The Pacific Northwest Laboratory Medicine Sentinel Monitoring Network

Final Report of the On-Site Review of CLIA-Waived Testing in Moderate- and High-Complexity Laboratories

Kathleen M. LaBeau [1] and Sharon Granade [2]

1 Office of Laboratory Quality Assurance
Washington State Department of Health
1610 N.E. 150th Street
Seattle, Washington 98155

2 Centers for Disease Control and Prevention
Public Health Practice Program Office
Division of Laboratory Systems
Laboratory Practice Assessment Branch (MS F-11)
4770 Buford Highway N.E.
Atlanta, Georgia 30341

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BACKGROUND

The Pacific Northwest Laboratory Medicine Sentinel Monitoring Network was created in 1995 to gather ongoing information about practices in hospital, independent and physician office laboratories (POLs) in Alaska, Idaho, Oregon, and Washington. To date, 21 questionnaires have been released to the network, exploring issues related to: testing quality; access to testing services; laboratory-related problems and errors; personnel training and changes; proficiency testing participation; point of care testing; genetic testing; and waived testing.

Final reports of the findings of each questionnaire and references to journal articles based on these studies can be found on the Centers for Disease Control and Prevention (CDC) website: www.phppo.cdc.gov/dls/mlp/phlmsmn.asp

On-site review of waived tests in moderate/high complexity laboratories

The intent of this project was to:

• Conduct on-site reviews of quality assessment activities used with waived test systems in moderate- and high-complexity laboratories during routine on-site surveys for compliance with Washington's Medical Test Site (MTS) rules.

• Provide immediate technical assistance regarding good laboratory practices with waived test systems while performing the on-site reviews.

• Identify training needs on good laboratory practices with waived test systems and based on the findings of this study:

- Conduct training classes
- Develop handout materials
- Write articles for the Washington *ELaborations* newsletter
- Provide resources on the Office of Laboratory Quality Assurance (LQA) website

• Compare data gathered from on-site reviews with that collected previously on self-administered questionnaires. Are questionnaires useful surrogates for on-site data collection?

• Share data with the Centers for Disease Control and Prevention (CDC), Centers for Medicare and Medicaid Services (CMS), Food and Drug Administration (FDA) and other interested parties. The information may be useful in connection with the following:

- Criteria for categorizing testing as waived
- Product insert instructions
- CLIA requirements for waived testing
- Educational efforts by manufacturers, medical and laboratory organizations

- Additional studies of waived test practices (i.e., linked to outcomes)
- New types of waived test devices or quality control mechanisms

• Initiate one of the recommendations made by the Clinical Laboratory Improvement Advisory Committee (CLIAC) in May 2001, based on the recent studies of waived testing practices by CMS, the Office of the Inspector General (OIG), CDC and New York State:

- Review waived testing in moderate and high complexity laboratories during routine surveys

STUDY DESIGN

In October 2001, a survey tool (questionnaire) was developed for use by the Washington State MTS program surveyors in the collection of information about waived test practices. (Appendix A)

To standardize the survey process and recording of data for this study, each of the four surveyors received training by the network director on how to conduct the on-site review and complete the survey form. Written instructions, about conducting the survey and completing the form, were also provided.

During October 2001, each surveyor conducted at least one on-site review of waived tests in a moderate/high complexity site to assess the intended survey process and the adequacy of the survey tool and instructions.

All moderate/high complexity laboratories in Washington with a routine compliance inspection due between November 2001 and July 2002 were included in this study. Excluded from the study group were accredited laboratories (since they are not routinely inspected by Washington State surveyors) and sites that did not perform any waived testing (i.e., dermatology practices, cytology laboratories). Two waived tests per site were selected for review by the network director and surveyor prior to the site visit to prevent any selection bias by the site and to assure a sampling of a variety of waived tests and specific test systems.

On-site reviews of waived test practices were conducted in 150 moderate/high complexity laboratories. Table 1 summarizes demographic characteristics of the laboratories that comprise our study group.

