Neuro-Oncology Quality Measurement Set

Approved by the AANI and SNO work group on February 9, 2017.

Approved by AANI Quality and Safety Subcommitee on February 17, 2017, AANI Practice Committee on March 8, 2017, and AANI Board on March 21,2017.

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Contents

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Improving Outcome for Patients with Neuro-Oncology Conditions

Rationale for Measures

The American Academy of Neurology (AAN) and Society of Neuro-Oncology (SNO) charged this work group with developing measures focused on improving outcomes for patients diagnosed with a neuro-oncology condition. As required, all members disclosed relationships with industry and other entities to avoid actual, potential, or perceived conflicts of interest.

Importance and Prevalence of Neuro-Oncology

In the United States, it is estimated that nearly 78,000 new cases of brain tumors are diagnosed yearly with approximately 53,000 non-malignant and 25,000 primary malignant brain tumors.[i] In 2015, it was estimated that 22,850 people in the U.S. would be diagnosed with primary malignant brain or other central nervous system (CNS) neoplasms, and these tumors would be responsible for approximately 15,320 deaths. [ii] Glioblastomas are the most common malignant primary brain tumor, while meningioma are the most frequently reported intracranial tumor.[iii] Gliomas account for 29% of all tumors and 82% of malignant tumors.[iv]

In a review of National Cancer Institute's database, the incidence of malignant glioma was 6.7 per 100,000 adults for white Americans and 3.6 per 100,000 for black Americans.[v] Central Brain Tumor Registry of the United States (CBTRUS) data indicates the overall incidence rate for primary brain and CNS tumors in Hispanics is 20.45 per 100,000 population compared to 22.31 per 100,000 population among non-Hispanics.[vi] The prevalence of glioblastoma diagnosis increases with age; it is about two times higher in whites compared to blacks, and men are affected more than women.[vii] The median survival for adults with a glioblastoma is 14.6 months, while lower grade gliomas may have a relatively better prognosis.[viii]

Curry and Barker noted in 2009, "In the US, black patients have lower incidences of most brain tumor types and lower-income patients have lower incidences of low grade glioma, meningioma and acoustic neuroma; ascertainment bias may contribute to these findings. Pathogenetic differences between malignant gliomas in patients of different races have been demonstrated, but their clinical significance is unclear."[ix]

Inskip et al. studied socioeconomic status on incidence rates of gliomas and meningiomas, finding incidence of high-grade gliomas similar across socioeconomic status, but patients with higher socioeconomic status had a significantly higher incidence of low grade glioma and meningioma.[x] Porter et al. found a strong association between higher socioeconomic status and risk of glioblastoma with effect across age, sex, and race.[xi] Porter et al. believed the association between higher socioeconomic status and glioblastoma risk was unlikely to represent an ascertainment effect given glioblastoma is rapidly progressive and ultimately fatal.[xii]

Curry and Barker concluded that "Evaluation of quality measures, including equity in health care delivery, should be a continuous and purposeful endeavor for organized and academic neuro-oncology."[xiii] It is hoped that this neuro-oncology quality measurement set can aid in this endeavor.

Additional information on how measures developed will address treatment gaps in care and link to patient outcomes is included in the individual measure specifications that follow.

Common Abbreviations and Definitions for the Measurement Set

Below is a list of acronyms utilized in this document. The AAN has a Quality Improvement Glossary, which provides more in depth explanations and is available at aan.com/practice/quality-measures/quality-resources.

- AAN: American Academy of Neurology
- ASCO: American Society of Clinical Oncology
- CMS: Centers for Medicare & Medicaid Services
- CNS: Central Nervous System
- DVT: Deep Vein Thrombosis
- IDH: Isocitrate dehydrogenase
- MGMT: O^6-methylguanin-DNA-methyltransferase
- MIPS: Merit-based Incentive Payment System

- MRI: Magnetic Resonance Imaging
- NCCN: National Comprehensive Cancer Network
- NQF: National Quality Forum
- PE: Pulmonary Embolism
- PQRS: Physician Quality Reporting System
- SNO: Society for Neuro-Oncology
- WHO: World Health Organization

2016 Neuro-Oncology Measurement Set
The work group approved the following measures, including process and outcome measures:

Measure Title
Multidisciplinary Care Plan Developed for Primary Brain or Spine Tumors
Molecular Testing in Accordance with World Health Organization Classification of Tumors of the Central Nervous System
Chemotherapy Education and Informed Consent for Brain Tumor Patients
Intra-Operative or Post-Operative MRI for Gliomas
Venous Thromboembolism Events (VTE) Following Primary Brain Tumor Resection

Relevant Cancer Measures
In addition to the above AAN and SNO measures the work group recommends providers and practices consider using the following measures, which are already available for use in the field for cancer patients:

NQF #0210 Proportion of patients who died from cancer receiving chemotherapy in the last 14 days of life. Available at: http://www.qualityforum.org/QPS/0210
NQF #0211 Proportion with more than one emergency room visit in the last 30 days of life. Available at: http://www.qualityforum.org/QPS/0211
NQF #0213 Proportion of patients who died from cancer admitted to the ICU in the last 30 days of life. Available at: http://www.qualityforum.org/QPS/0213
NQF #0215 Proportion of patients who died from cancer not admitted to hospice. Available at: http://www.qualityforum.org/QPS/0215
NQF #0216 Proportion of patients who died from cancer admitted to hospice for less than 3 days. Available at: http://www.qualityforum.org/QPS/0216

The work group determined there is value in using these measures at either an individual or practice level. Currently endorsed by the NQF for use at a provider level, the above measures are also available and specified for use at the individual provider level.

