

Proficiency Testing Program for Screening Drug Testing Laboratories in the Philippines, 2009-2019: Experience of the National Reference Laboratory of the East Avenue Medical Center

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ABSTRACT

Background. According to the guidelines of the Department of Health (DOH)'s Health Facilities and Services Regulatory Bureau (HFSRB), accreditation of drug testing laboratories (DTLs) requires annual participation in a proficiency testing (PT) program. Since 2009, the National Reference Laboratory for Environmental and Occupational Health, Toxicology and Micronutrient Assay of the East Avenue Medical Center (NRL-EAMC) has conducted the PT program for DTLs.

Objectives. This article aims to provide a general overview of the PT program conducted for screening drug testing laboratories (SDTLs) and to examine data on laboratories' participation and performance in the PT program.

Methodology. Laboratories registered for the PT program were given ten 3-mL synthetic urine specimens which may or may not contain drugs of abuse such as methamphetamine and tetrahydrocannabinol at or above the cut-off level. Laboratories analyzed the PT specimens using immunoassay test kits. The results of the analysis were reported back to NRL-EAMC. The performance of the laboratories in the PT depends on the number of incorrect responses.

Results. For ten years (2009-2019), 1102 ± 188 laboratories annually participated in the program. The mean passing rate was $96.6 \pm 4.8\%$. The number of laboratories which initially failed the PT program significantly decreased from 2009 (15.1%) to 2012 (1.5%). From 2013 to 2019, only below 2.5% of the participating laboratories initially failed the PT. On average, $48.4 \pm 18.4\%$ of the laboratories achieved an excellent performance, $34.0 \pm 13.6\%$ had a highly satisfactory performance, and $14.3 \pm 5.4\%$ got an acceptable performance.

Conclusion. The continued decreasing number of laboratories which failed the PT signifies the improvement of laboratories in urine drug testing. In general, some laboratories participating in the PT for the first time are the ones which initially fail the PT which could be due to a lack of experience in handling PT test items. The PT program highlights the effectiveness of quality control procedures being implemented in a drug testing laboratory.

Key words: laboratories, quality control, accreditation, drug testing, methamphetamine, tetrahydrocannabinol, proficiency testing

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INTRODUCTION

Drug testing laboratories (DTLs) are important facilities in clinical practice to determine drug overdose, manage mental health and seizure cases, identify exposure risk to illicit drugs, and monitor medication in substance abuse treatment centers. They also play a vital role in forensic toxicology such as monitoring of drug abuse in workplaces.¹ Therefore, it is imperative that they provide high-quality, accurate, and precise test results. In the Philippines, only DOH-accredited DTLs are authorized to conduct drug testing. DTLs accredited by the DOH receive urine specimens and test this matrix to determine the presence and absence of illegal drugs. The laboratories are instruments in the diagnosis, treatment, and monitoring of substance use disorders.



Relative to the Republic Act (RA) 9165 or the “*Comprehensive Dangerous Drugs Act of 2002*”, the Dangerous Drugs Board (DDB) issued Board Regulation No. 2 Series of 2003, “*Implementing Rules and Regulations Governing Accreditation of Drug Testing Laboratories in the Philippines*” which provides the technical and administrative requirements for the accreditation of DTLs.² Accreditation of DTLs shall be regulated by the DOH’s Health Facilities and Services Regulatory Bureau (HFSRB). One of the requirements for DTL’s renewal of accreditation is the annual participation and passing a proficiency testing (PT) program. The Board Regulation mandated the NRL-EAMC to conduct a continuing assessment of DTLs’ proficiencies through the implementation of a PT program.

The DDB Board Regulation No. 3 Series of 2006, “*Guidelines for the Drug PT Program for DTLs*” defined Proficiency Testing as an “external assessment of a laboratory’s performance using samples of known but undisclosed content, to assure competence and reliability of test results.” Said unknown samples shall be provided by NRL-EAMC as part of its mandated function. Furthermore, the Board Regulation specified three objectives for the conduct of PT: (1) to assure competency of DTLs and their compliance with the standards of conduct of drug tests; (2) to provide assessment for the regulation of DTLs; and (3) to continually assure the public of Quality Drug Testing Services. It also reiterated that DTLs should participate and pass the annual PT as a requirement for the renewal of their accreditation.³

The NRL-EAMC has been providing proficiency testing samples to screening drug testing laboratories (SDTLs) since 2009. The objectives of this article are to provide a general overview of the PT program conducted for SDTLs and to present the results of PT program during the 2009-2019 period. The scope of this article is only limited to the presentation of several participating laboratories and their performance. Highlights on the 2019 PT program are also included.

METHODOLOGY

The NRL-EAMC’s PT program for SDTLs follows a cycle from registration up to the reporting of results (Figure 1).

Registration

SDTLs are required to participate annually in the PT program. The registration for the succeeding year’s PT starts in November of the current year. Initially, the registration deadline was in September of the succeeding year. Beginning 2018, the scheduled deadline is every May 31 of the current year PT according to the DOH Circular No. 2017-0173.⁴ Registration form can be downloaded from NRL-EAMC’s website or official Facebook Page. The properly filled out registration form together with the participation fee is sent personally to NRL-EAMC’s office or via their preferred courier.

