

**The State of Montana
National Laboratory System
Antimicrobial Susceptibility Testing
2009 Survey Results**



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Introduction

Antimicrobial resistance is a significant health problem. Prior to 2009, four antimicrobial susceptibility testing (AST) surveys were written and administered in Montana. For all of these surveys, data was requested from the previous calendar year.

Fifty nine Montana clinical laboratories determined to provide microbiology testing were solicited for participation. Of these 59, 35 laboratories (60%) responded to the 2009 survey. This report summarizes the results of that survey, and discusses the findings.

In addition, as part of public health efforts to combat antimicrobial resistance, a statewide antibiogram report was compiled from data submitted in 2009 and again in 2010, and these composite antibiogram reports are available on the Montana Antibiotic Resistance Awareness (MARA) website at <http://mara.mt.gov/mara-news.shtml>.

Background

The discovery of antimicrobial drugs was a scientific advance that resulted in a substantial reduction in the mortality and morbidity related to infectious diseases. This progress is now seriously jeopardized by the emergence and spread of microbes that are resistant to economical, safe, and effective first-line drugs. When infections become resistant to first-line antimicrobials, treatment has to be switched to second- or third-line drugs, which are nearly always more expensive and sometimes more toxic as well. Antimicrobial resistance is an issue of global significance, developing through 70 years of use and misuse of antimicrobial drugs and the emergence of a mobile world population that can rapidly spread resistant organisms between individuals, communities, and countries. Contributing factors are numerous and complex and may be related to patient compliance and patient demands, provider overutilization, inappropriate prescribing, patient self-medication, low quality antibiotics, hospitalization, or veterinary supplements. The result is increased mortality, suffering, and disability, and higher healthcare costs.

To reflect public health objectives, effective antimicrobial susceptibility surveillance programs should incorporate enhanced routine surveillance (review, confirmation, and

investigation of routine clinical results) with the identification, confirmation, and communication of specific organisms of great public health importance (MRSA, VRSA, VRE, KPC, CRE).

In most surveillance programs, the key partner is the microbiology laboratory. Healthcare workers and public health authorities rely on the work and expertise of laboratory staff to determine: 1) what organism is causing a patient infection and 2) what antimicrobials would be effective treatment options. Lack of standardization in antimicrobial susceptibility testing practices can result in misinterpretation of data and inappropriate prescribing of empiric antimicrobial therapy.

The following report presents the results of the antimicrobial susceptibility testing survey conducted in 2009, using 2008 data, by the Montana Public Health Laboratory (MTPHL) in conjunction with the Centers for Disease Control and Prevention (CDC) National Laboratory System Project. The purpose of this AST survey was to: (1) assess the status of AST practices within Montana, (2) to determine susceptibility trends across Montana (3) identify changes in response over a 2-year period after outreach and education.

Methods

Survey Design and Implementation

The 2009 survey questions were identical to a survey administered in 2007 with two modifications: 1) The 2009 version combined questions 16 and 17 from the 2007 version into question 16, and 2) two knowledge based questions involving *Haemophilus influenzae* and *K. pneumoniae* were added to question 62. The survey was distributed on June 2, 2009 to all accredited clinical laboratories known to perform antimicrobial susceptibility testing in Montana, and requested AST data for calendar year (CY) 2008. As in the 2007 survey, in addition to requesting information about AST methodology, referral practices, and antibiogram data, the 2009 survey contained a number of “real-life situation” questions developed to assess knowledge of practices recommended in CLSI guidelines.

The questionnaire was preceded by an introductory letter and subsequent phone calls to each laboratory in order to confirm contact information. Additionally, follow-up phone contacts were used to clarify any questions and to facilitate the return of the questionnaire by the end of August 2009. Several follow-up calls were made to all facilities that did not respond in an effort to help them through the survey process and to increase participation.

Analysis of data

Laboratories mailed, emailed, or faxed their responses. Antibiograms were faxed or mailed. Follow-up calls were made to facilities if survey questions were unanswered or if answers were unclear. Data entry rules, created in 2007, to address translation problems and to standardize the data entry process were followed. Data from the questionnaire were compiled in Access software and descriptive statistics were generated using Access and Excel. The antibiogram data were compiled and calculated using Microsoft Excel.