Advance Care Planning Measures
The work group reviewed the numerous, existing palliative and end-of-life measures already available for use in the field. The work group declined to create a new measure, and encourages providers to identify a measure to meet their population needs. Every neuro-oncology patient should be engaged in a discussion on advance care planning and research indicated patients are not engaged in these conversations early in the course of treatment. Possible measures for use include:

NQF #1641. Hospice and Palliative Care – Treatment Preferences Available at: http://www.qualityforum.org/QPS/1641
AAN Inpatient and Emergency Neurology Discussion and Documentation of Advance Directives. Available at: https://www.aan.com/practice/quality-measures/

The AAN is also developing a similar Advance Care Planning measure for use in outpatient settings. The measure once finalized will be available at: https://www.aan.com/practice/quality-measures/

Other Potential Measures

The work group discussed multiple additional measures. Ultimately these measures were not included in this measurement set, but the concepts will be retained for future measurement set updates. New evidence may support development of a measure or identify a treatment gap in care exists.

- Initiation of timely chemotherapy or radiotherapy: The work group discussed development of a measure addressing the timing of initiation of chemotherapy or radiotherapy after tumor resection. It was determined that at this time there is not sufficient evidence to support a window of time for treatment initiation, with conflicting evidence on whether outcomes are impacted when treatment is initiated prior to 2-3 weeks and after 6 weeks. The work group anticipates revisiting this issue during the update of the measurement set, and would like to see Class I evidence to support development.
- Steroid Use: The work group discussed measurement of steroid use in practice. Lack of evidence to support a standard dosage, tapering, or timeline for corticosteroid use in this population prevented further development. It is anticipated that in future updates of this measurement set, information from current trials will be beneficial in developing such a measure.

No one measurement set is able to address all the needs of this patient population. The work group was tasked with developing a small set of measures ripest for development at this time given existing evidence to support the measure, known treatment gaps, and ability to gather data without burden to providers. Although the below concepts were proposed, the work group did not discuss further due to the limitations and scope of the project:

- Patients of child-bearing age with whom fertility is discussed
- Post-operative seizure incidence or prophylaxis
- Readmission rates
- Discharge to rehabilitation services versus skilled nursing facility
- Rates of new, unanticipated neurological deficits after craniotomy for brain tumor resections
- Documentation of adherence to National Comprehensive Cancer Network guidelines

Technical Specifications Overview

The Work Group developed technical specifications for measures that include data from:

- Electronic Health Record (EHR) Data
- Administrative Data
- Registry

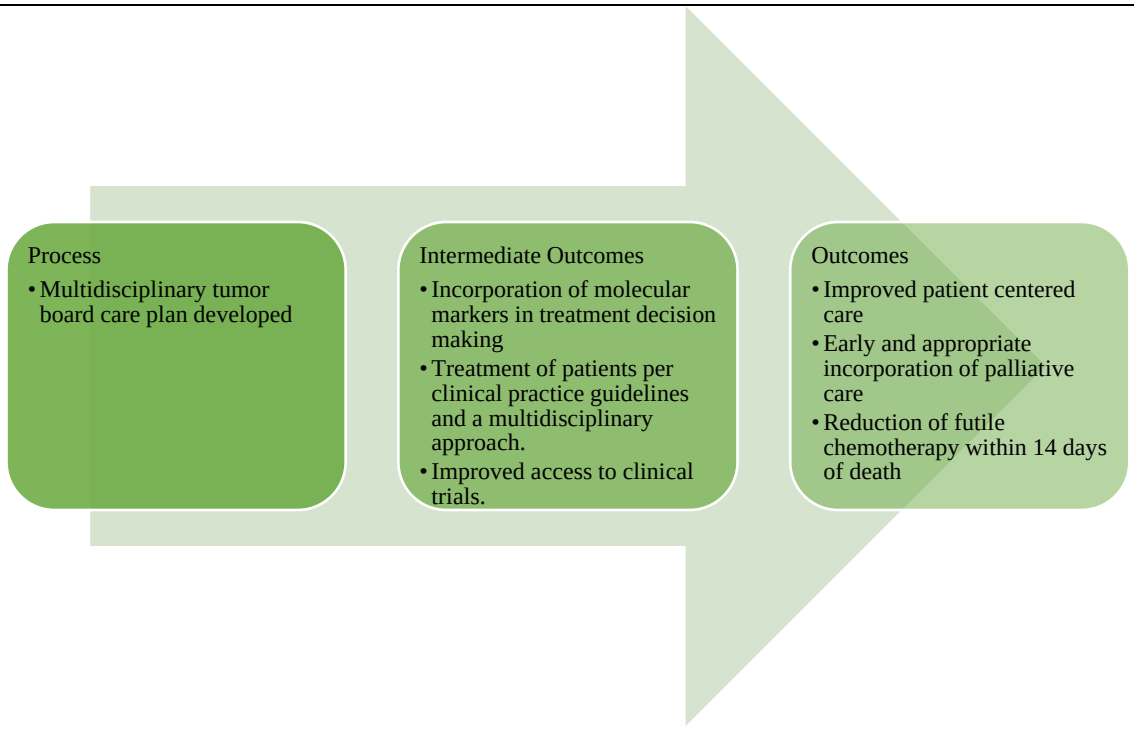
Administrative claims specifications are not provided for measures given the AMA's decision to discontinue the maintenance of CPT II codes. The AAN is in the process of creating code value sets and the logic required for electronic capture of the quality measures with EHRs, when possible. A listing of the quality data model elements, code value sets, and measure logic (through the CMS Measure Authoring Tool) for each of the measures will be made available at a later date. These technical specifications will be updated as warranted.

