Appendix S1

Suggested activities for incorporating learning outcomes into existing veterinary clinical pathology residency programs

Incorporation of suggested learning outcomes may be easiest (and likely already occurs) for Domain 10, given that mastering microscopy and cytology are already heavily emphasized in current residency programs. Additional ideas and suggested activities in this Appendix are not intended to be prescriptive; rather they are simply selected examples showing how learning outcomes from the other domains could be phased into to residency activities that may already occur in many programs and laboratories. A consideration is whether to set aside time in residency programs during which residents rotate through specific laboratory work areas (or specific laboratories, if the institution has more than one diagnostic laboratory unit), in order to shadow and work with the medical technologist(s) in that area.

Suggested activities are listed in order of Domain number:

- After reading the ASVCP QALS General Guidelines (Arnold JE, et al., *Vet Clin Pathol*. 2019;48:542-618. https://doi.org/10.1111/vcp.12810.), have residents complete the checklists (presented at the end of each article section) for the laboratory. Discuss checklists with supervisors. *Aims are to familiarize resident with the general guidelines and with the current quality system in the laboratory.* (Competency 1.1)
- Ask residents to create one new SOP, or to review/revise one to two existing SOPs, per year. (Competency 1.1)
- Have residents accompany supervisor(s) on a daily round through the laboratory in order to observe any troubleshooting and QA/QC procedures. As the residency progresses, allow

residents to become progressively more involved and to practice troubleshooting and solving QA/QC issues under the supervision of medical technologists. (Competencies 1.1, 1.2, 1.3, and 5.2)

- Have residents participate in end-of-shift checklists, assessment of key performance indicators, and/or use of other quality-related documentation that is routinely performed. If not currently in use and the laboratory wishes to develop these, ask residents to help develop checklists, key performance indicators, or documentation of other quality checks to be done on a daily, weekly, monthly, or quarterly basis, as fits the laboratories equipment and workflows. (Competency 1.1)
- Include residents in detailed cost analysis of one or more selected tests, e.g., as part of pricing adjustments, consults for clinical services about feasibility of offering requested new tests, or as part of installing new tests. (Competency 1.4)
- When a new instrument is installed, include residents in review and assessment of method verification data generated by field engineer doing the installation (and any additional verification or validation studies conducted by the laboratory as part of the installation). Use historical raw data from prior verification/validation studies as teaching datasets for resident training (e.g., to practice method comparison statistics or interpretation of precision or linearity). (Domains 3 and 4)
- Include residents in the interpretation of selected daily QC data, any troubleshooting, and any resulting actions and resolution. Use selected historical QC data to develop a teaching dataset. (Competency 5.2)
- After completing reading assignments about statistical QC, assign an analyzer (usually chemistry, suggest starting with 5 to 10 measurands) to a resident and have them prepare an Excel spreadsheet summarizing QC data (target values, measured results, and standard deviation values for the last 30 days of QC). Have the resident calculate bias, coefficient of variation, total

error, and sigma metric. Have the resident compare total error to quality goal (e.g., allowable total error TEa) and perform QC validation and select QC rule(s) to be used with the instrument. Consider having the resident continue to monitor performance of those measurands for the remainder of their residency (e.g., monthly or quarterly, with report of results to a supervisor). (Competencies 4.2, 5.1, 5.2, and 5.3)

- For institutions participating in EQA programs, include periodic interpretation of EQA data during the residency training program (e.g., as part of rounds or following receipt of EQA reports by the laboratory). If a resident has been assigned measurands to monitor (see bullet above), include interpretation of EQA data in the ongoing evaluation. (Competency 5.4)
- Have residents review all or selected daily patient laboratory reports (e.g., chemistry panels, CBCs) to screen these for data outliers or data drift. Pursue troubleshooting as needed. Archive noteworthy cases in a teaching file. (Competencies 6.2 and 6.3)
- Include CBC instrument histograms and scattergrams in the interpretation and discussion of CBC data (e.g., as in hematology case rounds). (Competency 6.2).
- Have residents practice confirming automated or hemacytometer CBC data with manual blood smear review. Archive noteworthy cases in a teaching file. (Competency 6.2).
- For laboratories reporting L (lipemia), I (icterus), and H (hemolysis) indices with chemistry data, include L/I/H index data with chemistry cases reviewed by residents (e.g., as in chemistry rounds) to facilitate discussion of interferents in chemistry data interpretation. (Competency 6.2)
- When population-based reference intervals are generated, updated, or transferred and validated, have residents attempt to generate reference limits themselves using published guidelines, available software (e.g., MedCalc, or Reference Value Advisor freeware add-in for Microsoft Excel), and on-line resources (e.g., pRI checklist and templates from ASVCP). Include

residents in the discussion and final selection of reference limits. Archived raw data from prior reference interval studies can be used as teaching datasets for resident training. (Competency 8.2, Domain 2)

- Have residents calculate and interpret observed total error, dispersion, expanded measurement uncertainty, and individualized reference intervals (iRI) for selected patients having abnormal laboratory results close to reference limits or clinical decision thresholds. Archive selected patient data and calculations to create a teaching file. (Competencies 8.3, and 8.4, and 4.1)
- After they have read about biological variation, have residents search the literature for recent veterinary BV studies. Ask residents to record intraindividual coefficient of variation (CVi), interindividual coefficient of variation (CVg), and index of individuality (II) for one or more measurands of their choosing and indicate if subject-based or population-based RIs are more appropriate for patient data interpretation. Have residents practice calculating individualized reference intervals (iRI) for those measurands. (Competencies 8.1 and 8.3)
- If the laboratory provides QA/QC oversight of point-of-care testing (POCT) equipment, involve residents in monitoring and quality assessment procedures (e.g., have residents analyze data from comparability testing events where POCT results are compared with those from the central laboratory). Archived selected POCT QC data can be used to create a teaching file. (Competency 11.3)
- Include residents in discussions with other hospital sections (e.g., the emergency and critical care service) about the addition of desired POCT equipment. This could be equipment which is expected to be managed by the clinical pathology service, or simply on a consultation basis for equipment managed by the relevant section. (Competency 3.1, 11.1, and 11.4)