Results and Discussion

Laboratory Response

Thirty five (59%) laboratories responded with completed surveys. 27 of these laboratories had also completed the 2007 AST survey. Eight laboratories completing the 2009 survey had not completed the survey previously. Eleven laboratories that had completed the survey in 2007 did not do so in 2009.

Demographics

Data were stratified by Public Health Region (Figure 1) and by laboratory capacity using the total number of ASTs performed in 2008 (Table 1).

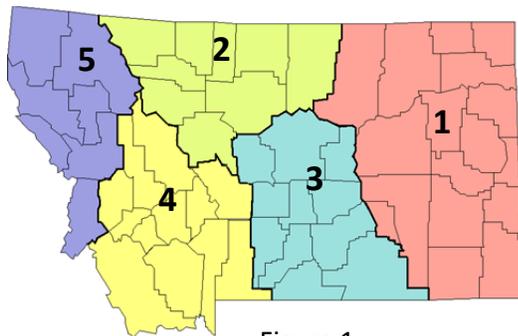


Figure 1

Capacity	Annual AST Tests
Ultra-Low	0-250 tests
Low	251-600 tests
Medium	601-1500 tests
High	1501-9000 tests

Table 1

The following chart (Figure 2) shows the distribution of responding laboratories by public health region and annual AST volume.

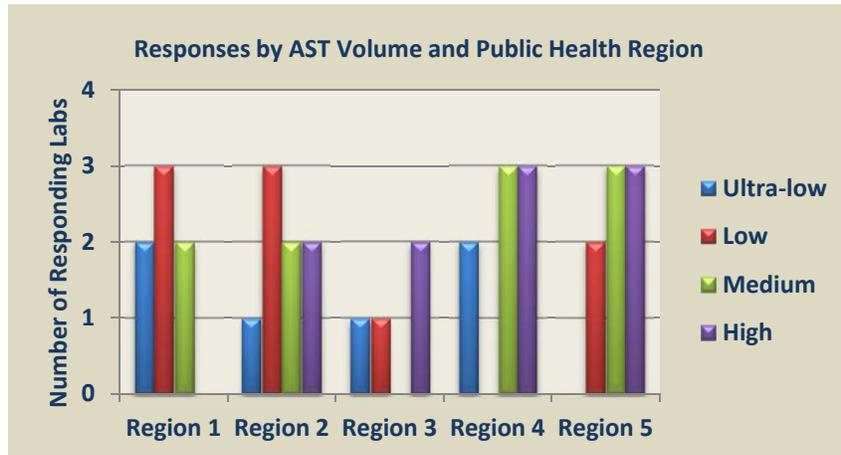


Figure 2

Thirty-one of 35 laboratories (89%) describe their population served as “rural” or “small city plus rural”. The majority of responding laboratories (69%) served community or critical access hospitals with fewer than fifty beds, 6% served 50-99 beds, 11% served 100-199 beds, 6% served 200-349 beds, one laboratory (3%) served a hospital of greater than 500 beds, and two respondents (6%) were outpatient facilities. (Figures 3 & 4) This response was similar to 2007. Most laboratories hold either Joint Commission or CAP accreditation. Laboratories may be accredited by more than one agency.

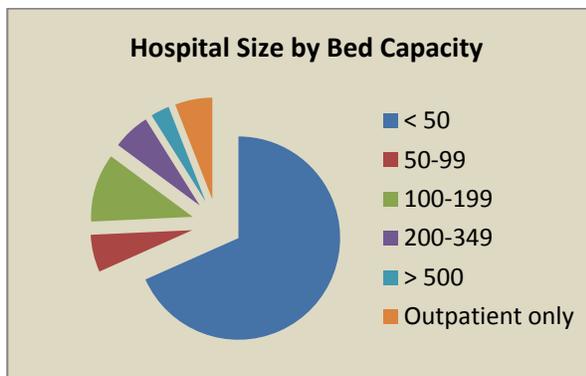


Figure 3

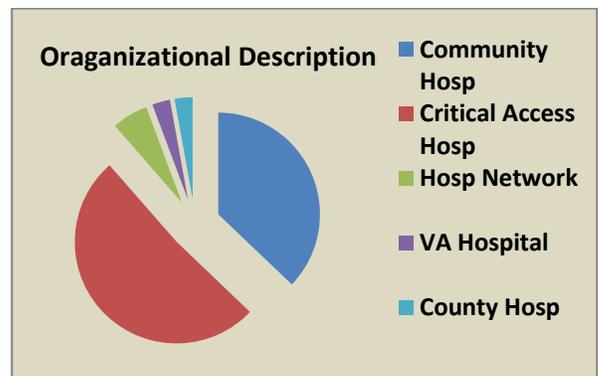


Figure 4

Over ¾ of the responding laboratories serve populations of less than 50,000 people (Figure 5). Seventy-one percent of responding laboratories serve populations of less than 25% Native American, 9% serve populations of greater than 75% Native American, 6% serve