Table 1 - Demographic characteristics of the study group

Demographic characteristic	**Study group** (N=150)	**All non-accredited moderate/high complexity laboratories in Washington** (N=539)
	Percent of laboratories	
CENSUS BUREAU DESIGNATION		
Urban	79	79
Rural	21	21
REGION		
1 Western Washington, Olympia-South	16	13
2 Western Washington, Seattle-North	33	39
3 Western Washington, Tacoma area	21	22
4 Eastern Washington	29	26
LABORATORY TYPE		
Physician office*	88	84
Hospital	5	7
Independent	7	9
TESTING PERSONNEL		
At least one medical technologist (MT) or medical laboratory technician (MLT)	49	43
No MT or MLT	51	57

*Includes: Physician office laboratories (POLs), clinics, community health centers, rural health centers, health departments/districts, student health centers, end stage renal dialysis centers, industrial laboratories and health maintenance organizations (HMOs).

FINDINGS

A total of 279 tests were evaluated for 23 waived test analytes.

Personnel performing waived testing

The testing personnel in the laboratories we studied represented 19 different education/training backgrounds. (Table 2)

Table 2 - Personnel performing waived testing (N=150 laboratories)

Education/training background of testing personnel	Percent of laboratories with that type of testing personnel
Medical assistant	47
Medical technologist	30
Registered nurse	27
Medical laboratory technician	26
Licensed practical nurse	25
On-the-job trained	23
Medical doctor	9
X-ray technician	7
Advanced registered nurse practictioner	6
Physician assistant	3
Phlebotomist	3
Certified nursing assistant	2
Laboratory assistant	2
Military trained	1
Canadian technologist	<1
Certified laboratory assistant	<1
Certified office laboratory technician	<1
Health care assistant	<1
Navy medic	<1

Annual test volumes

We found that the annual test volume for an individual waived test averaged 679, with a range of 2 to 15,600 tests per year.

Availability of product inserts

The surveyors asked the testing personnel for a copy of the manufacturer's product insert for the waived tests reviewed and if they knew what it stated in the quality control instructions. Their statements were compared with the actual product insert instructions.

A product insert was available for 91% of the 279 waived tests reviewed. Although the individuals interviewed said they knew what the product insert stated in the quality control instructions for 70% of the tests reviewed, they were correct with 61% of the tests.

Testing external controls

External controls are reference solutions or materials (e.g., control swabs) that are tested in the same manner as the patient sample.

As part of the review process, the surveyors asked to see the external control materials to verify that they were available for use. External control materials were found for 66% of the tests reviewed. Laboratory personnel stated that external controls were tested (at some frequency) with 65% of the 279 waived tests and records of this activity were available for 61% of the tests. External controls were tested at the same frequency as stated in the quality control instructions with 42% of tests. Testing was performed less frequently than the instructions indicated with 27% of tests and more frequently with 31%.

The rate of testing of external controls was higher in laboratories that had testing personnel with formal laboratory training (at least one medical technologist or medical laboratory technician) than in laboratories without. Hospital and independent laboratories tested external controls at a higher rate than POLs. We did not find significant differences between laboratories in urban versus rural locations. (Table 3)

Table 3 - Testing external controls

	Number of waived tests	Percent with which external controls were tested
All laboratories	279	65
Laboratories with a medical technologist (MT) or medical laboratory technician (MLT)	140	79
Laboratories without MT or MLT	139	51
Physician office laboratories	246	63
Hospital or independent laboratories	33	79
Urban location	218	66
Rural location	61	64

Differences in quality control practices based on the wording of the product insert instructions

For many waived test systems, the manufacturer's instructions for test performance include **recommendations** for testing external liquid quality control materials, e.g., "Good laboratory practice recommends the use of external controls to assure that the assay is performing properly. It is recommended that controls be tested once for each 25 tests and as otherwise required by your laboratory's standard quality control procedures."

For other waived test systems, the manufacturer's instructions include specific **requirements** for testing liquid controls, e.g., "A positive and negative external control must be tested when opening a new test kit. Each operator performing testing within a test kit must test a positive and negative external control once with each test kit."

By comparing practices with product insert instructions, we found that external controls were tested with 94% of the waived tests where this was required in the manufacturer's instructions.