Specimen preparation

The PT specimens are prepared in such a way that they are like those normally tested and have similar levels of determinant (routine specimens). Since it is not feasible to collect large amounts of human urine (e.g., one cycle

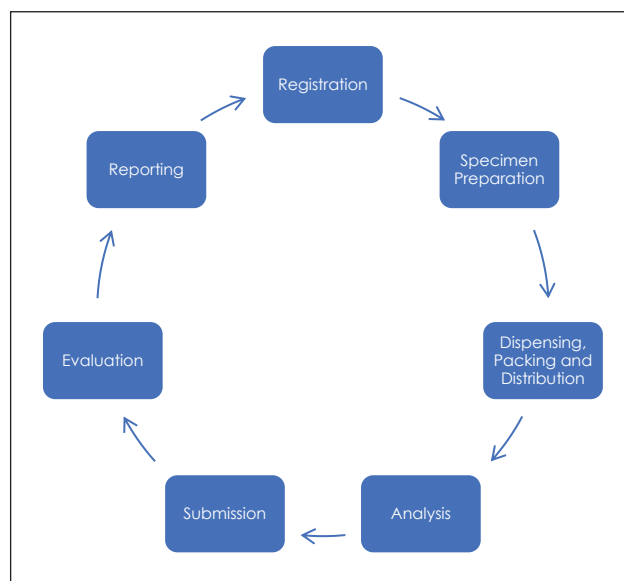


Figure 1. Process flow for the conduct of proficiency testing program for screening drug testing laboratories.

of PT for 500 laboratories requires at least 17 liters of urine), the NRL-EAMC prepares synthetic urine (SU). The SU resembles the common chemicals found in normal human urine. It has been widely used in laboratories for teaching urinalysis concepts⁵, and analysis of creatinine and albumin.⁶ For PT purposes, it is prepared by dissolving certain amounts of salts, urea, creatinine, acids, and bases (Merck, Darmstadt, Germany) in ultrapure water (18.2 MΩ·cm). Yellow color food dye (obtained from a local supermarket) is added to give its urine-like color. The pH (6 to 7.5) and specific gravity (1.005 to 1.030) are analyzed to be within the acceptable ranges.

The SU is spiked with standard solutions of common drugs of abuse: methamphetamine (Meth) and tetrahydrocannabinol (THC) obtained from Cerillant®, Millipore-Sigma, Merck, KGaA, Darmstadt, Germany. The spiked concentration is $\pm 50\%$ of the common cut-off values in immunoassay test kits (1000 ng/mL and 500 ng/mL for Meth, and 50 ng/mL for THC). For Meth, synthetic urine is spiked with the standard solution to obtain the following final concentrations: 1500 ng/mL, 500 ng/mL, 750 ng/mL, and 250 ng/mL. For THC, 75 ng/mL and 25 ng/mL. Meth and THC remain to be the most common drugs to be abused.⁷ The combinations of these values are used to obtain ten formulations. The formulations’ concentrations are initially screened with immunoassay test kits and verified via analysis with gas chromatography-mass spectrometry (Agilent Technologies Inc., Santa Clara, CA, USA) and/or liquid chromatography-mass spectrometry (Thermo Scientific, Waltham, MA, USA).

The PT specimen must have sufficient bias, homogeneity, and stability. The PT bias is sufficient when the spiked concentrations of the analytes are within the acceptable recoveries. Homogeneity is tested by analyzing one PT package consisting of 10 proficiency test items for every 20 participating laboratories. Homogeneity is attained if at least 80% of the results are the same. In one PT cycle, around 30 PT packages are randomly selected

for homogeneity testing. To ensure the stability of the specimen, an aliquot of the formulations is stored in three different storage conditions: room temperature ($\approx 25^{\circ}\text{C}$), cold temperature ($\approx 8^{\circ}\text{C}$) and hot temperature ($\approx 35^{\circ}\text{C}$). The formulations are tested after preparation up to 2 weeks or until all the laboratories have received the PT package. In general, the PT specimens are stable for up to three weeks.

Dispensing, packing and distribution

An aliquot of 3 mL from each formulation is dispensed to cryogenic polypropylene vials. Each PT specimen vial is randomly coded corresponding to each formulation. PT packages containing ten PT specimen vials are sent out to each participating laboratory. Each laboratory is assigned a unique laboratory code. The vial codes and laboratory codes are confidential. Also included in the PT package are the Instructions on handling the PT test items, as well as the Acknowledgement and Results Forms.

Although the PT specimens are synthetic urine, it is still considered to contain biological hazards. As per the International Air Transport Association (IATA), a triple packaging system is imposed. The triple packaging system is composed of plastic airtight cryovials (primary receptacle), zip plastic bag (secondary packaging) and aluminum insulator pouch and courier pouch (tertiary packaging). All packaging materials were obtained from a local supermarket hardware store. Depending on the number of successfully registered laboratories, the PT samples are distributed in 3 to 4 batches/cycles. The PT packages are expected to be delivered by courier within 1 to 2 weeks.

Analysis

The laboratories are expected to analyze the samples as soon as they receive the samples according to their laboratory procedures. Screening methods such as instrumented or immunoassay test kits can be used. Laboratories are advised to strictly follow instruments or test kits' instructions and to properly use quality control materials (negative and positive controls). For each PT specimen, the laboratory must identify the presence or absence of the analytes and report them as positive or negative. A total of twenty responses must be reported (two analytes for each PT specimen).

