and Quality Manager
National TB Reference Laboratory,"National TB Control Center" SNPO, MOH, RA
Arzni highway 10, 2204, Abovyan, Kotayk Marz, Armenia
Tel: +374 94 081 583
Fax: +374 222 20011
Email: cholakyansv@yahoo.com

Conflict of interests: No conflict of interests is declared.