# AOE Analysis of AANP's Fall 2023 Membership Survey

A survey was sent to the membership base of the American Association of Neuropathologists (AANP) in the fall of 2023. This survey is used for planning of future annual meeting topics by providing a better understanding of current neuropathology practice characteristics. A total of 118 members provided responses to the 29 clinical assertion statement questions within the survey and the summary of these results is described below.

The survey asked individuals to provide responses to demographic questions, shown in figures 1-3, to help further contextualize the results.
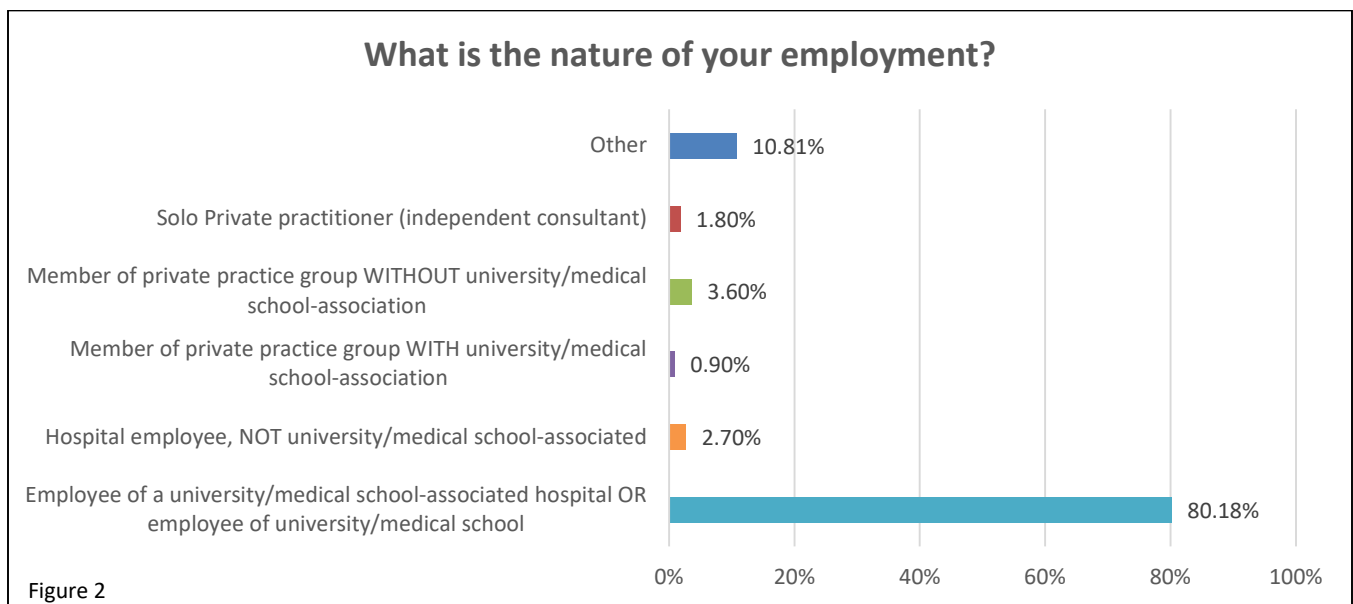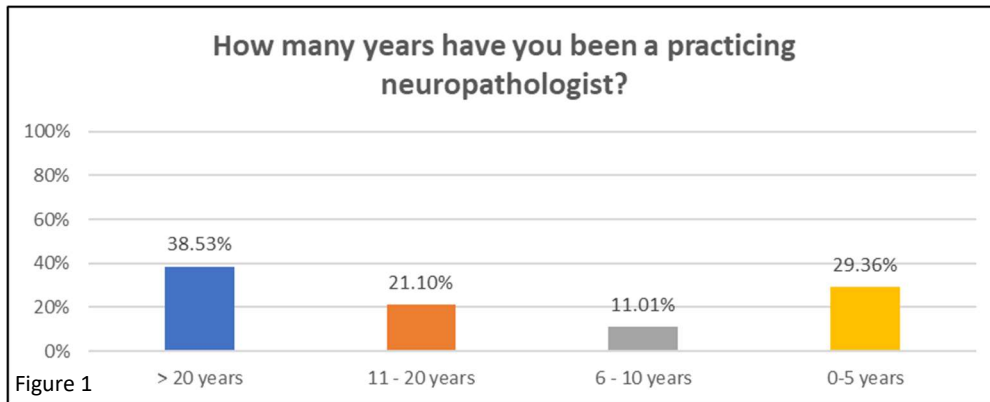
Figure 1

Figure 2

Other includes: Retired/Semi-Retired (7), Consultant (2), Trainee/Fellow (2), Multiple Selections (1)

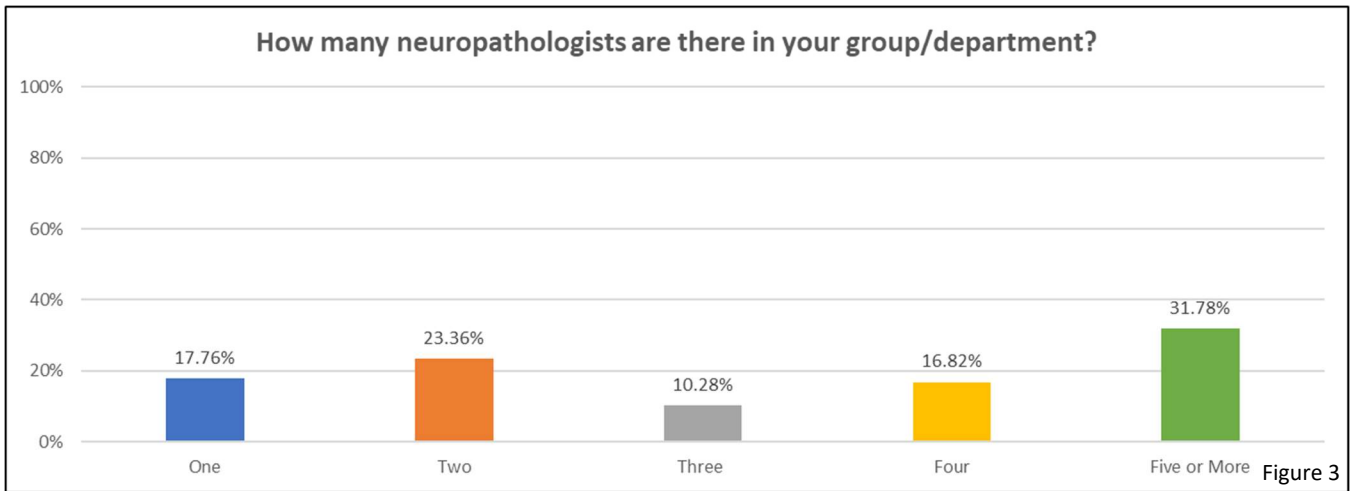How many neuropathologists are there in your group/department?

Figure 3

Clinical Assertion Statements

The survey asked members to rate 29 different clinical assertion statements using a 5-point Likert-type scale from 1=Disagree Completely to 5=Agree Completely, with a neutral option of 3=Neither Disagree nor Agree. These questions were developed to determine a member's level of knowledge regarding 7 separate topics in neuropathology. Data is presented as mean +/- percent unknown. Percent unknown indicates the number of responses in the incorrect/neutral position of total responses. For consistency, throughout this summary, a mean was considered close to the neutral position if it fell between 2.75 to 3.25. Further, if more than 50 percent of respondents answered at the neutral/incorrect position, narrative indicates that additional education may be appropriate.