Submission

According to the DDB Board Regulation No. 3 Series of 2006, DTLs are instructed to submit results within 48 hours through the NRL-EAMC website or Google Forms. Hard copies shall also be submitted to NRL. Annex A. No. 4, of the Board Regulation also requires DTLs to submit test results in two modes: hard copy and online.³ For the hard copy, the original signatures of the analyst and head of the laboratory are required. Furthermore, cut-off values for the method must be correctly indicated.

Evaluation

Participating laboratories' responses are evaluated according to the modified Metrology of Qualitative Chemical Analysis (MEQUALAN) method for binary responses⁸ In this method, correct and incorrect responses are marked with "0" and "1", respectively. The marks are then added. Hence, "0" is the best score. Table 1 presents

Table 1. Evaluation of PT performance according to total incorrect responses

Total Score (Incorrect Responses) out of 20	Performance Description	Remarks
0 to 2	Excellent	Passed
3 to 5	Highly Satisfactory	Passed
6 to 8	Acceptable	Passed
≥ 9	Questionable	Initially Failed
Passed Repeat PT	Acceptable	Passed
Failed Repeat PT	Failed	Failed

the ranges of the total score and their corresponding description. A total of 20 incorrect responses are possible (10 each for Meth and THC).

DDB Board Regulation No. 2 Series of 2003 states that failure in the PT shall result in the suspension of the laboratory's accreditation and must be given a repeat PT (to be included in the next PT cycle/batch). The laboratory's failure in the repeat PT shall result in the revocation of the DTL's accreditation.²

Reporting

Every fourth quarter of the year, NRL-EAMC submits the PT reports to HFSRB. These include the list of DTLs which passed the PT, failed the PT, and with pending status. Laboratories with pending status are those with deficiencies such as no or incorrect cut-off value indicated, no or not original signature (electronic or stamped), and no online submission. Laboratories are given two weeks to comply with their deficiencies. Meanwhile, the laboratories receive their certificates of proficiency, performance of laboratories, announcement of the next PT, and registration form.

Data analysis

MS Excel program was used to encode the data from laboratories, generate graphs and tables, and calculate the mean and standard deviation. Excluded in the analysis are the laboratories which 1) did not submit hard copy or online results, 2) did not provide the cut-off values of the method used, 3) indicated invalid cut-off values, 4) had no original signatures of analyst and/or head of the laboratory, and 5) did not follow instructions. The identities of the participating laboratories were kept confidential. Statistical analyses were performed on the aggregate data collected from 2009 to 2019.

RESULTS AND DISCUSSION

PT participation

The majority of SDTLs cater to drug testing services for driver's licenses, pre-employment, and random drug testing in workplaces. In the first year of PT program implementation in 2009, 1045 SDTLs successfully participated. Successful participation refers to the laboratories which registered in the PT program, received the PT package, analyzed the PT samples, and submitted their PT results. In 2010, it was not possible to provide PT samples due to logistical concerns. Thus, PT samples distributed in 2011 covered the 2010-2011 period. The average number of successfully participated laboratories nationwide from 2009 to 2019 is 1102 ± 188 (Figure 2).

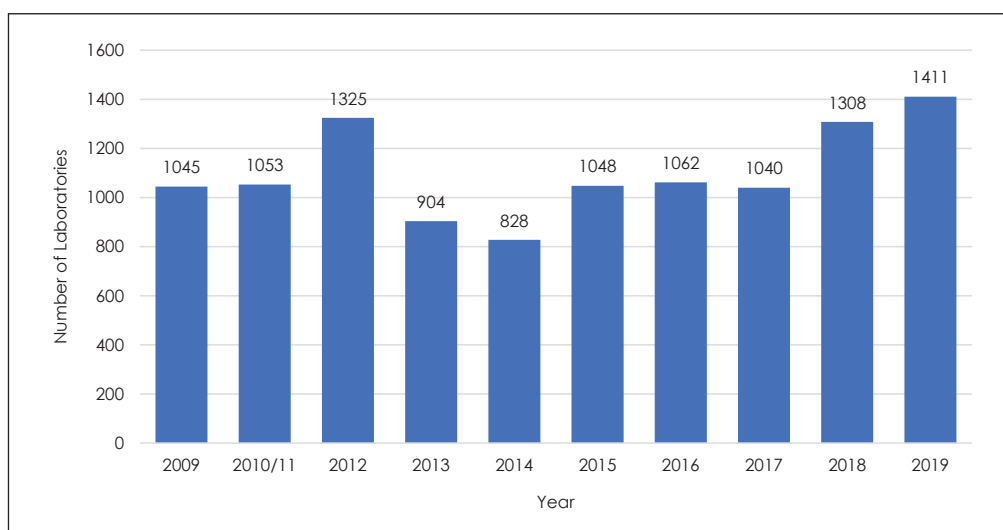


Figure 2. Annual number of participating laboratories during the 2009-2019 PT implementation period.

There was no significant difference in the number of laboratories between 2009 and 2010/2011. By 2012, a 25.8% increase in the number of participating SDTLs was noted. However, in 2013, it went down (-31.8%) to 904 laboratories. This could be due to the enactment of RA 10586 or the Anti-Drunk and Drugged Driving Act of 2013 which prohibits driving a motor vehicle under the influence of alcohol, dangerous drugs, and other similar substances.⁹ Under this law, drug testing is only required for drivers when involved in a vehicular accident. Thus, drug testing for the renewal of a driver's license is no longer required. Many Land Transportation Office (LTO)-based SDTLs (laboratories near LTO branches) closed as a result. The decreased number of participating laboratories continued in 2014.