Testing and Implementation of the Measurement Set

The measures in this set are being made available without any prior testing. The AAN encourages testing of this measurement set for feasibility and reliability by organizations or individuals positioned to do so. Select measures will be beta tested once the set has been released, prior to submission to the National Quality Forum for possible endorsement.

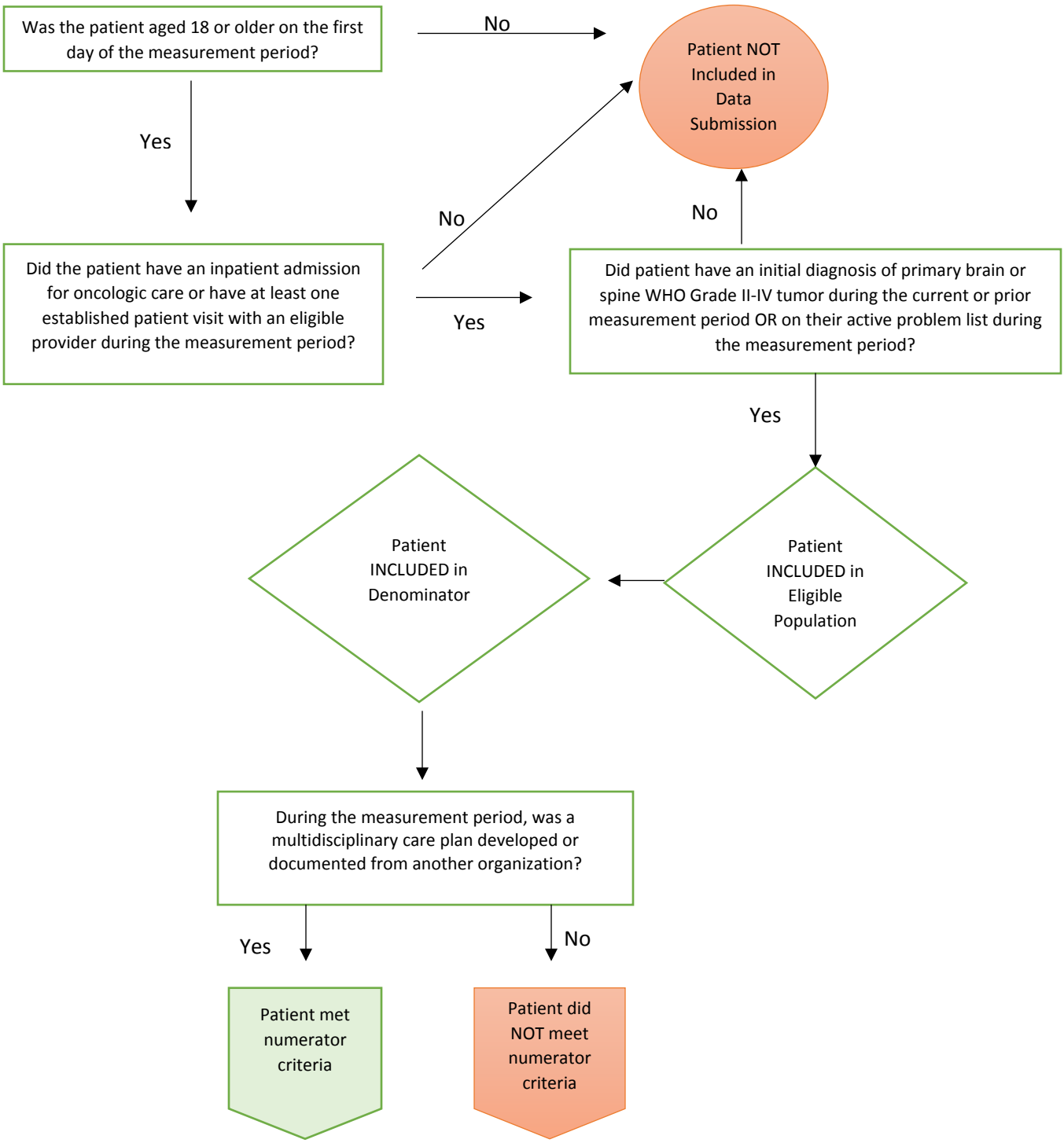
2016 Neuro-Oncology Measure Specifications and Flow Sheets