Toxic/Metabolic

Toxic/Metabolic

Figure 4

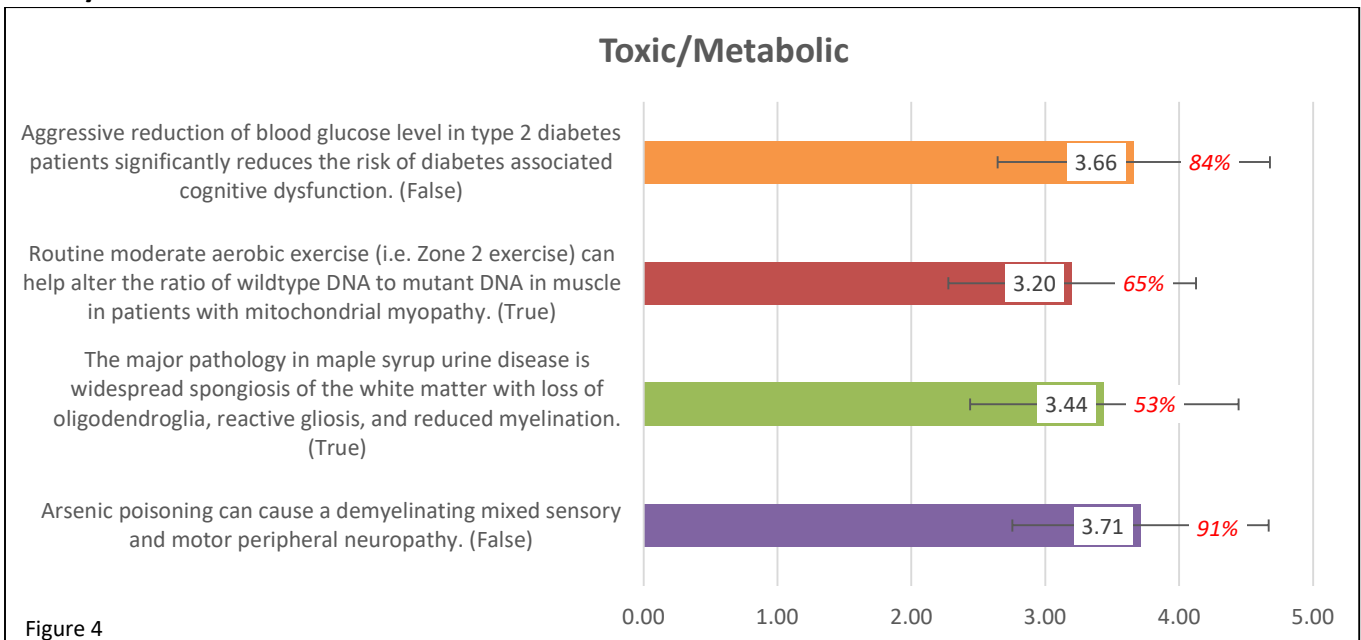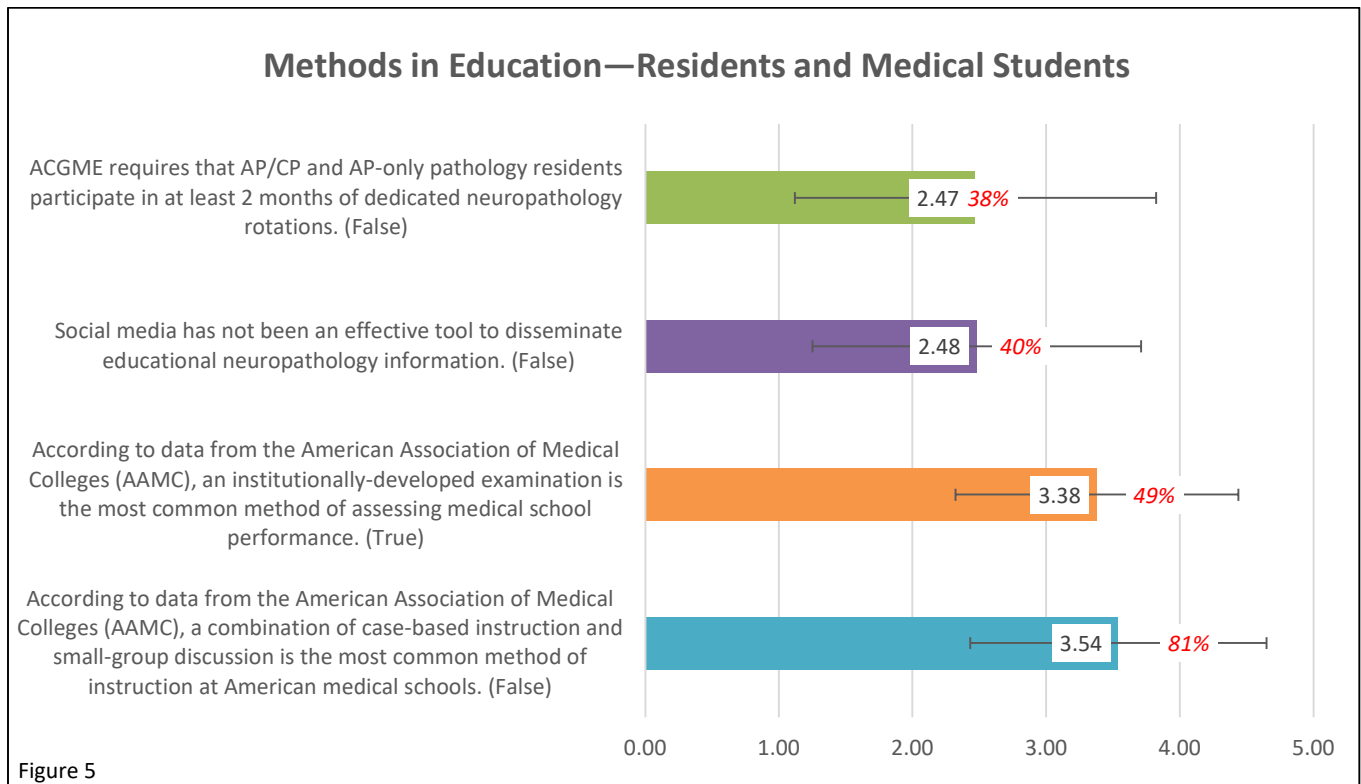**Figure 4** provides the results for the three questions evaluating knowledge in the area of **toxic/metabolic**. Statements one and four are false, while statements two and three are true. Statements two and three had mean scores in the desired direction. However, statement two had 65% of the respondents who answered at the neutral/incorrect position and statement three had 53% of respondents who answered at the

neutral/incorrect position. In both instances, this may indicate additional education is appropriate. Statements one and four had mean scores in the incorrect direction. In sum, areas of appropriate additional education include:

- Aggressive reduction of blood glucose level in type 2 diabetes patients significantly reduces the risk of diabetes associated cognitive dysfunction. (False)
- Routine moderate aerobic exercise (i.e. Zone 2 exercise) can help alter the ratio of wildtype DNA to mutant DNA in muscle in patients with mitochondrial myopathy. (True)
- The major pathology in maple syrup urine disease is widespread spongiosis of the white matter with loss of oligodendroglia, reactive gliosis, and reduced myelination. (True)
- Arsenic poisoning can cause a demyelinating mixed sensory and motor peripheral neuropathy. (False)

Methods in Education—Residents and Medical Students

Figure 5

Figure 5 provides the results for the four questions evaluating knowledge in the area of **methods in education – residents and medical students.** Statements one, two, and four are false while statement three is true. Statements one, two, and three had a mean score on the correct side. Statement four had a mean score on the incorrect side of the scale indicating that additional education is appropriate. In sum, areas of appropriate additional education include:

- According to data from the American Association of Medical Colleges (AAMC), a combination of case-based instruction and small-group discussion is the most common method of instruction at American medical schools.