In 2015, there was a 26.6% increase (compared to 2014) in the number of participating laboratories. The number of laboratories remained to be more than 1000 in 2016 and 2017. The increased number of laboratories compared to the previous year (2014) was due to the country's situation and implementation of different drug policies. For instance, the Office of the President under the Aquino Administration (2015) released a memorandum regarding the implementation and institutionalization of the national anti-drug plan of action.¹⁰ The memorandum reiterated the implementation of a drug-free workplace program in the government and private offices. Thus, more laboratories were established or re-established for random drug testing in workplaces. In 2016, then-President Rodrigo Duterte declared his war on drugs¹¹ which further increased the need for drug testing of individuals. In support of Duterte's drug policy, the Civil Service Commission (CSC) issued Memorandum Circular No. 13 series of 2017, providing guidelines for mandatory random drug testing for public officials and employees.¹² For the private sector, the Department of Labor and Employment (DOLE) reminded employers to comply with Department Order 53-03 regarding the implementation of a drug-free workplace.¹³

The implementation and reiteration of drug testing programs especially in workplaces whether public or private

resulted in the need for more drug testing laboratories to conduct authorized random drug testing. In effect, the number of participating laboratories in the PT program continued to increase in 2018 and 2019.

SDTLs are categorized according to ownership, whether private or government. It is also classified according to the nature of the laboratories. Institution-based refers to laboratories which are under a main laboratory, or the laboratory simultaneously offers other clinical laboratory services (e.g., clinical chemistry, hematology). On the other hand, a free-standing laboratory solely offers drug testing services. SDTLs are further classified according to the status of their accreditation whether initial or renewal.

In 2019, 1411 successfully participated in the PT program. A majority (92.8%) of the participants were private laboratories while only 7.2% were government laboratories (Table 2). Of the 1309 private SDTLs, 72.4% were institution-based while 27.6% were free-standing laboratories. From the private institution-based laboratories, 10.4% and 89.6% were on initial and renewal accreditation status, respectively. On the other hand, from the private free-standing laboratories, 6.1% and 93.9% were on initial and renewal accreditation status, respectively. Of the 102 government SDTLs, 94.1% were institution based while 5.9% were free-standing laboratories. From the government institution-based SDTLs, 4.2% and 95.8% were on initial and renewal accreditation status, respectively. On the other hand, from the government free-standing SDTLs, 16.7% and 83.3% were on initial and renewal accreditation status, respectively. Throughout the implementation of the PT program during 2009-2019, the majority of the participating laboratories came from private institution-based SDTLs. Most of the free-standing laboratories were located near an LTO, when drug testing was a requirement for renewal of a driver's license.

According to the 2019 data, almost one-third or 32.6% (460/1411) of the SDTLs were from the National Capital Region (NCR). It was followed by Region IV-A and Region III, which registered 244 (17.3%) and 155 (11.0%)

Table 2. Number of participating laboratories in the 2019 PT program

		Initial	Renewal
Government	Institution- based	Initial	4
		Renewal	92
	Free- Standing	Initial	1
		Renewal	5
Private	Institution- based	Initial	99
		Renewal	849
	Free- Standing	Initial	22
		Renewal	339

SDTLs, respectively. The three regions with the highest participating laboratories corresponded with the three regions with the highest populations, according to the census by the Philippine Statistics Authority (PSA). Region VII and Region VI contributed more than 5% of the total SDTLs with 115 (8.2%) and 75 (5.3%) laboratories, respectively. They were followed by Regions XI, I, and X with 56 (4.0%), 45 (3.2%), and 41 (2.9%) participating laboratories, respectively. Regions V and XII both had 36 (2.6%) SDTLs which participated in the PT while Region II had 30 (2.1%). Regions with less than 30 participants were Region IX (27), Region VIII (24), Cordillera Administrative Region (CAR) (22), Region XIII- CARAGA (22), and Region IV-B (18). The region with the lowest number of participating laboratories was the Bangsamoro Autonomous Region of Muslim Mindanao (BARMM) with 5 or 0.4% only of the total SDTLs. The distribution of the participating laboratories in different regions was consistent with the other PT years.

Throughout the 2009-2019 PT implementation period, 100% of the participating laboratories used immunoassay test kits with dual (2-panel) test analytes: methamphetamine and tetrahydrocannabinol, with 1000 or 500 ng/mL and 50 ng/mL cut-off values, respectively. In 2019, around 90%

used the drop test kits while the remaining 10% used the dip test kits.

Laboratory performance in PT

The performance of laboratories from 2009-2019 is shown in Figure 3. During the initial implementation of the PT program (2009), 16.6% (173/1045) of the participating laboratories achieved excellent performance. On the other hand, almost half of the participants, 43.9% (459/1045) had a highly satisfactory performance. The number of laboratories with excellent performance is lower than the number of laboratories with highly satisfactory performance since it was the first time that laboratories participated in a PT program. The number of excellent laboratories increased to 47.7% (502/1053) in 2010/2011, further increased to 56.3% (746/1325) in 2012, and peaked at 76.9% (695/904) in 2013. Beginning in 2014, a downward trend in the number of excellent laboratories was observed. In 2014, 65.8% (545/828) had excellent performance which slightly decreased to 63.6% (667/1048) in 2015; further decreased to 51.0% (542/1062) in 2016 until it reached 42.2% (439/1040) in 2017. The percentage of total laboratories with excellent performance in 2018 was 33.7% (441/1308) which decreased to 29.6% (418/1411) in 2019.