populations of 25% to 75% Native American, and 14% were unsure of the Native American population served (Figure 6).

Demographic Charts

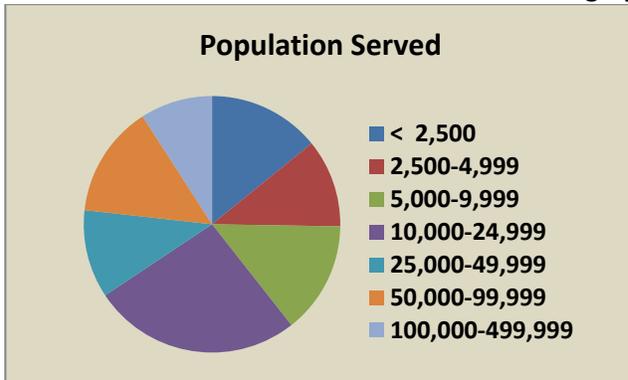


Figure 5

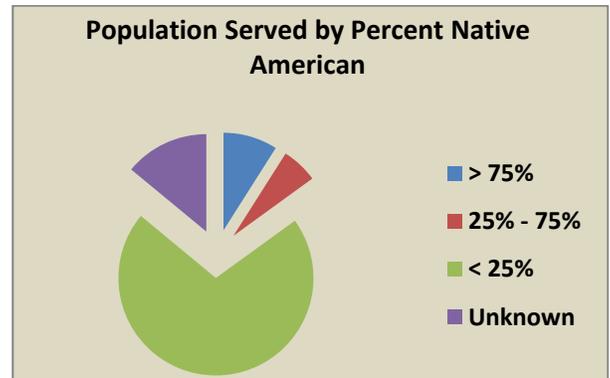


Figure 6

Staff

The number of laboratories with more than 6 AST-trained FTEs increased from 18% to 29% between 2007 and 2009. Of that 29%, 60% have AST-trained FTEs who are also trained in other laboratory areas. 97% of responding laboratories report that the majority of staff are certified as MT, MLT, CLS, or CLT. 91% report that the majority of staff hold BA/BS. 60% of responding laboratories require that staff hold at least a BA/BS degree. 34% require an AA/AS degree with MLT/CLT certification. Six percent of responding laboratories accept other forms of training. Slightly greater than half of laboratories are directed by MD's.

The responding 35 laboratories reported they performed a total of 57,796 antimicrobial susceptibility tests in 2008. The total number of tests performed in individual laboratories ranged from 73 to 8,000 tests, with 23 (66%) of laboratories performing 1000 or fewer tests. 92% of the reported AST tests were performed in High or Medium Volume facilities (Figures 7 & 8).