Measure Title	Multidisciplinary Care Plan Developed for Primary Brain or Spine Tumors	
Description	Percentage of patients with a new diagnosis of primary brain or spine Central Nervous System (CNS) World Health Organization (WHO) Grade II-IV tumor with a multidisciplinary tumor board treatment plan developed.	
Measurement Period	January 1, 20xx to December 31, 20xx	
Eligible Population	**Eligible Providers**	Medical Doctor (MD), Doctor of Osteopathy (DO), Physician Assistant (PA), Advanced Practice Registered Nurse (APRN)
	Care Setting(s)	Inpatient and Outpatient
	Ages	18 years and older
	Event	Patient had an office visit performed or supervised by an eligible provider as an established patient (Established Patient Value Set) or admitted to an inpatient unit for oncologic care during the measurement period.
	Diagnosis	New diagnosis of a primary brain or spine CNS WHO Grade II-IV tumor. (See comprehensive diagnostic list below)
Denominator	All patients diagnosed in the measurement period with a new diagnosis of primary brain or spine CNS WHO Grade II-IV tumor. (See comprehensive diagnostic list in code table below)	
Numerator	Patients with a multidisciplinary tumor board treatment plan* developed in the 12-month measurement period. *Multidisciplinary tumor board treatment plan is defined as a treatment planning approach in which several doctors who are experts in different specialties (disciplines) meet at one time to review and discuss the medical condition and treatment options of a patient. In cancer treatment, a tumor board may include a medical oncologist (who provides cancer treatment with drugs), a surgical oncologist (who provides cancer treatment with surgery), and a radiation oncologist (who provides cancer treatment with radiation).(1) The measure may be met if a treatment plan developed by a third party tumor board is present in the patient's medical record. The measure would not be met if the only evidence of multidisciplinary input resides in clinical notes from individual clinicians in multiple specialties.	
Required Exclusions	None	
Allowable Exclusions	None	
Exclusion Rationale	Not Applicable	
Measure Scoring	Percentage/Proportion	
Interpretation of Score	Higher Score Indicates Better Quality	
Measure Type	Process	
Level of Measurement	Provider, Practice and Hospital	
Risk Adjustment	Not Applicable	
For Process Measures Relationship to Desired Outcome	This measure is intended to improve patient centered care, early and appropriate palliative care, and reduce chemotherapy within 14 days of death. Multidisciplinary care is linked to improved patient centered care.(2) This measure is intended to improve implementation of clinical practice guidelines using case review and team-based care planning. By reviewing patient's presentation with a multidisciplinary team patients benefit from reduced variation of care delivery, improved access to appropriate treatment, including clinical trials, and reduction of inappropriate or unnecessary treatments.(3)	

	
Opportunity to Improve Gap in Care	Multidisciplinary tumor board discussions for care plan determination have been associated with improved quality and coordination of care in various cancers and are a well-established quality indicator in oncology care, both in the United States and abroad.(2,4) One study of brain tumor board discussions revealed that 91% of 1516 clinical recommendations from such discussions are implemented clinically, demonstrating the utility of multidisciplinary input in neuro-oncology cases.(5) Another study showed that patients treated by physicians who attend weekly tumor boards are significantly more likely be enrolled in clinical trials for various cancers, and patient survival is better when physicians attend a specialized tumor board as compared to a general oncology tumor board, thus a treatment gap does exist.(6) Providers and teams are encouraged to present cases beyond those enumerated in the denominator if it may be to the benefit of the patient. The denominator was narrowed to avoid burden of presenting cases that may be inappropriate for review and presentation to the tumor board. It is the work group's expectation that any plan developed has considered National Comprehensive Cancer Network (NCCN) Central Nervous System Cancers guideline recommendations(7) and has a strong basis in evidence. The work group has mirrored the definition of the National Cancer Institute (NCI) tumor board review for measurement purposes. Individual practices and systems will need to finalize the make-up of their tumor boards. The work group believes input must be received from three specialties: neurosurgery, radiation oncology and medical neuro-oncology. Additional input from radiologists and pathologists would be beneficial to individuals with brain and spine tumors. This measure will be updated routinely and during periodic reviews, unexpected consequences will be evaluated including potential fee structures instituted by third party review boards. The work group anticipates that relationships may be developed between facilities to reduce or limit the fees for any review being passed on directly to patients.
Harmonization with Existing	No similar measures known.

Measures	
References	1. National Cancer Institute (NCI). NCI Dictionary of Cancer Terms. Available online at: https://www.cancer.gov/publications/dictionaries/cancer-terms?cdrid=322860 Accessed on September 22, 2016. 2. Wright FC, De Vito C, Langer B, et al. Expert Panel on Multidisciplinary Cancer Conference Standards. Multidisciplinary cancer conferences: a systematic review and development of practice standards. Eur J Cancer 2007;43(6):1002-1010. 3. Guilfoyle MR, Weerakkody RA, Oswal A, et al. Implementation of neuro-oncology service reconfiguration in accordance with NICE guidance provides enhanced clinical care for patients with glioblastoma multiforme. British Journal of Cancer 2011;104:1810-1815. 4. American College of Surgeons. Cancer Program Standards: Ensuring Patient-Centered Care. 2016 Edition. 84 p. Available at: https://www.facs.org/~/media/files/quality%20programs/cancer/coc/2016%20coc%20standards%20manual_interactive%20pdf.ashx Accessed on September 6, 2016. 5. Lutterbach J, Pagenstecher A, Spreer J, et al. The brain tumor board: lessons to be learned from an interdisciplinary conference. Onkologie 2005;28(1):22-26. 6. Kehl KL, Landrum MB, Kahn KL, et al. Tumor board participation among physicians caring for patients with lung or colorectal cancer. J Oncol Pract. 2015 May;11(3):e267-78. 7. National Comprehensive Cancer Network (NCCN). NCCN Guidelines Version 1.2016 Central Nervous System Cancers. January 2016. Available online at: https://www.nccn.org/professionals/physician_gls/f_guidelines.asp Accessed on October 14, 2016.