For the 2009-2019 period, the trend in the number of laboratories with highly satisfactory performance is opposite to the trend observed in the excellent performance. In 2009, 43.9% (459/1045) had highly satisfactory performance but decreased to 24.7% (260/1053) in 2010/2011. It further decreased to 24.1% (319/1325) in 2012 and 17.3% (156/904) in 2013, which was the lowest during the 2009-2019 period. In 2014, it increased to 20.4% (169/828) and further increased to 24.5% (257/1048) in 2015. The increasing trend in the number of laboratories with highly satisfactory performance continued in 2016 with

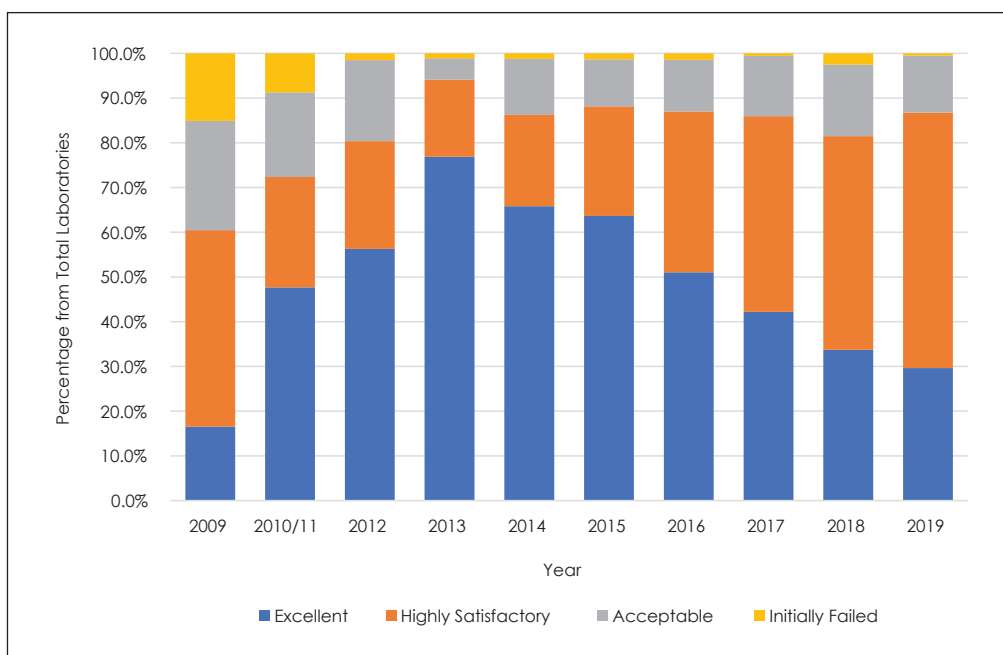


Figure 3. Annual percentage of laboratories achieving excellent, highly satisfactory, and acceptable performance in the PT program (2009-2019).

36.0% (382/1062); 43.8% (455/1040) in 2017; and 47.8% (625/1308) in 2018. The highest percentage was recorded in 2019 with 57.1% (806/1411).

A similar trend with highly satisfactory performance, the number of laboratories with acceptable performance decreased from 2009 to 2013. Laboratories with acceptable performance were lowest in 2013 (4.8%, 43/904) and highest in 2009 (24.4%, 255/1045). On the average, less than 20% of the participating laboratories had acceptable performance during the 2009-2019 period: 24.4% (255/1045) in 2009; 18.9% (199/1053) in 2010/2011; 18.1% (240/1325) in 2012; 4.8% (43/904) in 2013; 12.6% (104/828) in 2014; 10.5% (110/1048) in 2015; 11.6% (123/1062) in 2016; 13.5% (140/1040) in 2017; 16.0% (209/1308) in 2018; and 12.8% (180/1411) in 2019.

The upward and downward trend in the number of excellent laboratories could be correlated to the trend observed in the number of new participating laboratories. New participants tended to obtain highly satisfactory performance on their initial participation as they were not yet familiar with the PT procedures. Participants tend to commit more errors during their first participation in PT program.¹⁴ Moreover, it could be due to the random formulations of the PT specimens every year, i.e., the number of positive and negative specimens would be different every year depending on the results of randomization, making it harder to achieve less than three incorrect responses. Nevertheless, the passing rate for the PT was consistently high: 84.9% (2009), 91.3% (2010/2011), 98.5% (2012), 98.9% (2013), 98.8% (2014), 98.7% (2015), 98.6% (2016), 99.4% (2017), 97.5% (2018), and 99.5% (2019). During the 2009-2019 period, the average passing rate was 96.6% ± 4.8%.