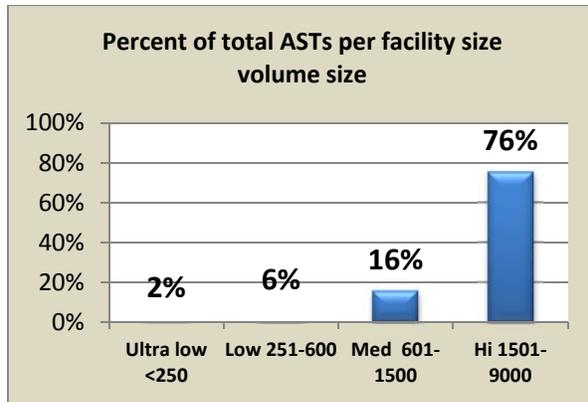


Figure 7

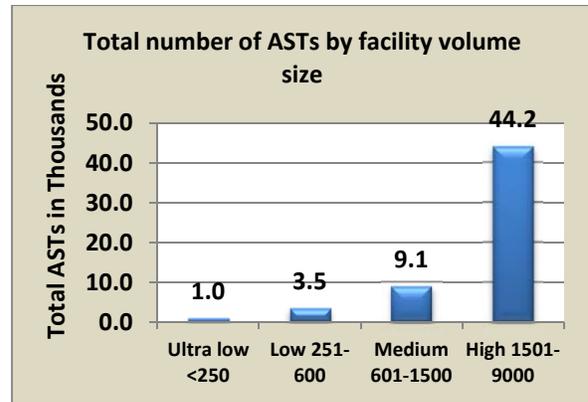


Figure 8

As part of a strategy to mitigate deficiencies identified in the 2007 Antimicrobial Susceptibility Testing (AST) survey, DPHHS contracted with a retired clinical microbiologist to develop curriculum for tailored trainings and to provide workshops. In response to stated preferences, training was provided in several delivery options, including on-site workshops, webinars, presentations at state ASCLS meetings, and on-line self-study. Three workshops were presented in 2008. Two of these trainings were geared toward small clinical laboratories and one was geared toward larger clinical laboratories. Comparing results of pre-test and post-test scores showed an increase in knowledge.

Responses from the 2007 survey and the 2009 survey were compared to see if these intervention strategies impacted AST practices and knowledge. Data reflects the total respondents in each survey, not just the laboratories that responded in both 2007 and 2009.

Laboratory Practices

Responses demonstrated a significant (20%) increase over 2007 results in the number of laboratories that follow CLSI guidelines for AST, a 5% increase in the number of laboratories who have a designated individual responsible for integration of CLSI and a 10% increase in the number of laboratories that have made changes to their AST procedures within the preceding six months based on CLSI guidelines. 2009 responses showed an increase of 26% in the number of responding laboratories creating antibiograms and a 36% increase in the number of laboratories who share antibiograms with the Montana PHL. There was a 14% increase in the number of laboratories using MIC methodology that always run purity plates and an increase of 21% in the

number of laboratories using Disk Diffusion methodology that always run purity plates (Figure 9).



Figure 9

Knowledge and Methodology

Comparing responses to the knowledge-based questions did not demonstrate the same level of improvement as was found in the Laboratory Practices group of questions (Figure 10). Although an improvement in the percent correct between 2007 and 2009 was seen for three of the eight questions, the remaining five questions had decreases in the percent correct. The knowledge-based question with the greatest reduction in percent correct pertained to the choice of antibiotics for a pediatric stool isolate of *Salmonella/Shigella*, answered correctly by only 12% of laboratories who perform this test. This represents a 7% decrease in correct responses over the previous survey. The question concerning antibiotic choice for ESBL-producers was answered correctly by 26%, a decrease of 7% over the previous survey. Antibiotic choice for a community-associated methicillin-resistant *Staphylococcus aureus* was answered correctly by 34%, a decrease of 9% over the previous survey.