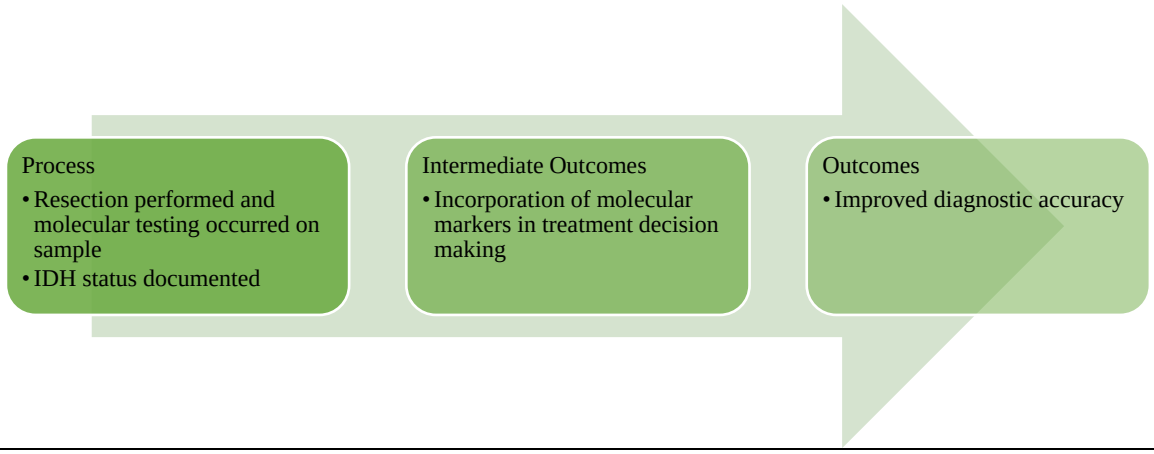
Flow Chart Diagram



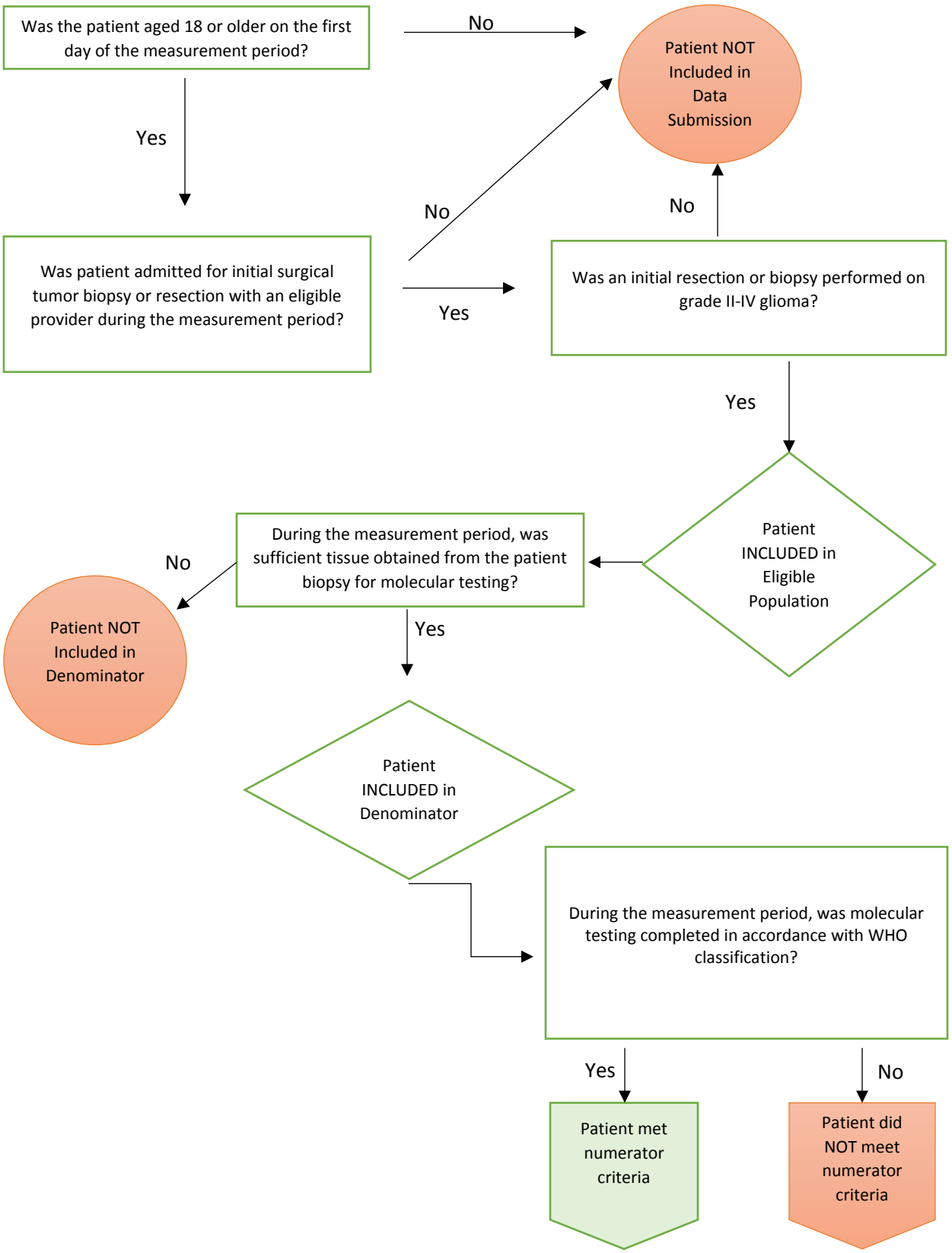
Code System	Code	Code Description
		Meningioma
		Anaplastic meningioma
		Atypical meningioma
		Diffuse astrocytic and oligodendroglial tumors
		Diffuse astrocytoma, IDH-mutant
		Gemistocytic astrocytoma, IDH-mutant
		Diffuse astrocytoma, IDH-wildtype
		Diffuse astrocytoma, NOS
		Anaplastic astrocytoma, IDH-mutant
		Anaplastic astrocytoma, IDH-wildtype
		Anaplastic astrocytoma, NOS
		Glioblastoma, IDH-wildtype
		Giant cell glioblastoma
		Gliosarcoma
		Epithelioid glioblastoma
		Glioblastoma, IDH-mutant
		Glioblastoma, NOS
		Diffuse midline glioma, H3 K27M-mutant
		Oligodendroglioma, IDH-mutant and 1p/19q-codeleted
		Anaplastic oligodendroglioma, IDH-mutant and 1p/19q-codeleted
		Other astrocytic tumors
		Pilomyxoid astrocytoma
		Pleomorphic xanthoastrocytoma
		Anaplastic pleomorphic xanthoastrocytoma
		Ependymal tumors
		Ependymoma
		Clear cell ependymoma
		Tanycytic ependymoma
		Ependymoma, RELA fusion-positive
		Anaplastic ependymoma
		Other gliomas