Focusing on the 2019 data (Figure 4), for every region except BARMM, the number of laboratories with highly satisfactory performance was greater than the number of laboratories with excellent performance. The percentages of laboratories with excellent performance in every region were as follows: I- 24.4%, II- 33.3%, III- 34.8%, IV-A-

32.8%, IV-B- 22.2%, V- 36.1%, VI- 36.0%, VII- 19.1%, VIII- 29.2%, IX- 33.3%, X- 14.6%, XI- 21.4%, XII- 33.3%, NCR- 29.8%, CAR- 31.8%, BARMM- 0%, and CARAGA- 31.8%. Region V had the highest percentage of excellent performance while the BARMM had the lowest.

For the highly satisfactory performance, the percentages of participating laboratories in the 2019 PT were: I- 60.0%, II- 56.7%, III- 52.9%, IV-A- 59.4%, IV-B- 72.2%, V- 55.6%, VI- 54.7%, VII- 58.3%, VIII- 45.8%, IX- 59.3%, X- 61.0%, XI- 66.1%, XII- 47.2%, NCR- 56.1%, CAR- 59.1%, BARMM- 100%, and CARAGA- 54.6%. The top three regions with the highest percentages of laboratories with highly satisfactory performance were BARMM, IV-B, and XI, while Region VIII had the lowest.

The percentages of laboratories with acceptable performance in every region were as follows: I- 15.6%, II- 10.0%, III- 11.6%, IV-A- 7.8%, IV-B- 5.6%, V- 8.3%, VI- 9.3%, VII- 21.7%, VIII- 25.0%, IX- 7.4%, X- 22.0%, XI- 12.5%, XII- 16.7%, NCR- 13.5%, CAR- 9.1%, BARMM- 0%, and CARAGA- 13.6%. Region VIII had the highest percentage of excellent performance while the BARMM had the lowest.

Failures in the PT program

According to the DDB Board Regulation, initial failure in PT will result in the suspension of the laboratory's accreditation. In the first year of implementation of PT (2009), 158 laboratories initially failed the PT (Figure 5), corresponding to 15.1% of the total participating laboratories (1045). Since it was the first time, it was expected to have many initially failed participants. Most participants were not yet familiar with the PT program, especially in the conduct of testing the proficiency test specimens and the quality assurance procedures were not yet fully established. In 2010/2011, the initial failed laboratories dropped to 92 or 8.7% of the total participating laboratories (1053). It further decreased to 20 (1.5% of 1325) laboratories in 2012 and remained to be less than 20 until 2017. On average, less than 1.5% of the total participating laboratories initially failed the

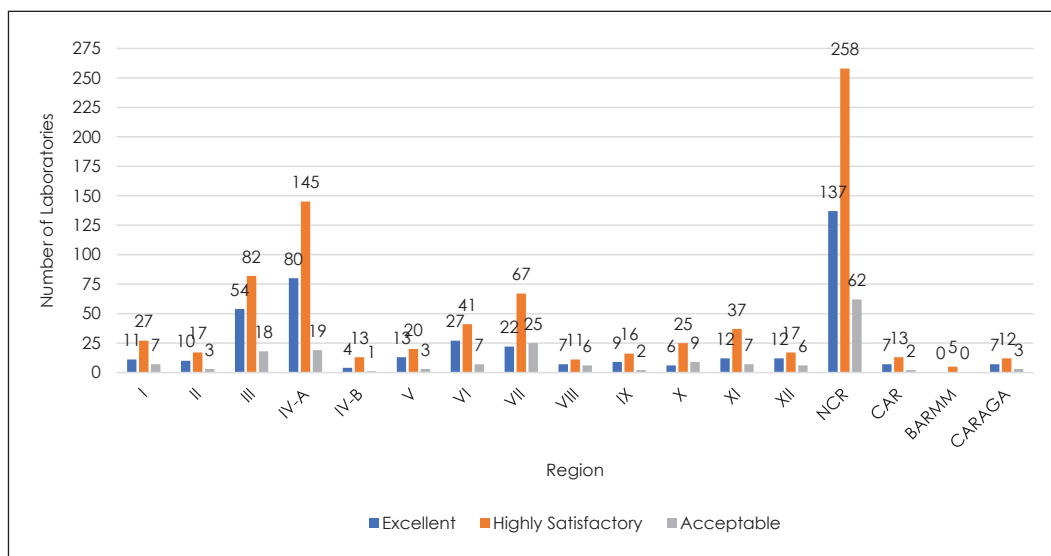


Figure 4. Number of laboratories and their performances in the 2019 PT program.