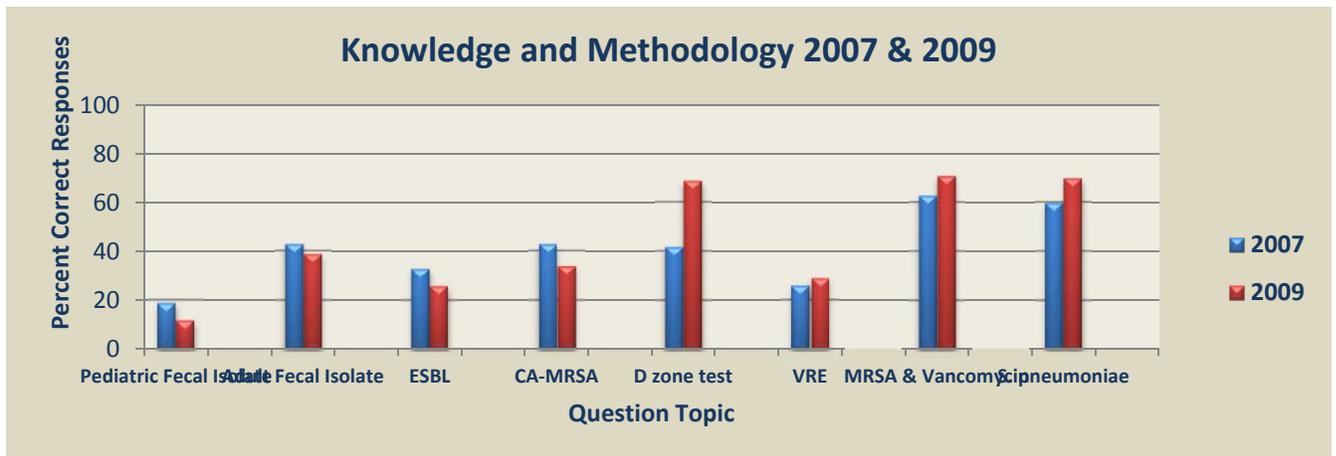


Figure 10

Although it appears from this data that many laboratorians have not gained knowledge and expertise in the areas described by the scenario questions as a result of our interventions, there are several possible explanations. 69% of responding laboratories service facilities with fewer than 50 beds. In these small facilities, the volume of AST performed may not justify the time required to gain the expertise necessary to correctly answer all these questions, especially when specific testing is not performed in-house. Many respondents have noted in survey comments that they send all but the most routine isolates to reference laboratories for identification and susceptibility testing. The personnel of these small facilities are often generalists, responsible for performing the full spectrum of laboratory analyses. Only the few largest laboratories have the resources to employ microbiology specialists. Additional explanations could include different staff members completing the two surveys, staff turnover, an inability to reach and train all of the generalists performing microbiology in small laboratories, and generalists choosing to not commit their limited time to learning about tests that they do not perform. It is also possible that some laboratories chose to attempt to answer questions instead of choosing the “Not done in our laboratory” option. Indeed, many incorrect answers were partially correct, especially true on those questions where correct answers required the choice of several antibiotics. Analysis of data confirmed a general trend toward higher percentages of correct answers on knowledge-based questions from laboratories with the highest AST volumes (Figure 11).

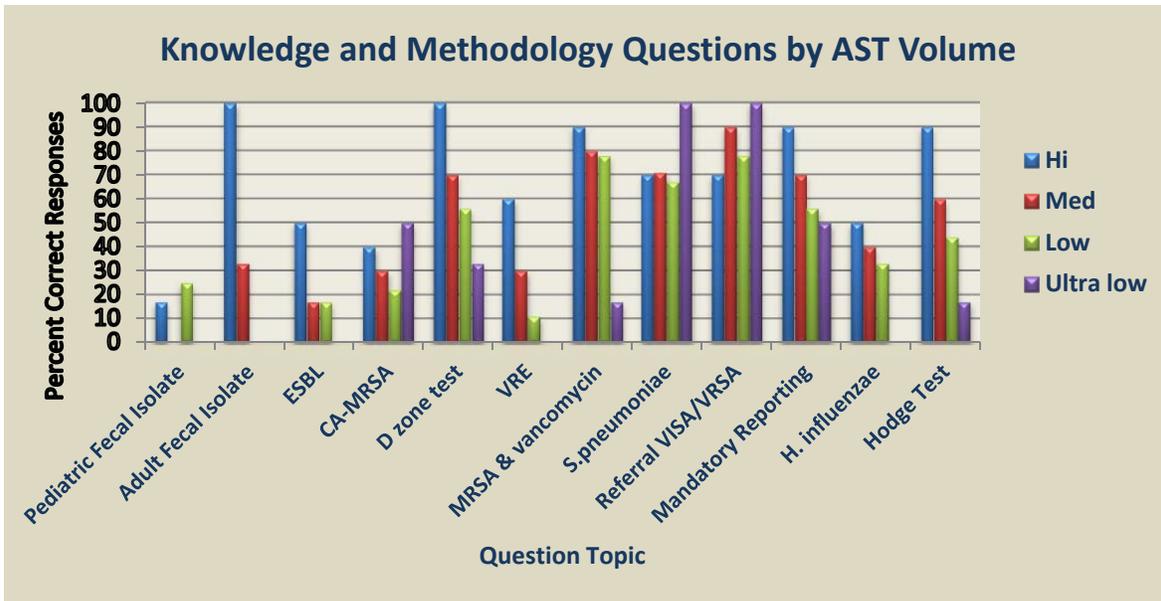


Figure 11

Those laboratories that performed the highest number of antimicrobial susceptibility tests averaged a significantly higher percentage of correct answers than those laboratories that did the fewest tests. This trend remained consistent in both 2007 and 2009 surveys (Figure 12)