DNA Methylation

DNA Methylation

DNA methylation profiling can be used to differentiate meningeal melanoma from melanocytoma. (False) — 2.96 — *67%*

DNA methylation profiling can be used to grade IDH-mutant astrocytomas. (False) — 2.82 — *55%*

Accurate MGMT promoter methylation status can be established based on the DNA methylation array data. (True) — 3.68 *35%*

Chromosomal copy-number information generated as part of DNA methylation array is equivalent to chromosomal microarray testing. (False) — 2.57 — *47%*
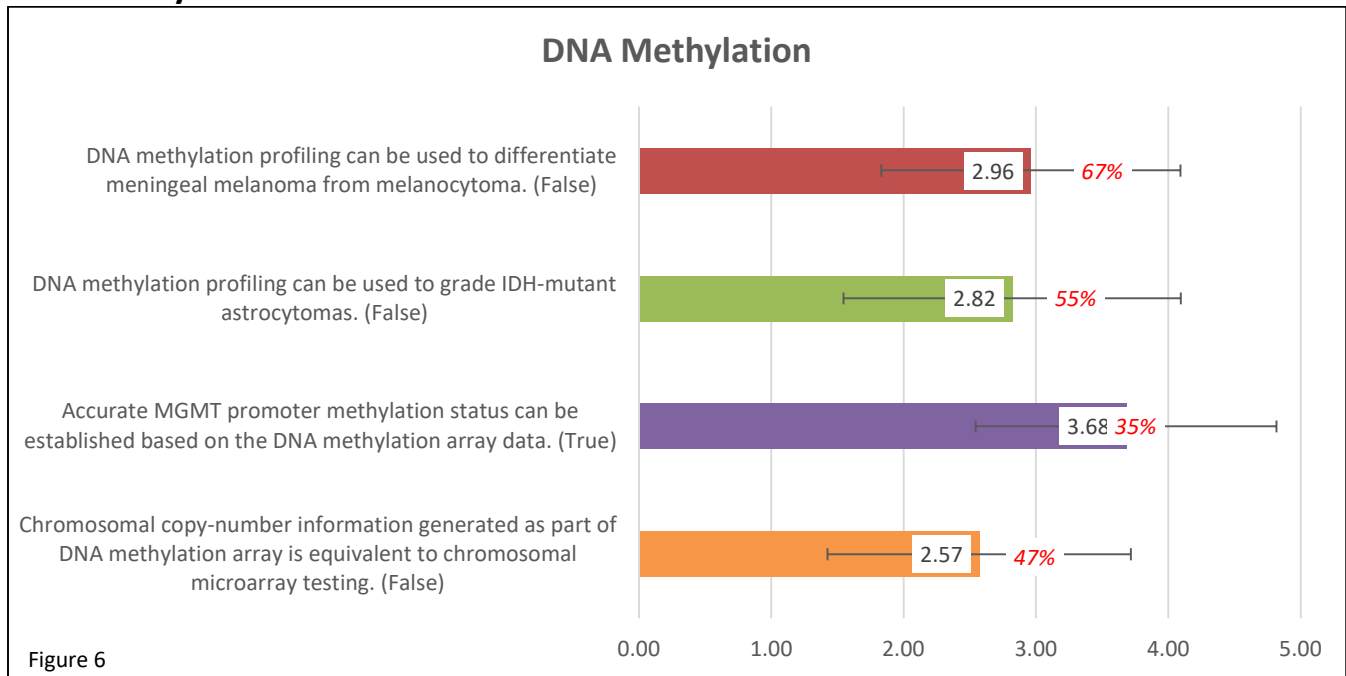
Figure 6

Figure 6 provides the results for the three questions evaluating knowledge regarding **DNA methylation.** Statements one, two, and four are false while statement three is true. Statements one and two had a mean close to the neutral position, with 67% and 55% of responses, respectively, in the incorrect or neutral position indicating education is likely appropriate related to these statements. Statements three and four had mean scores in the desired direction. In sum, areas of appropriate additional education include:

- DNA methylation profiling can be used to differentiate meningeal melanoma from melanocytoma.
- DNA methylation profiling can be used to grade IDH-mutant astrocytomas.

Cognition/Memory Formation and Related Disorders

Cognition/Memory Formation and Related Disorders

Reliable biomarkers exist for diagnosing early Alzheimer's disease. (False) — 2.99 — *60%*

Acquisition of new memories can be influenced by previous experience. (True) — 4.24 *8%*

Aging-related tau astrogliopathy (ARTAG) is characterized by tufted astrocytes. (False) — 2.88 — *58%*

Limbic-predominant age-related TDP-43 encephalopathy (LATE) is commonly identified in patients with neuropathologic changes of Alzheimer's disease or hippocampal sclerosis. (True) — 4.04 *21%*