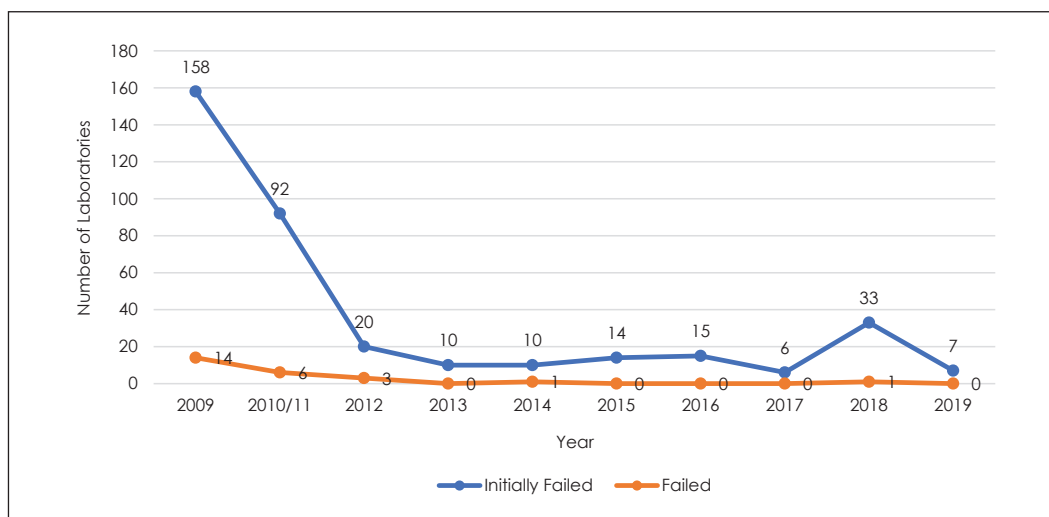


Figure 5. Annual number of initially failed and failed laboratories in the 2009-2019 PT implementation period.

PT during 2012-2019, except in 2018 which had 2.5%. Based on this trend, we can conclude that the proficiency testing program implemented for SDTLs has helped them improve the quality of their tests.

In 2019, seven laboratories initially failed the PT which were all private SDTLs (100%). Three of them came from NCR (two free-standing and one institution-based). On the other hand, one laboratory each from Regions III (institution-based), VII (institution-based), X (free-standing), and XII (institution-based) initially failed the PT. Since NCR had the largest number of participants, it was expected that they would have the highest rate of failure. The trend is similar to previous years.

A review of testing and quality control procedures of the initially failed laboratories revealed that they were not able to follow specific test kit instructions regarding the required temperature and reading time. The immunoassay test kits were also not stored properly which affected their performance. Mistakes in reading the test kits were also noted. Some analysts read the drug test kits as pregnancy test kits which have different interpretations (i.e., a line in the drug test kits means a negative result while it is a positive result in a pregnancy test). Some drug test kits consider a faint line as a negative, while others already consider it as positive. The expiry of drug test kits may also affect its performance, however, all the laboratories used test kits that were within their expiry dates.

Some initially failed laboratories did not handle and store the PT specimens properly. When the testing was not performed right away, the specimens were not put in the refrigerator. Furthermore, due to its high cost, quality control materials were not regularly run together with the PT specimens. Clerical errors in notetaking and record-keeping were also reasons for the laboratory's failure. Overall, the initially failed laboratories were not able to follow or maintain good laboratory practice.

Since the screening drug testing is qualitative, the experience, analytical and interpretive capabilities of the analyst are very important. Continued training and

application of quality control procedures are needed by the drug test analysts.¹⁵ NRL-EAMC is responsible for the training of drug testing analysts and re-training is available whenever needed.

To lift the suspension of accreditation of initially failed laboratories, they must immediately register for the next available PT cycle. The initially failed laboratories must improve their testing and quality assurance procedures prior to taking the repeat PT. On their second attempt, most of them passed the repeat PT. In 2009, 14 laboratories or 9.7% of the initially failed laboratories failed their second PT. This has resulted in the revocation of their accreditation as authorized drug testing laboratories. In 2010/2011, 7.0% of the initially failed laboratories failed their repeat PT while 17.7% in 2012. From 2013 to 2019, less than or equal to one laboratory failed their second attempt in PT. Furthermore, laboratories which initially failed their current PT tended to obtain acceptable/highly satisfactory or even excellent performance in their next year's participation. This has shown the improvements of the laboratories in their drug testing procedures and the effectiveness of the PT program implementation.

PT programs in other countries

In the United States, PT program for DTLs started in 1972 when 114 laboratories were invited to participate. Initially, morphine and methadone were spiked into water matrix and added with caramel and urea to achieve the specific gravity of urine. Around 50 – 70% of the participating laboratories were able to correctly identify the drugs.¹⁶

The American Association for Clinical Chemistry (AACC) Special Study on Drugs of Abuse in Urine initiated the Toxicology Surveys Plus in 1985 to check the capability of DTLs to assess the presence/absence of five drugs or drug classes of interest usually encountered in pre-employment drug testing. Forty-nine laboratories participated and were given eight 50 mL urine specimens spiked with tetrahydrocannabinol, benzoylecgonine, morphine/codeine, methamphetamine, and phencyclidine. They reported that 69 – 82% of the laboratories used enzyme immunoassay (EIA) test kits. The lowest accuracy achieved

by any participating laboratory was 75%. On the other hand, 100% accuracy was achieved for cannabinoids.¹⁷

Since 1987, the United Kingdom National External Quality Assessment Scheme (UK NEQAS) for Drugs of Abuse in Urine has been providing proficiency testing specimens for DTLs. Participants were supplied with three sets of freeze-dried aliquots of 25 mL of urine spiked with amphetamine, barbiturates, benzoylecgonine, benzodiazepines, methadone, and morphine. For the PT between March 1990 and August 1992, 131 laboratories participated wherein high-performance liquid chromatography (HPLC) was revealed to be the most sensitive technique.¹⁵

The first implementation of a proficiency testing program for DTLs in Spain was in 1987. Participating laboratories received six samples of urine specimens spiked with drugs of abuse (amphetamines, barbiturates, benzodiazepines, opiates, methadone, dextropropoxyphene, benzoylecgonine, and cannabinoids) four times a year. The mean percentage error of the 25 participating laboratories was 2.8%. For laboratories participating for the first time, the mean error was 3.6%. A majority (62%) of the laboratories used EIA test kits.¹⁴