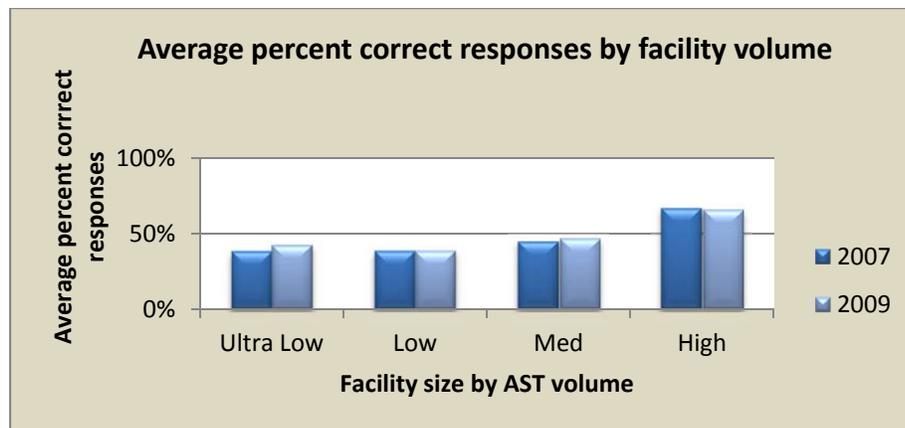


Figure 12

We conclude that while the total number of laboratories answering this set of questions incorrectly may appear high, the number of tests performed in these low and ultra-low volume laboratories is a small fraction of the total tests. Most of the AST testing is being performed in laboratories that answered the majority of the knowledge-based questions correctly. Approximately 92% of the isolates are tested in the 21% of laboratories categorized as medium and high volume.

Reporting protocols

When reporting AST results using MIC methodology, 23 (70%) laboratories report both MIC determination and the CLSI interpretation; nine (27%) report only the CLSI interpretation; and one laboratory reports only the MIC determination. When using Disk Diffusion methodology, ten of twelve (83%) laboratories report both zone diameter and CLSI interpretation. Two of twelve laboratories report the CLSI interpretation only.

Implementation of guidelines

When asked to identify the top challenge to implementing changes in AST practices, twelve laboratories (34%) responded that they find no challenge to implementing changes in AST practices. Of 23 laboratories that reported challenges, 11 laboratories (48) cited lack of time as the primary obstacle. Twenty one percent (21%) cited waiting for manufacturer software updates as the primary problem. These responses are consistent with the 2007 survey when twelve laboratories reported no problem and eleven cited lack of time as the primary challenge.

Seventy one percent (71%) of responding laboratories acquire CLSI guidelines annually. Of the ten laboratories who do not receive them annually, 50% cited lack of funds as the primary reason. In 2007, only 37% of responding laboratories reported yearly acquisition of guidelines. Most often cited reasons for non-acquisition were lack of funds (25%) and the complexity of the guidelines (25%)

The most important factor influencing changes in AST procedures was CLSI guidelines for 71% of respondents, an increase from 61% in 2007. Seventeen percent of responders cited the manufacturer as the most important influence.

The number of laboratories that routinely refer specimens for AST testing has decreased from 32% to 14%, while the number of laboratories that accept specimens from other laboratories for AST testing increased from 34% to 51%.

Antibiograms

Thirty three of the responding 35 laboratories (94%) submitted antibiograms, compared to 68% in 2007. All 33 laboratories compile the antibiogram data at least yearly. 28 of 33 (85%)

were created by the laboratory or the microbiology department. 82% of laboratories remove surveillance isolates from the antibiogram and 67% removed multiple isolates. Thirty laboratories share their antibiograms with the state public health laboratory; one laboratory does not share; two do not know whether it is shared. Barriers to compiling an antibiogram were identified as a) lack of time, b) lack of staff, and c) decisions by physicians.

Existing Training Practices

The number of laboratories that reported receiving no AST training remained essentially unchanged (39% vs. 37%) and the number of laboratories that reported at least annual AST training increased from 29% to 40%.

Fifteen (68%) responding laboratories reported receiving no AST training from the state public health laboratory. Six (27%) laboratories report that they do receive training from the public health laboratory, and one respondent did not know (Figure 13). When asked how long they would travel to participate in training, 28% responded that they would travel more than four hours and 94% responded that they would travel one hour or more (Figure 14). Twenty-five (71%) respondents reported that they would attend training on weekends.