		Chordoid glioma of the third ventricle
		Angiocentric glioma
		Astroblastoma
		Neuronal and mixed neuronal-glial tumors
		Anaplastic gangliglioma
		Diffuse leptomeningeal glioneuronal tumor
		Embryonal tumors
		Medulloblastomas, genetically defined
		Medulloblastoma, WNT-activated
		Medulloblastoma, SHH-activated and TP53-mutant
		Medulloblastoma, SHH-activated and TP53-wildtype
		Medulloblastoma, non-WNT/non-SHH
		Medulloblastoma, group 3
		Medulloblastoma, group 4

		Medulloblastomas, histologically defined
		Medulloblastoma, classic
		Medulloblastoma, desmoplastic/nodular
		Medulloblastoma with extensive nodularity
		Medulloblastoma, large cell/anaplastic
		Medulloblastoma, NOS
		Embryonal tumor with multilayered rosettes, C19MC-altered
		Embryonal tumor with multilayered rosettes, NOS
		Medulloepitheleioma
		CNS neuroblastoma
		CNS ganglioneuroblastoma
		CNS embryonal tumor, NOS
CPT	99211-99215	Office or Other Outpatient Visit - Established Patient (E/M Codes)
CPT	99231-99233	Subsequent Hospital Care
CPT	99238-99239	Hospital Discharge