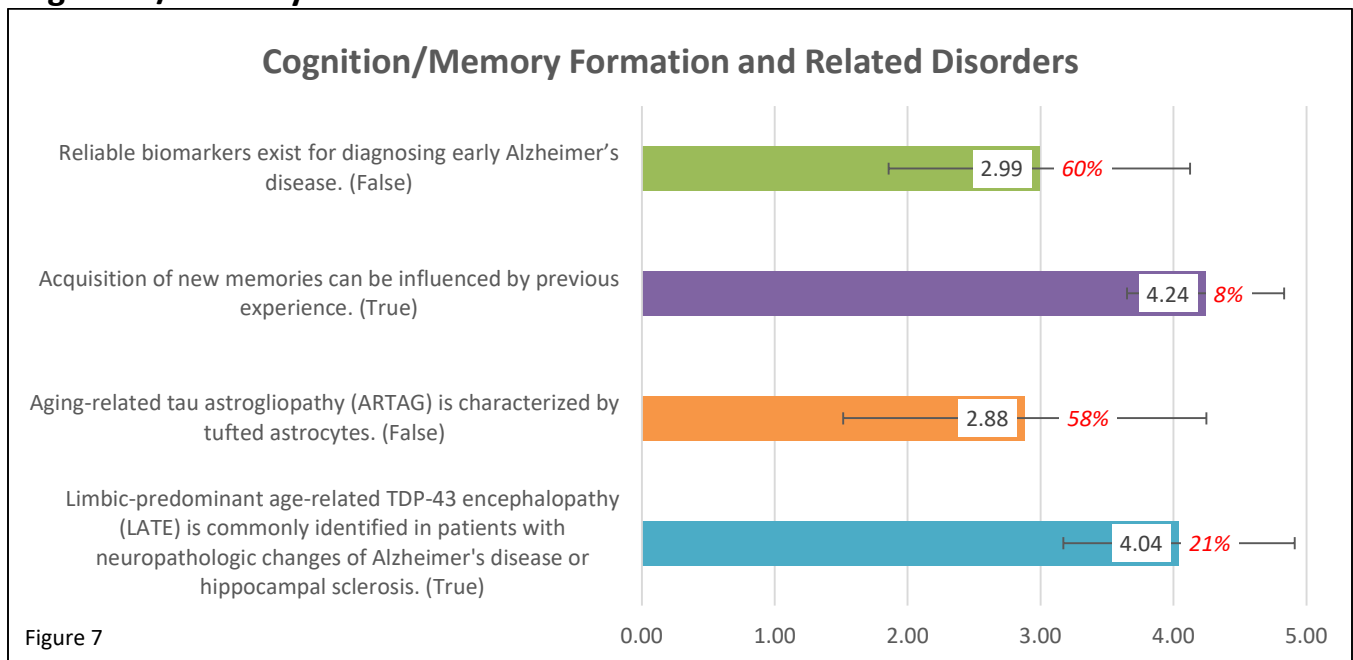Figure 7

Figure 7 provides the results for the three questions evaluating knowledge in the area of **cognition/memory formation and related disorders**. Statements one and three are false while statements two and four are true. Statements two and four had mean scores in the desired direction. Statements one and three had a mean score close to the neutral position and 60% and 58% of responses, respectively, were incorrect or in the neutral position indicating education is appropriate related to these statements. In sum, areas of appropriate additional education include:

- Reliable biomarkers exist for diagnosing early Alzheimer's disease.
- Aging-related tau astrogliopathy (ARTAG) is characterized by tufted astrocytes.

New or Provisional CNS5 WHO Entities
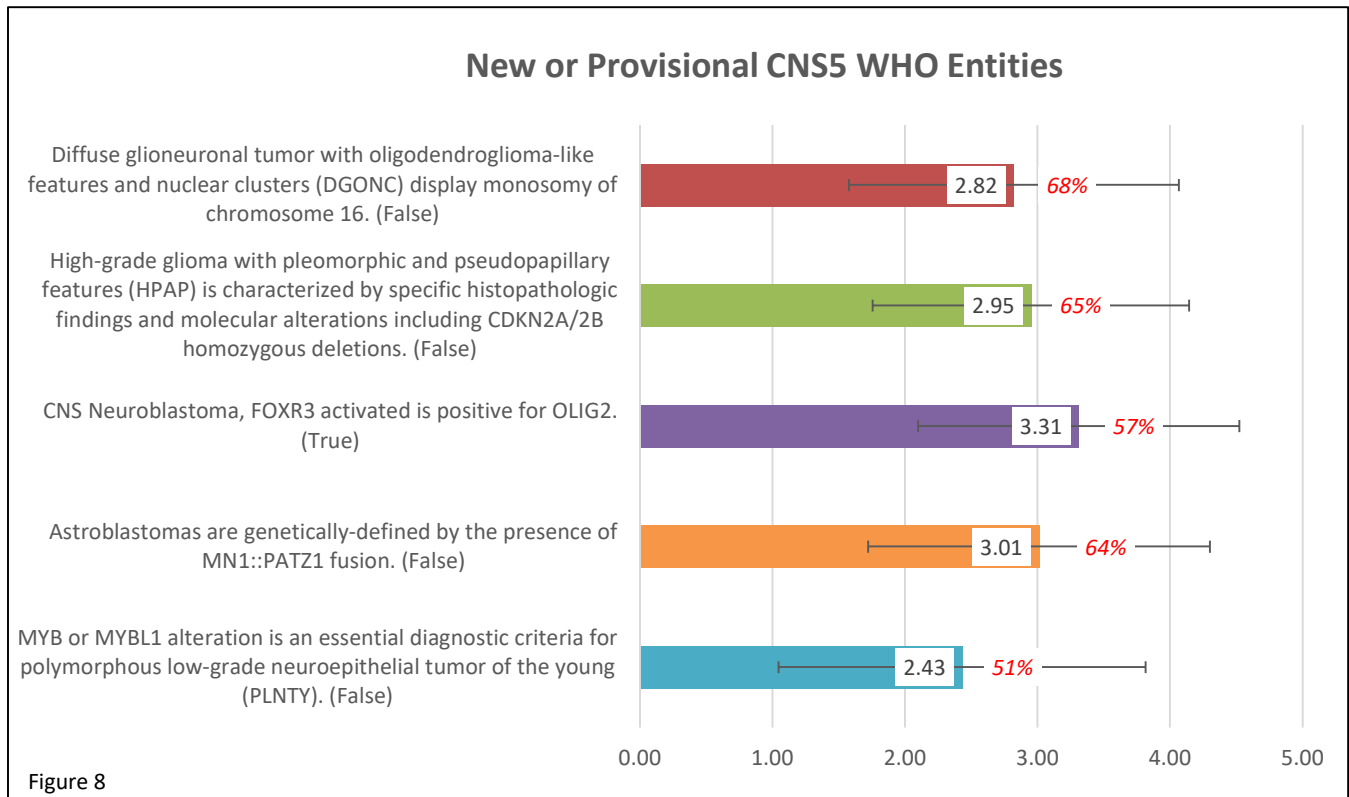
Figure 8

Figure 8 provides the results for the three questions evaluating knowledge in the area of **new or provisional WHO entities**. Statements one, two, four, and five are false while statement three is true. Members selected responses in the desired direction for statement five. Statements one, two, three, and four had a mean score close to the neutral position and 68%, 65%, 57%, and 64% of responses, respectively, were incorrect or in the neutral position indicating education is appropriate related to these statements. In sum, areas of appropriate additional education include:

- Astroblastomas are genetically-defined by the presence of *MN1::PATZ1* fusion.
- CNS Neuroblastoma, FOXR3 activated is positive for OLIG2.
- High-grade glioma with pleomorphic and pseudopapillary features (HPAP) is characterized by specific histopathologic findings and molecular alterations including CDKN2A/2B homozygous deletions.
- Diffuse glioneuronal tumor with oligodendroglioma-like features and nuclear clusters (DGONC) display monosomy of chromosome 16.