For tests where quality control was not even mentioned in the product insert, the testing of external controls was low (12%).

Table 4 shows the testing of external controls for each waived test system reviewed.

Table 4 - Testing external controls

Waived test	Manufacturer / Brand name	Manufacturer instructions about testing external controls			Number of tests	Percent with which controls were tested
		Recommended	Required	Not specified		
Alanine amino transferase (ALT)	Cholestech LDX		√		1	100
Bladder tumor antigen	Bion Diagnostic Sciences BTA stat	√			2	50
Cholesterol/Lipids	Cholestech LDX	√			3	100
Erythrocyte sedimentation rate	Non-automated			√	12	0
Fructosamine	LXN (Duet & In Charge)		√		1	100
Glucose	Monitoring devices cleared by FDA for home use	√			25	84
	Cholestech LDX	√			1	0
	Hemocue B-Glucose	√			3	100
H. pylori antibody	Beckman Coulter Flexsure	√			1	100
	Polymedco, Inc Poly stat	√			2	100
	Quidel QuickVue One-Step	√			4	100
	Quidel QuickVue One-Step g II		√		7	100
H. pylori gastric tissue	Ballard (Delta West) CLO test		√		2	50
Hematocrit	Microhematocrit			√	13	31
Hemoglobin	GDS Diagnostics HemoSite Meter		√		1	100
	HemoCue	√			7	0
Hemoglobin A1C	Bayer DCA 2000 Bayer DCA 2000+		√		7	100
HDL cholesterol	Cholestech LDX	√			2	100
Influenza	Quidel QuickVue	√			3	100
	Zyme TX Zstatflu	√			1	0
Microalbumin	Bayer Clinitek 50	√			2	100
	Roche Micral Chemstrip	√			4	25

Waived test	Manufacturer / Brand name	Manufacturer instructions about testing external controls			Number of tests	Percent with which controls were tested
		Recommended	Required	Not specified		
Mononucleosis	BioStar Acceava	√			2	100
	Genzyme Diagnostics Contrast	√			1	100
	Meridian ImmunoCard STAT	√			1	100
	Polymedco, Inc Poly stat	√			1	0
	Quidel CARDS OS	√			10	100
	Quidel QuickVue +	√			1	100
	Wampole Mono-Plus WB	√			7	57
Occult blood-fecal	Various manufacturers			√	14	0
Occult blood-gastric	SmithKline Gastroccult			√	1	0
pH, fluid	Qualitative color comparison	√			2	50
Prothrombin time	International Technidyne Corp			√	1	0
	Roche CoaguChek, CoaguChek S		√		9	100
Strep antigen	Abbott Signify		√		10	90
	Applied Biotech SureStep	√			1	100
	Beckman Coulter ICON Fx	√			2	100
	Becton Dickinson LINK 2	√			3	67
	Biostar Acceava	√			15	93
	Fisher HealthCare Sure-Vue		√		1	100
	Polymedco, Inc Poly stat	√			1	100
	Quidel QuickVue In-Line (Two versions of instructions)		√		7	100
		√			3	67
	SmithKline Diagnostics ICON Fx	√			3	67
	Wyntek Diagnostics OSOM	√			1	100
	Wyntek Diagnostics OSOM Ultra	√			2	100
Urinalysis	Dipstick (nonautomated), various manufacturers	√			33	52
	Bayer Clinitek 50	√			6	100
	Roche Chemstrip 101		√		1	0

Urine pregnancy	Visual color comparison	√			36	58

Observing procedural controls

Procedural controls are built into each test reagent device to ensure that the reagents are active, the reagents and the patient sample are added correctly, and the test system performs according to specifications. Procedural controls are common in qualitative waived test kits (e.g., urine pregnancy, mononucleosis, Strep antigen and *H.pylori* antibody tests).

Laboratory personnel stated they observed the results of procedural controls with 99% of the 142 waived tests where procedural controls are part of the test system. Records of this activity were kept with 46% of these tests.

Testing electronic controls

Electronic controls are inert, reusable devices (test strips, cartridges, cassettes, etc.) that are used to check instrument performance specifications. Electronic controls are available for use with some quantitative waived test systems (e.g., hemoglobin, lipid profile, prothrombin time and hemoglobin A1C).