Measure Title	Molecular Testing in Accordance with World Health Organization Classification of Tumors of the Central Nervous System	
Description	Percentage of patients 18 years and older who have had an initial resection or biopsy of their grade II-IV glioma and molecular testing was performed in accordance with most recent World Health Organization (WHO) classification flow.	
Measurement Period	January 1, 20xx to December 31, 20xx	
Eligible Population	**Eligible Providers**	Medical Doctor (MD), Doctor of Osteopathy (DO), Physician Assistant (PA), Advanced Practice Registered Nurse (APRN)
	Care Setting(s)	Inpatient
	Ages	18 years and older
	Event	Initial resection or biopsy of grade II-IV glioma
	Diagnosis	Grade II-IV glioma
Denominator	Patients 18 years and older who have had an initial resection or biopsy of grade II-IV glioma.	
Numerator	Patients with molecular testing* performed in accordance with most recent WHO classification flow. *Molecular testing in accordance with WHO classification ensures that an integrated diagnosis is available for each tumor, and may change over time. As an example, for astrocytomas (grade II-III), oligodendrogliomas (grade II-III), or glioblastomas (grade IV), isocitrate dehydrogenase (*IDH*) mutation testing currently must be reported as a component of the integrated diagnosis. Based on the 2016 WHO Classification of Tumors of the Central Nervous System, *IDH1* R132H immunohistochemistry would be sufficient if positive, but for negative immunohistochemical staining, sequencing of both *IDH1* and *IDH2* is recommended except in glioblastoma patients over 55 years of age (where the likelihood of a non-R132H mutation is <1%). Further, 1p/19q co-deletion status is required for a diagnosis of oligodendroglioma (grade II-III) in the present diagnostic schema. These diagnostic requirements include required molecular testing in many additional histologies, and are subject to change over time. Fulfillment of this measure will include additional and future molecular testing in line with updates to the WHO classification guidelines.	
Required Exclusions	Patients with tissue insufficient for molecular testing.	
Allowable Exclusions	None	
Exclusion Rationale	Without adequate testing sample, complete molecular testing is impossible to achieve.	
Measure Scoring	Percentage/Proportion	
Interpretation of Score	Higher Score Indicates Better Quality	
Measure Type	Process	
Level of Measurement	Provider and Hospital	
Risk Adjustment	Not Applicable	
For Process Measures Relationship to Desired Outcome	This measure is intended to improve diagnostic accuracy, increasing the number of patients who received a definitive diagnosis and prognostic information following resection and molecular testing in accordance with WHO classification system.(1) This information also aids in appropriate therapeutic decision making.	

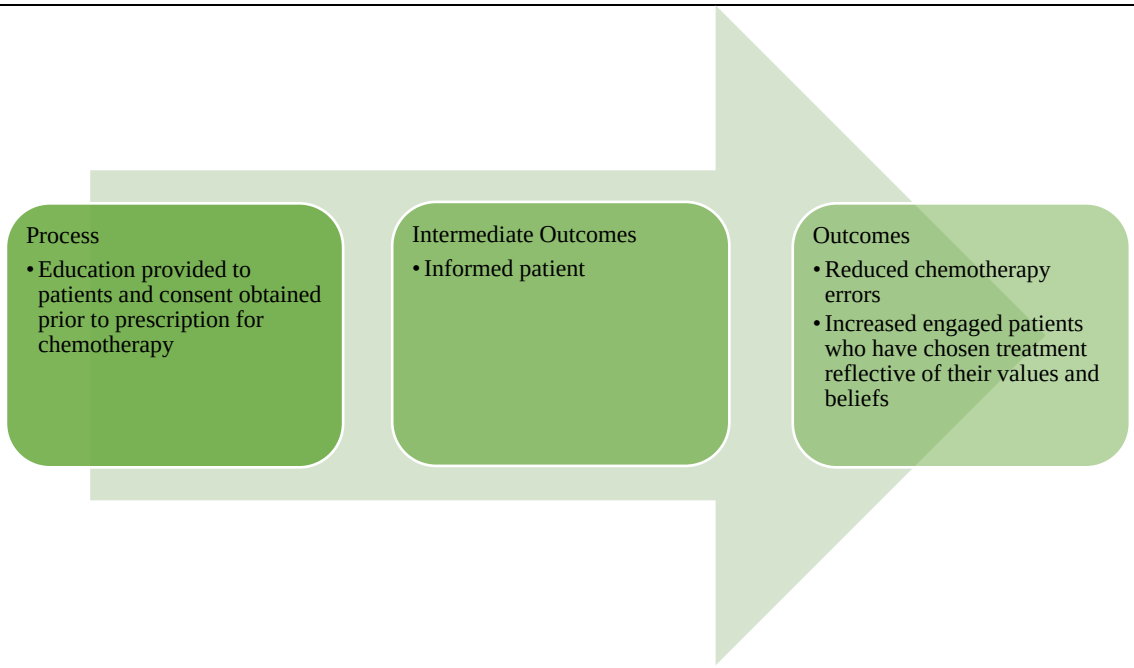
	
Opportunity to Improve Gap in Care	The work group developed the measure to improve diagnostic precision, thereby improving prognostication and therapeutic decision-making. By conducting molecular testing of gliomas in compliance with WHO guidelines, isocitrate dehydrogenase (IDH) status will be routinely recorded, as well as 1p/19q co-deletion status in appropriate cases. Before the release of the most recent WHO guideline, the evaluation of these markers was not required for the integrated diagnosis of a glioma. IDH mutation portends a marked improvement in glioma prognosis; it is commonly found in lower grade gliomas, and its presence in a newly diagnosed GBM may reflect a transformation from a previously lower grade glioma.(1,2) There is also an opportunity to use mutation status to drive treatment planning.(3) Codeletion of 1p/19q also confers improved prognosis for anaplastic gliomas(4) and more specifically indicate an oligodendroglial phenotype of tumor(1). O^6-methylguanin-DNA-methyltransferase (MGMT) mutation testing is encouraged, but the current evidence was not strong enough to support development of a measure.
Harmonization with Existing Measures	No similar measures known.
References	1. Louis DN, Perry A, Reifenberger G, et al. The 2016 World Health Organization Classification of Tumors of the Central Nervous System: a summary. Acta Neuropathologica 2016;131:803. 2. Hottinger AF, Homiscko K., Negretti L, et al. Decision making and management of gliomas: practical considerations. Annals of Oncology 2012;23(10):x33-x40. 3. Millward CP, Brodbelt AR, Haylock B, et al. The impact of MGMT methylation and IDH-1 mutation on long-term outcome for glioblastoma treated with chemoradiotherapy. Acta Neurochir 2016;158(10):1943-1953 4. Cairncross G, Wang M, Shaw E, et al. Phase III trial of chemoradiotherapy for anaplastic oligodendroglioma: long-term results of RTOG 9402. J Clin Onc 2013; 31(3) 337-43.