Digital Pathology

Digital Pathology

- CAP strongly recommends that the validation of whole slide imaging systems for diagnostic purposes include 95% or more interobserver variability between digital and glass slides. (False) — 3.44 — *85%*
- Per CAP requirements, digital images used for primary diagnosis should be retained for 10 years if the original glass slides are not available. (True) — 3.65 — *46%*
- CAP recommends including at least 50 cases for whole slide imaging system validation. (False) — 3.58 — *89%*
- Digital pathology cannot be used for remote intraoperative consultations. (False) — 1.56 — *7%*
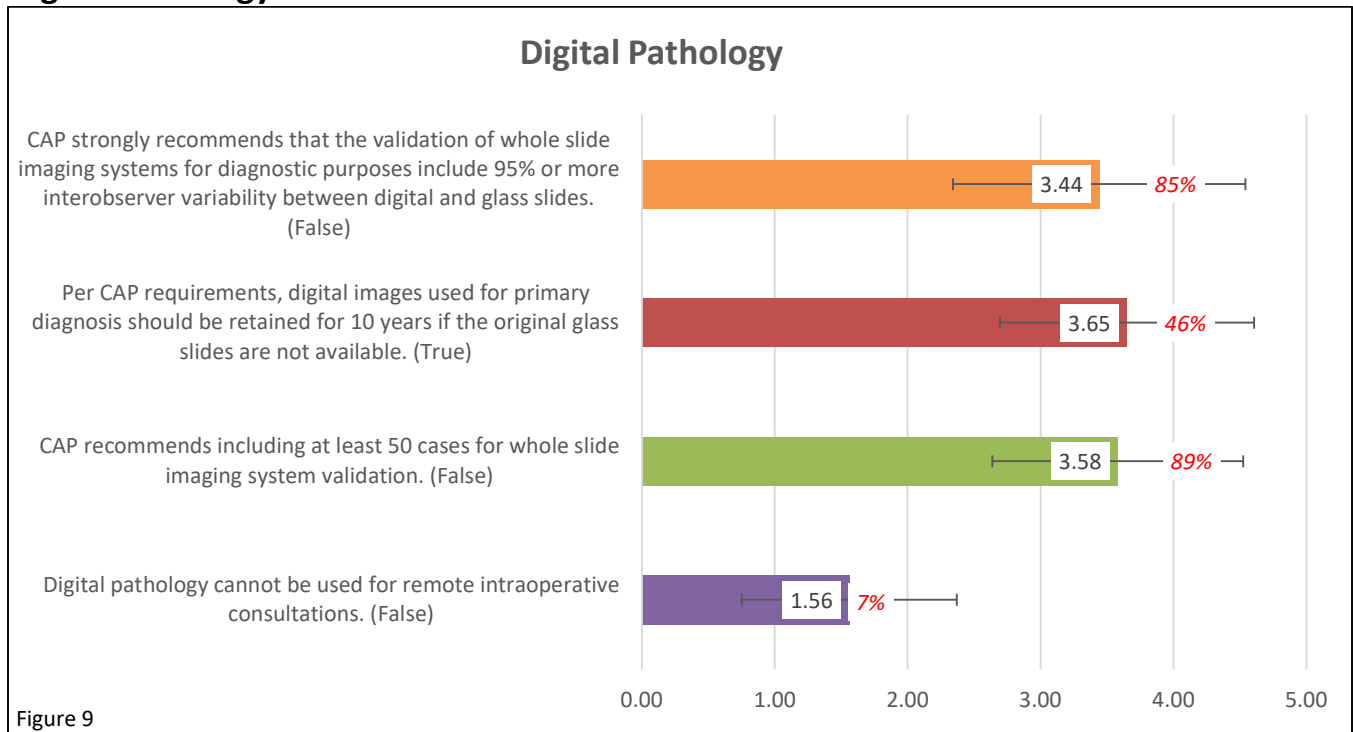
Figure 9

Figure 9 provides the results for the four questions evaluating knowledge in the area of **digital pathology**. Statements one, three, and four are false and statement two is true. Statements two and four had answers on the correct side. Statements one and three had answers on the incorrect side, indicating that education may be appropriate. In sum, an area of appropriate additional education include:

- CAP strongly recommends that the validation of whole slide imaging systems for diagnostic purposes include 95% or more interobserver variability between digital and glass slides.
- CAP recommends including at least 50 cases for whole slide imaging system validation.

Artificial Intelligence

Artificial Intelligence

- Emerging data suggest that computer assisted technology does not impact the speed or accuracy with which pathologists arrive at a diagnosis. (False) — 2.63 — *52%*
- Artificial Intelligence (AI) tools can be used to assist with quality control in the pathology lab. (True) — 4.16 — *11%*
- Artificial Intelligence (AI) in neuropathology can enhance diagnostic accuracy. (True) — 3.90 — *23%*
- Emerging advancements in AI within neuropathology present a potential threat to traditional roles, potentially diminishing job security for practitioners, prompting cautious consideration before its widespread integration. (False) — 2.51 — *43%*
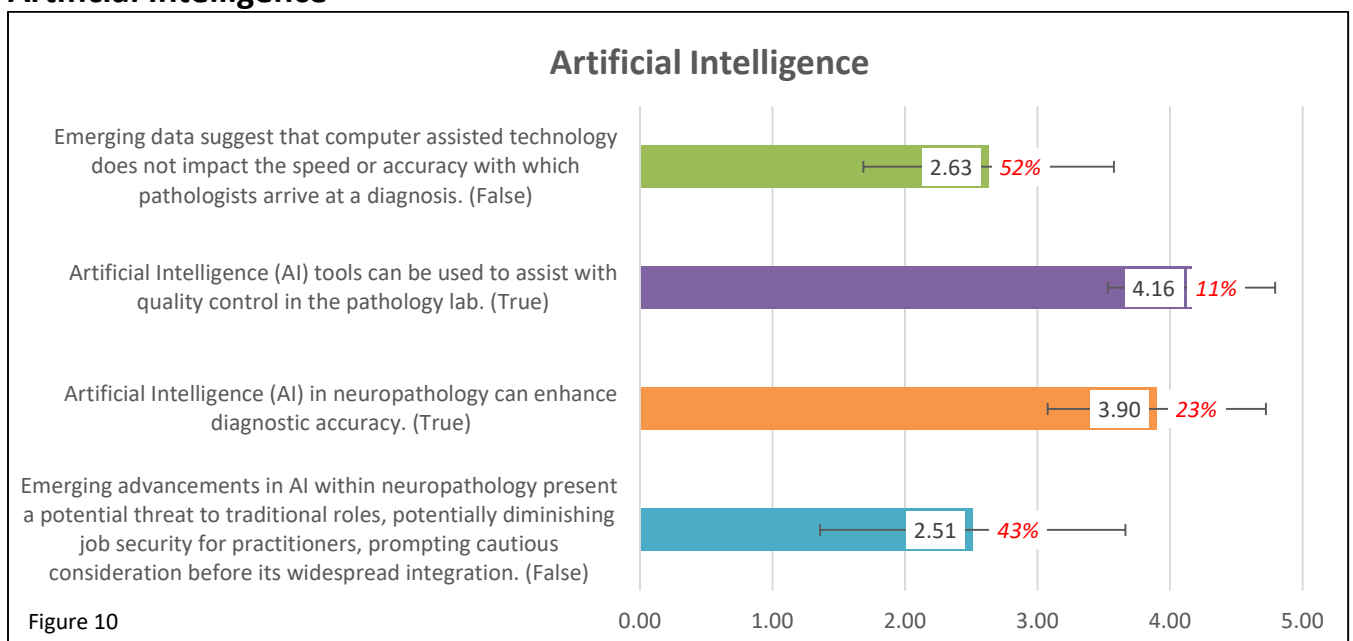
Figure 10

Figure 10 provides the results for the four questions evaluating knowledge in the areas of **artificial intelligence**. Statements one and four are false, while statements two and three are true. All four statements had a mean score in the desired direction. However, 52% of respondents answered in the incorrect or neutral position for statement one, indicating additional education may be appropriate. In sum, areas of appropriate additional education include:

- Emerging advancements in AI within neuropathology present a potential threat to traditional roles, potentially diminishing job security for practitioners, prompting cautious consideration before its widespread integration.
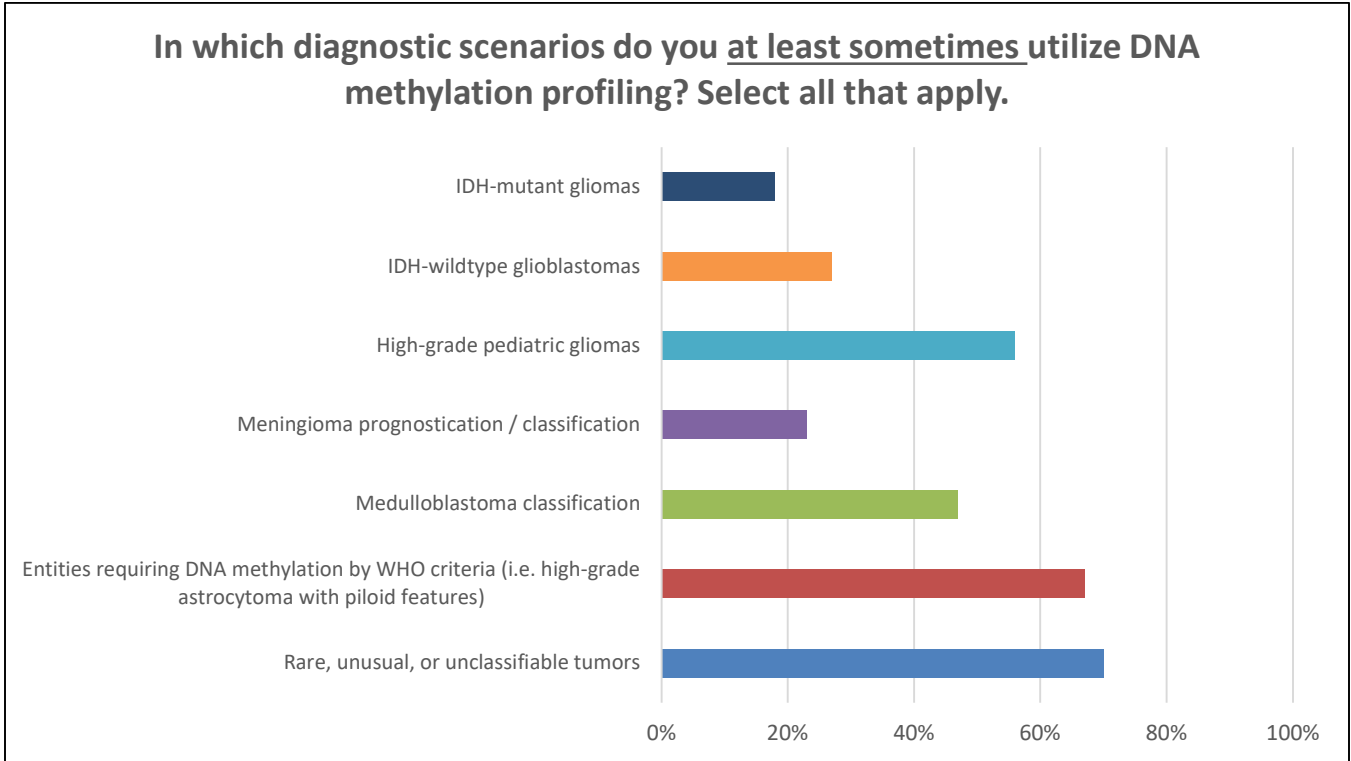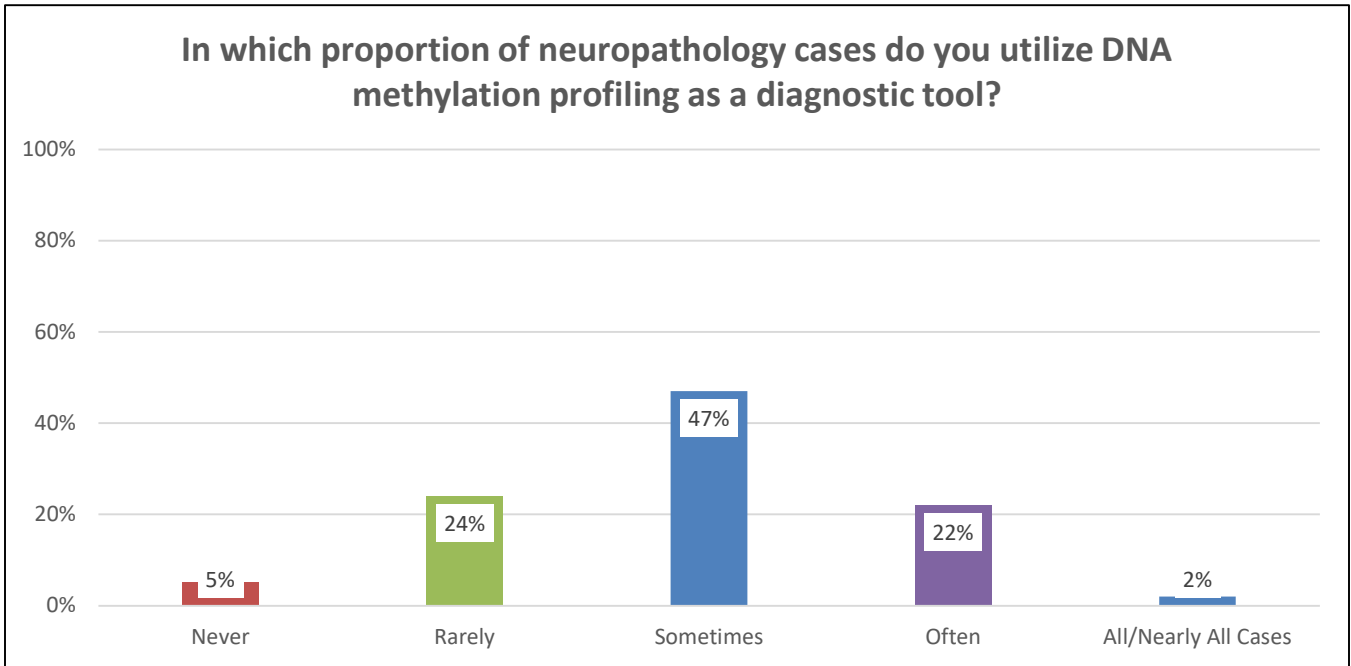
Conclusion:

Based on the analysis of the 2023 Annual Membership Survey, there were some statements where responses were close to neutral, and many respondents answered in the neutral position which indicates areas where there may be need for additional education. Further, several scores were on the opposite/wrong side of the scale. Both situations indicate that the following are areas of need for additional education:

- **Toxic/Metabolic**
  - Aggressive reduction of blood glucose level in type 2 diabetes patients significantly reduces the risk of diabetes associated cognitive dysfunction. (False)
  - Routine moderate aerobic exercise (i.e. Zone 2 exercise) can help alter the ratio of wildtype DNA to mutant DNA in muscle in patients with mitochondrial myopathy. (True)
  - The major pathology in maple syrup urine disease is widespread spongiosis of the white matter with loss of oligodendroglia, reactive gliosis, and reduced myelination. (True)
  - Arsenic poisoning can cause a demyelinating mixed sensory and motor peripheral neuropathy. (False)
- **Methods in Education—Residents and Medical Students**
  - According to data from the American Association of Medical Colleges (AAMC), a combination of case-based instruction and small-group discussion is the most common method of instruction at American medical schools.
- **DNA Methylation**
  - DNA methylation profiling can be used to differentiate meningeal melanoma from melanocytoma.
  - DNA methylation profiling can be used to grade IDH-mutant astrocytomas.
- **New or Provisional CNS5 WHO Entities**
  - Astroblastomas are genetically-defined by the presence of *MN1::PATZ1* fusion.
  - CNS Neuroblastoma, FOXR3 activated is positive for OLIG2.
  - High-grade glioma with pleomorphic and pseudopapillary features (HPAP) is characterized by specific histopathologic findings and molecular alterations including CDKN2A/2B homozygous deletions.
  - Diffuse glioneuronal tumor with oligodendroglioma-like features and nuclear clusters (DGONC) display monosomy of chromosome 16.
- **Cognition/Memory Formation and Related Disorders**
  - Reliable biomarkers exist for diagnosing early Alzheimer's disease.
  - Aging-related tau astrogliopathy (ARTAG) is characterized by tufted astrocytes.
- **Digital Pathology**
  - CAP strongly recommends that the validation of whole slide imaging systems for diagnostic purposes include 95% or more interobserver variability between digital and glass slides.
  - CAP recommends including at least 50 cases for whole slide imaging system validation.
- **Artificial Intelligence**
  - Emerging advancements in AI within neuropathology present a potential threat to traditional roles, potentially diminishing job security for practitioners, prompting cautious consideration before its widespread integration.

Additional Survey Questions

The following data regarding utilization of DNA methylation were included by the AANP Education Committee to garner data on this topic.

In which proportion of neuropathology cases do you utilize DNA methylation profiling as a diagnostic tool?

Category	Percent
Never	5%
Rarely	24%
Sometimes	47%
Often	22%
All/Nearly All Cases	2%

In which diagnostic scenarios do you at least sometimes utilize DNA methylation profiling? Select all that apply.

Scenario	Approx. %
IDH-mutant gliomas	~18%
IDH-wildtype glioblastomas	~27%
High-grade pediatric gliomas	~56%
Meningioma prognostication / classification	~23%
Medulloblastoma classification	~47%
Entities requiring DNA methylation by WHO criteria (i.e. high-grade astrocytoma with piloid features)	~67%
Rare, unusual, or unclassifiable tumors	~70%

In which diagnostic scenarios do you <u>routinely</u> utilize DNA methylation profiling? Select all that apply.

Horizontal bar chart showing percentages for diagnostic scenarios:
- IDH-mutant gliomas: ~8%
- IDH-wildtype glioblastomas: ~11%
- High-grade pediatric gliomas: ~44%
- Meningioma prognostication / classification: ~8%
- Medulloblastoma classification: ~39%
- Entities requiring DNA methylation by WHO criteria (i.e. high-grade astrocytoma with piloid features): ~66%
- Rare, unusual, or unclassifiable tumors: ~67%
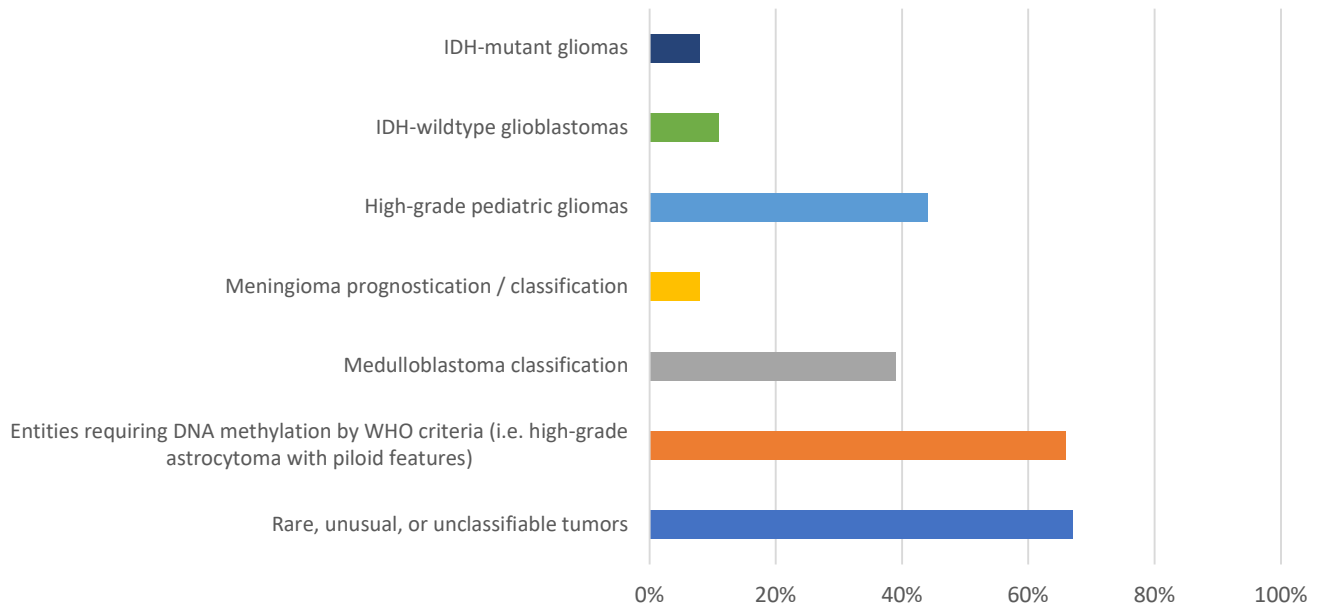
How do you order or perform DNA methylation profiling?