Laboratory personnel stated they tested electronic control devices with 86% of the 42 waived tests where electronic controls are available for quality assurance purposes. Records of this activity were kept for 71% of these tests.

Other quality assessment activities

Laboratory personnel were asked if they performed any other activities to assess the quality of their waived test system. A positive response was given for 53% of the 279 waived tests reviewed. Participation in proficiency testing was the most popular activity, which was performed with 37% of the tests. The rate of participation in proficiency testing in hospitals and independent laboratories (55%) was higher than in POLs (34%) and was higher in laboratories with personnel with formal laboratory training (54%) than in sites without those types of personnel (19%). Split sample or correlation studies were cited next in frequency, followed by the assessment of personnel competency. Table 5 shows a listing of the various quality assessment activities performed.

Table 5 - Other quality assessment activities

Quality assessment activity	Number of times listed
Participation in proficiency testing	102
Split sample studies / Correlation studies	32
Competency assessment of personnel	10
Documentation of personnel training	8
Biannual verification	8
For microhematocrits: Tachometer check on centrifuge; maximum packing time check; run test in duplicate	7
Total quality assurance plan / Regular quality control review	6
Verify result with another test Negative urine pregnancy checked with serum HCG test Negative Strep antigen test checked with throat culture	4
Check linearity, calibration check, calibration verification	4
Compare test result with patient history, diagnosis, presentation	3
Other	3

Review of product inserts

When reviewing product inserts we found a number of factors contributing to the confusion by testing personnel about what to do for quality control. These may account for the varying approaches taken by personnel in establishing quality assurance practices. The following are some examples.

• Product insert instructions for quality control change from one version to another

In 1997, the instructions for a Strep antigen test stated: “In addition to your laboratory’s standard QC procedures, it is **recommended** that Positive and Negative Controls be run every 25 tests (twice per kit), and when changing operators within a test kit.” In 2000, the instructions became more stringent: “A positive and negative external control **must** be tested when opening a new test kit, once within each 25 tests and each operator performing testing within a test kit **must** test a positive and negative external control with each 25 tests.”

Before April 2001, instructions for a Strep antigen test stated: “A positive and negative external

control **must** be tested when opening a new test kit. Each operator performing testing within a test kit **must** test a positive and negative external control once with each 25 test kit." After April 2001, the instructions became less stringent: "Positive and negative controls **should** be tested with each new lot or shipment of test materials once for each 25 test kit, and with each new operator within that 25 test kit, and as otherwise required by your laboratory's standard quality control procedures."

Prior to 2002, quality control instructions for a prothrombin time test stated: "Weekly Requirements: Each operator performing . . . testing must test two levels of liquid quality control . . . " In 2002, the weekly requirement was dropped from the quality control instructions.

• Quality control systems that do not monitor the extraction step of the test procedure

Two Strep antigen tests have instructions that state: "The controls provided with the kit do not monitor the extraction step." They go on to discuss how the user can test other controls or live organisms to check the extraction step of the procedure.

• Instructions that confuse **procedural** control with **external** control and use **must** in one section and **should** in another section

For a Strep antigen test, under a section called **Procedural** Control it states: "A positive and negative **external** control **must** be tested when opening a new kit. Each operator performing testing with a test kit **must** test a positive and negative external control once with each test kit." Under another section called Quality Control: "Good laboratory practice includes the use of controls to ensure proper kit performance. Before using a new . . . kit, a quality control test using the Positive and Negative Controls **should** be conducted to confirm the expected QC results."

• Urine **dipstick** instructions state "**test** known positive and negative specimens or controls whenever a new bottle is first opened." But when reviewing the waived **instrument** that can be used with that dipstick it states controls "**should**" be tested.

• A urine pregnancy test kit **recommends** that controls are run, but under the section called "Materials **required** but not provided", positive and negative controls are listed.

• Some manufacturer's have developed **two versions** of quality control instructions for one test system, depending on whether **the user** considers the test to be waived or moderate-complexity.