Figure 13



Figure 14

40% of the laboratories responded affirmatively when asked if their facility had someone designated to provide AST training, compared to 29% affirmative responses in 2006.

Two questions were asked regarding the provision of time-off for training held either off-site or on-site. Only one laboratory responded that they were never allowed time off for training.

The majority of laboratories responded affirmatively to both off-site and on-site training (Table 2).

	Off Site	On-Site
Yes	60%	63%
Sometimes	37%	34%
No	3%	3%

Table 2

Either CD Rom (86%) or On-Line study (86%) is available to most laboratories. Fifty seven percent have the capability to video conference, 74% to teleconference, and 63% to participate in Webinars.

The top choice for future training venue was teleconference with 29%. On-site training was the first choice of 17% of responders and self-study was the first choice of 14%. Workshop, Webinar, and CD-Rom were each the first choice of 11% of respondents.

Future improvements

Laboratories were asked two questions concerning future improvements to provision of quality AST services. In response to what is perceived as the primary need for improving AST testing in their laboratories, most frequent responses were 1) increased training on reporting and other post-analytical processes and 2) training on the use of CLSI guidelines (Figure 15). When asked how the interaction between laboratories and the PHL could be improved, the majority of respondents cited updates and training in a) the use of CLSI guidelines (22 responses) and b) AST procedures (18 responses) (Figure 16).



Figure 15

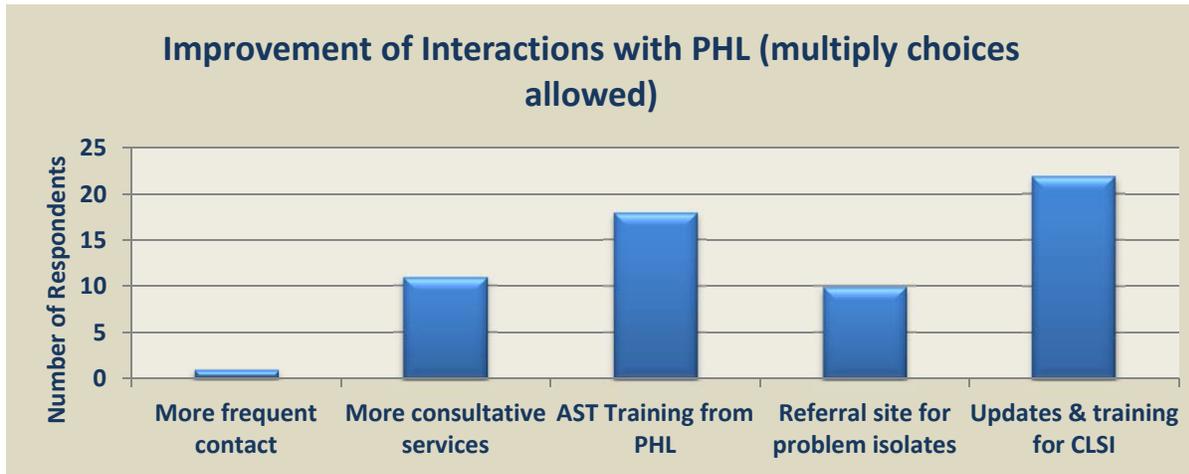


Figure 16

Conclusions and recommendations

The variation in hospital bed capacity, staff size and expertise, equipment and in-house resources, volume of ASTs, degree of isolation from larger and better equipped facilities, and availability of outside resources, demands flexibility in expectations of expertise and ability. The practice of performing antimicrobial susceptibility testing on non-routine isolates may not be in the best interest of public health nor private health care. Demands on the time and expertise of clinical laboratory professionals in smaller and isolated facilities can be intense and overwhelming. When determining the extent of microbiological testing appropriate to a given facility, consideration must be given to the urgency and prioritization of competing responsibilities. The ability and willingness of a facility to recognize those situations that exceed its level of expertise, and to seek assistance in those situations, is a standard of excellence.

These survey results have provided valuable insight into the current practices and knowledge base of the clinical laboratories performing antimicrobial susceptibility testing. In partnership with these laboratories, the Montana Public Health Laboratory is committed to working collaboratively to address gaps and improve the public health laboratory system.