Vertical bar chart:
- An in-house molecular laboratory at my institution: ~5%
- Tissue is sent to publicly available laboratory (e.g. National Institutes of Health / National Cancer Institute): ~24%
- Tissue is sent to another private or academic molecular laboratory / reference laboratory: ~47%
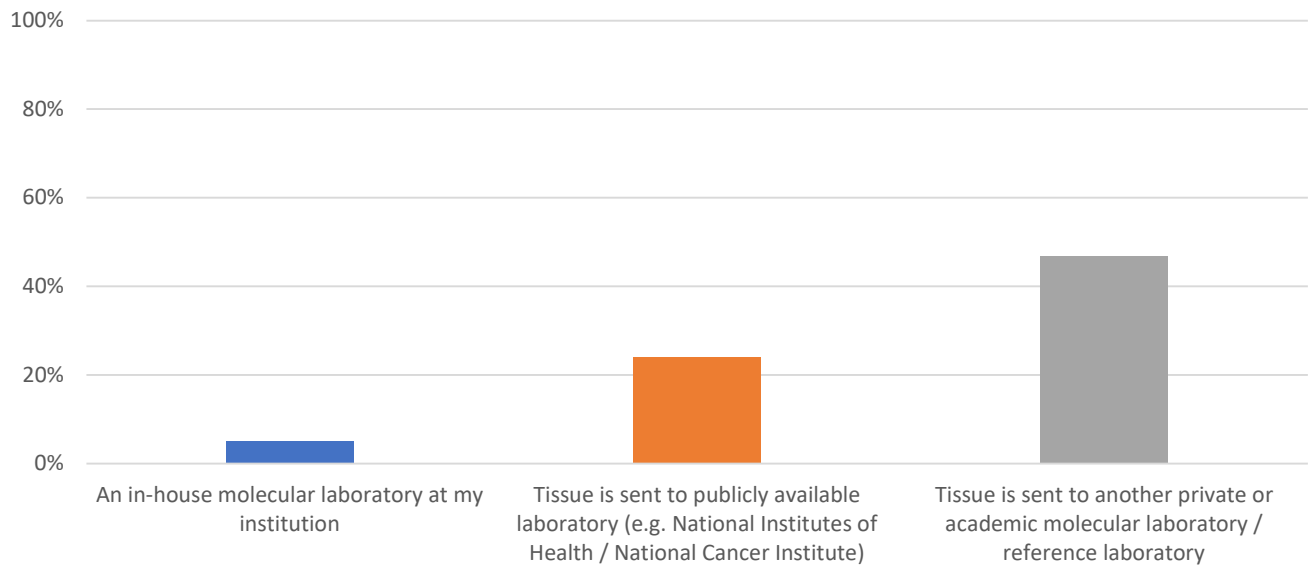
If you perform DNA methylation profiling in-house, what techniques do you use to analyze the data? Select all that apply.
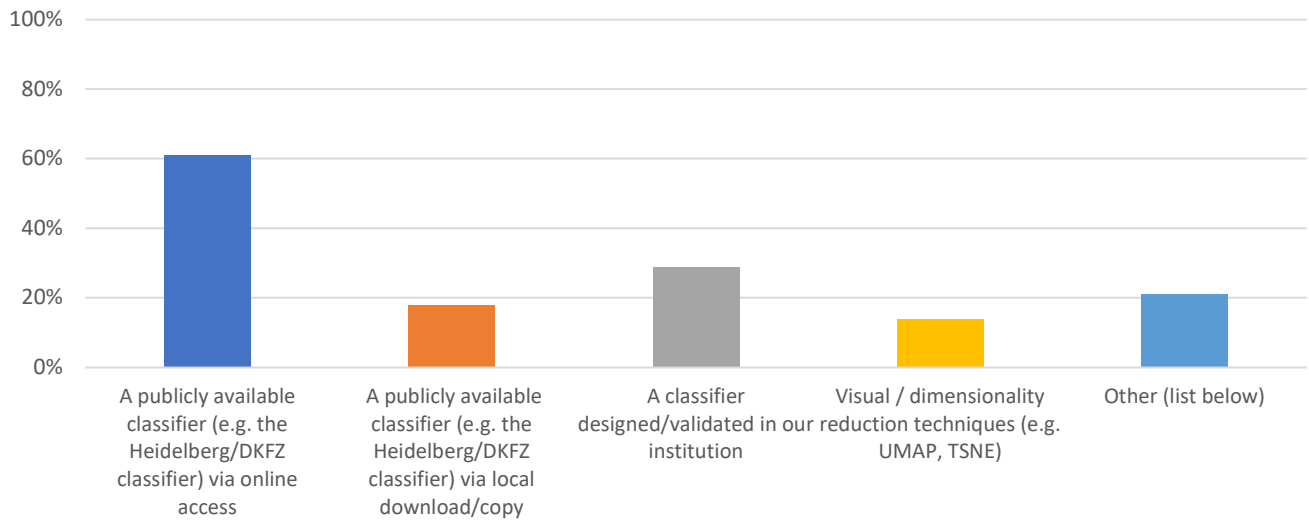
Other Responses Included the Following:
- Send idats directly to NIH for the NCI/Bethesda classifier
- I no longer provide tumor diagnosis services so am not answering this block of questions
- I don't use it
- NIH
- Classifier results and UMAP embedding provided by publicly available laboratory (NCI)
- Unsupervised clustering (graph-based modularity optimization)

If you perform DNA methylation profiling in-house, how do you bill for the test?
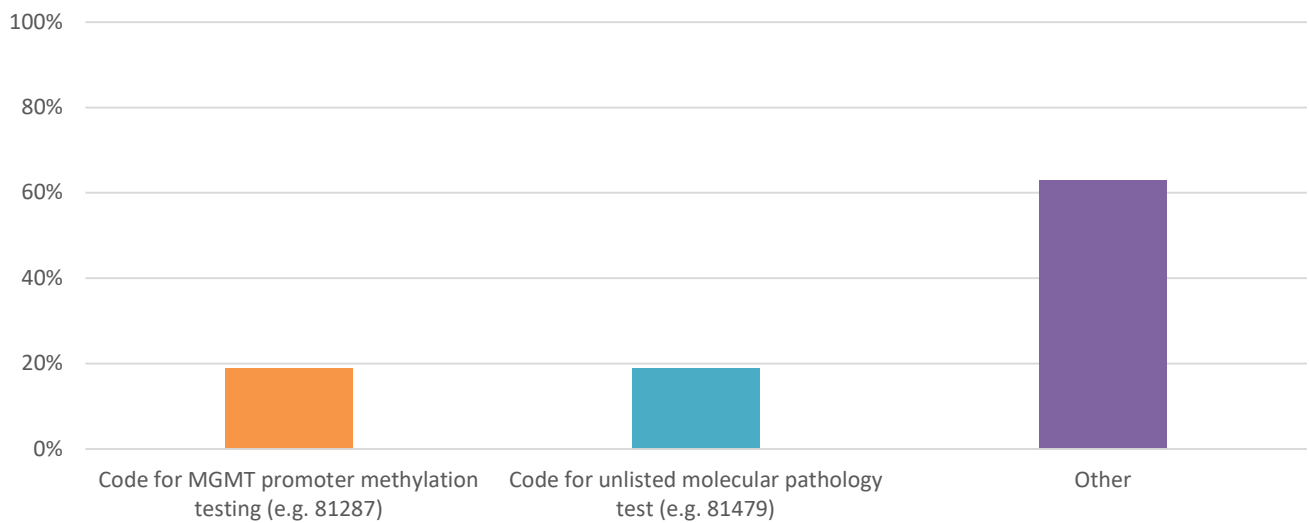
Other Responses Included the Following:
- No billing
- Don't know/Not sure
- It's free
- Institution absorbed cost
- No code yet
- Indecipherable answer
- Not available in house

Which statement best describes your institutional experience with DNA methylation profiling?

DNA methylation profiling has dramatically changed our practice.	DNA methylation profiling has meaningfully aided in resolving unusual cases but has had less significant impact on routine cases.	DNA methylation has not significantly impacted our practice or is mostly of academic interest.
~18%	~65%	~18%

Which statement best describes the attitude of neuro-oncologists, neuro-radiologists, and neurosurgeons at your institution regarding DNA methylation profiling?

Clinicians at my institution are mostly unaware of DNA methylation profiling or how it is used in tumor diagnostics.	Clinicians at my institution are interested in the results of DNA methylation profiling for rare or unclassifiable tumors.	Clinicians at my institution routinely expect DNA methylation profiling and utilize the results in clinical decision-making.
~17%	~65%	~18%