For a prothrombin time test and a urinalysis method using an instrument the waived instructions are more definitive (using the word "must") and require more frequent quality control testing than the "moderate-complexity" instructions. Although the tests are officially categorized as CLIA-waived, the user can follow the instructions for "moderate-complexity" and demonstrate that they follow manufacturer instructions.

COMPARISON WITH OTHER STUDIES
Pacific Northwest Network Questionnaires

Questionnaire 8 - Tests Systems with Non-Traditional Mechanisms for Quality Control

The intent of this questionnaire was to determine how testing sites assess the quality of patient test results using waived test systems. Two hundred twenty-one laboratories responded to Questionnaire 8 which was mailed to moderate- and high-complexity network laboratories in January 1998. The network respondents listed each waived test they performed and answered questions about quality assessment practices for each test listed. The full report of this study can be found at: www.phppo.cdc.gov/dls/mlp/pnlmsmn.asp. In addition, a journal article was published in 2000, based on these findings [1].

Table 6 - Comparison of data gathered by self-administered questionnaire vs. on-site review

	Questionnaire 8	**Current study**
Date of study	January 1998	October 2001 - July 2002
Number of laboratories evaluated	221	150
Format of gathering-data	Self-administered questionnaire	On-site review by trained surveyors
How were waived tests selected?	Respondents listed all waived tests performed	Surveyor selected tests for review prior to on-site visit
Number of tests reviewed	920	279
Percent of tests where external controls were tested	56	65
Percent of tests with proficiency testing participation	37	37

The findings of these two studies are quite similar.

Questionnaire 15 - Quality Assessment of Waived Test Systems

The intent of this questionnaire was to evaluate quality assessment activities used by moderate- and high-complexity laboratories on test systems categorized as waived under CLIA. One-hundred sixteen laboratories responded to Questionnaire 15 which was mailed to moderate- and high-complexity network laboratories in October 2000. Respondents selected two qualitative and two quantitative waived tests they performed and answered questions about their quality assessment activities with those tests. The full report of this study can be found at: www.phppo.cdc.gov/dls.mlp/pnlmsmn.asp.

Table 7 - Comparison of data gathered by self-administered questionnaire vs. on-site review

	Questionnaire 15	**Current study**
Date of study	October 2000	October 2001 - July 2002
Number of laboratories evaluated	116	150
Format of gathering-data	Self-administered questionnaire	On-site review by trained surveyors
How were waived tests selected?	Respondents selected two qualitative and two quantitative waived tests	Surveyor selected tests for review prior to on-site visit
Number of tests reviewed	331	279
Percent of tests where external controls were tested	67	65
Percent of tests where external controls were tested when required by manufacturer	85	94
Percent of tests where procedural controls were observed (where applicable)	91	99
Percent of tests where electronic controls were tested (where available)	70	86 (Records kept for 71%)
Percent of tests with proficiency testing participation (non-accredited labs)	48	37
Hospital/Independent	64	55
POL	45	34
MT or MLT as testing personnel	57	54
No MT or MLT	36	19

Despite the different mix of tests and different methods of test selection and data collection, the overall patterns of rates of quality assessment activities in these studies are quite similar.

• The rates at which external controls are tested are similar.
• The rates of testing external controls are higher when it is “required” in the instructions.
• The rates of usage of procedural controls are very high.
• The rate at which electronic controls were tested was higher in our current study, however the percentage of tests where records were kept matches closely with the rate found in the

Questionnaire 15 study.
• The rate of participation in proficiency testing was higher in our Questionnaire 15 study, however both studies found significant differences in proficiency testing participation between different types of laboratories and between laboratories with different types of testing personnel.

Self-administered questionnaires can be useful surrogates for on-site data collection when looking at general patterns of quality control usage.

DISCUSSION

Laboratory directors and testing personnel need to take waived testing more seriously. Any test, no matter how simple, can produce erroneous results if not performed correctly. Performing a test correctly starts with reading and following instructions. We found that a product insert was not even available for 9% of the tests we reviewed and that testing personnel did not know what was advised for quality control for 39% of the tests evaluated. Since waived tests have been essentially unmonitored by CMS and state agencies, laboratory directors and testing personnel need to set their own minimal standards for good laboratory practices, quality assessment activities and personnel training. They need to know that their reagents, testing devices, instrumentation and testing personnel are all working properly.