In Italy, the Centre of Behavioral and Forensic Toxicology (CBFT) of the University of Padova initiated the PT program for DTLs in 1995. In batches, six urine specimens (spiked with amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, methadone, opiates, and interfering substances) were sent every three months to about 200 participating laboratories. Between 1995 – 1998, the average percentage of correct results was 96.8%.¹⁸

The United Nations Office on Drugs and Crime (UNODC) has organized the International Collaborative Exercises (ICE) program since 1995. Its primary objective is to aid DTLs worldwide in assessing their performance. The UNODC ships twice a year four unknown test specimens of drugs and their metabolites in urine to more than 300 laboratories worldwide.¹⁹ The NRL-EAMC regularly participates in the said ICE program with satisfactory results.

For laboratories worldwide performing screening drug testing only, the College of American Pathologists (CAP) sends five 10mL liquid urine specimens thrice per year to registered laboratories. They provide specimens for testing of diverse analytes: acetaminophen, amphetamines, barbiturates, benzodiazepines, benzoylecgonine, buprenorphine, tetrahydrocannabinol, ethanol, fentanyl, lysergic acid diethylamide (LSD), methadone and metabolite, methamphetamines, methylenedioxymethamphetamine (MDMA), opiates, oxycodone, phencyclidine, propoxyphene, and tricyclic group. In their Urine Drug Testing, Screening (UDS) Proficiency Survey 2011-2017, more than 3000 laboratories participated in the screening of THC, while more than 1000 laboratories for METH/AMPH.²⁰ However, the survey did not provide details on the performance of the laboratories but rather focused on the cross-reactivities of immunoassays especially for synthetic opioids. The laboratories used different cut-offs for the immunoassays and the authors encouraged them to adjust their test services based on clinical needs.

Plans on improving the PT program

Most of the PT programs for DTLs in other countries use drug-free human urine as a matrix while the PT program in this article uses synthetic urine. As previously mentioned, the use of human urine for the PT specimen would be hard to achieve since a large volume is required and consent from healthy volunteers would be needed. The collected human urine must also be certified to be drug-free prior to use as PT specimen. Furthermore, the homogeneity and stability of collected human urine in large volumes would be harder to attain. Although there is commercially available drug-free human urine, it is very expensive.

Synthetic urine has also been used by the Thailand Association for Clinical Biochemists for their PT Program for urinalysis.²¹ Advantages of the use of synthetic urine include easy preparation, longer stability, better homogeneity, assurance of being drug-free, and less hazardous. However, the formulation for synthetic urine could be further improved to better imitate human urine. Additional quality control measures such as measuring the infrared absorbance spectra of the synthetic urine and comparing it with human urine could be implemented.²²

Although Meth and THC remain to be the top drugs to be abused in the Philippines, additional analytes such as methylenedioxymethamphetamine (MDMA, ecstasy), benzodiazepines, opiates and cocaine which are also requested for screening drug testing could be added to the proficiency test specimens in the future. Interfering substances or drugs with similar structures with the analytes of interest could also be added to the PT specimens to make the PT more challenging. Although currently there are only three confirmatory drug testing laboratories nationwide, an external quality assurance program for them could also be initiated by conducting interlaboratory comparisons or sending blind samples.

The evaluation of PT scores could also be improved. Although still fit-for-purpose, the scoring method currently used, which relies on the number of incorrect responses does not reflect the performance of a laboratory in comparison with other laboratories. Furthermore, the score is based on the total score and not per analyte. The PT program for SDTLs is qualitative and the calculation of z-scores is deemed to be impossible. A new method that mimics the calculation of z-scores based on the proportion of satisfactory results and consensus from laboratories could also be applied in the future PT program.²³

Provided with enough funding, the PT program could also be improved by developing and maintaining a dedicated website for PT where laboratories can access from registration up to the releasing of results.

Ultimately, the NRL-EAMC aims to be an accredited proficiency testing provider that is compliant with the ISO 17043:2023 standard requirements.²⁴

CONCLUSION

The proficiency testing program for SDTLs has been successfully implemented since 2009. Through its

implementation, the objectives defined by the DDB Board Regulation have been fulfilled. Firstly, the competency of the SDTLs was assured since passing the PT is a requirement to be recognized as an authorized SDTL. Secondly, the results of the PT have been the basis for the regulation of SDTLs (i.e., initial PT failure results in suspension of accreditation; second failure leads to revocation of accreditation). Finally, the public is assured that authorized SDTLs which passed the PT offer drug testing services of high quality.

The number of participating laboratories fluctuated during the 2009-2019 period. On average, around 1000 laboratories participate annually. The mean passing rate was high (>96%). Although there is a decreasing trend in the number of laboratories achieving excellent performance, the number of laboratories failing the PT has significantly decreased. This demonstrates the effectiveness of the PT program in improving the testing procedures of SDTLs. Initially failed laboratories improved by reviewing and implementing rigorously their quality control procedures and strict adherence to good laboratory practices.

While the laboratory is improving by participating in the PT program, there is still a need to improve the PT program itself to better assess the performance of drug testing laboratories.

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