Manufacturers and the FDA need to assure that product insert instructions for waived tests are written more clearly. Some product inserts are confusing about what is advised for quality assessment purposes. Instructions should be written in a straightforward fashion so that quality control is promoted and encouraged by the manufacturer. The use of two sets of quality control instructions for one test system sends a mixed message about the validity of the test categorization criteria. Should the user be able to deem a test system “waived” or “moderate-complexity” depending on which of the two quality control instructions appear to be least burdensome for their setting?

The training of testing personnel counts, even for simple waived tests. We found that individuals with formal laboratory training tested quality control materials at a significantly higher rate than those without this background. Quality control practices are reinforced in laboratory training programs. Medical schools, nursing schools and training programs for medical assistants need to follow suit and educate their students on good laboratory practices and quality assessment activities. Each of these students will likely encounter waived testing at some time in their career. In addition, the professional organizations representing physicians, nurses and medical assistants need to train their members on these same principles. Laboratory professionals can help by preparing and conducting training courses and by training nurses and medical assistants to be trainers.

The most important outcome of the study in Washington was the immediate technical assistance provided to the laboratories visited. Although the surveyors only reviewed a sampling of waived tests per site, the discussions initiated by the review process were typically broadened to waived

testing practices in general, allowing for a greater impact than anticipated.

As a result of this study, we have initiated a number of activities to assist laboratories in using good practices with waived tests:

• We have prepared handout materials about good laboratory practices with waived test systems for directors and testing personnel of sites seeking an initial application for a certificate of waiver or PPMP testing license.

• We have developed a self-study module that resides on the LQA website: www.doh.wa.gov/hsqa/fsl/LQA_home.htm

• We have prepared articles about waived testing practices in our *ELaborations* newsletter, which is mailed to all testing sites licensed in Washington.

• The network director participated in a workgoup that developed a training course and handout materials for waived and PPMP testing sites in Washington. In June 2002, 60 participants from waived testing sites attended a 2-hour presentation about good laboratory practices with urine dipstick testing.

Due to the significant increase in the number and types of tests waived, the expanding number of laboratories with no oversight and serious findings in recent studies, CMS surveyors started on-site visits to 2% of waived testing sites in April 2002. CLIA laboratory surveyors will gather information about quality assessment practices with waived tests and provide education and technical assistance while on-site.

REFERENCES

1. LaBeau KM, Simon M, Steindel SJ. Quality control of test systems waived by the Clinical Laboratory Improvement Amendments of 1988: Perceptions and practices. *Arch Path & Lab Med* 2000; 124:1122-1127. Reprints are available by calling (206) 361-2828.

Appendix A - Survey tool for on-site review of waived testing in moderate/high complexity laboratories

MTS#: **Date of visit:** **Background of person interviewed:**		
Backgrounds of personnel that perform waived testing:		
1. Test (analyte) name: Specific test kit or system:		
2. Estimated annual test volume: Based on:	**Records**	**Verbal**
3. Manufacturer's product insert available?	**Yes**	**No**
4. Do they know what it says for quality control?	**Yes**	**No**
5. Review the product insert. Were they correct regarding QC?	**Yes**	**No**
6. **Liquid controls** **Required or recommended?**		
What do mfr instructions say for liquid control QC?		
Does this site have liquid controls?	**Yes**	**No**
How do they use liquid controls?		
Do they keep records of liquid controls?	**Yes**	**No**
7. **Procedural controls** **Part of test system or not applicable?**		
Do they observe procedural controls?	**Yes**	**No**
Do they keep records of procedural controls?	**Yes**	**No**
8. **Electronic controls** **Available for use or not applicable?**		
What do mfr instructions say for electronic QC?		
Does this site have electronic controls?	**Yes**	**No**
How do they use electronic controls?		
Do they keep records of electronic controls?	**Yes**	**No**
9. Do they perform any other quality assessment activities? Describe:	**Yes**	**No**
10. Other comments:		**Initials**