Flow Chart Diagram



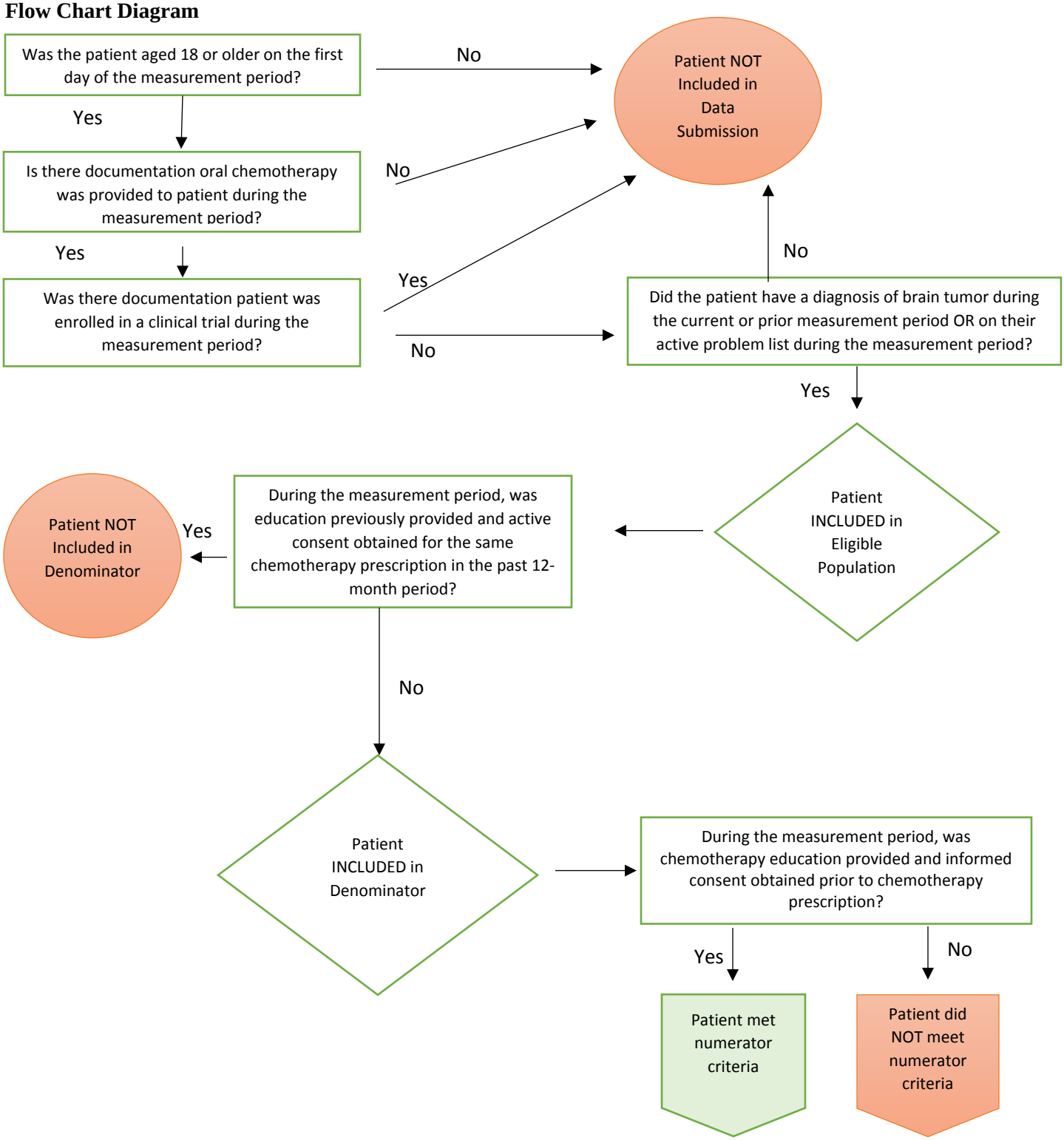
Code System	Code	Code Description
		Diffuse astrocytic and oligodendroglial tumors
		Diffuse astrocytoma, IDH-mutant
		Gemistocytic astrocytoma, IDH-mutant
		Diffuse astrocytoma, IDH-wildtype
		Diffuse astrocytoma, NOS
		Anaplastic astrocytoma, IDH-mutant
		Anaplastic astrocytoma, IDH-wildtype
		Anaplastic astrocytoma, NOS
		Glioblastoma, IDH-wildtype
		Giant cell glioblastoma
		Gliosarcoma
		Epithelioid glioblastoma
		Glioblastoma, IDH-mutant
		Glioblastoma, NOS
		Diffuse midline glioma, H3 K27M-mutant
		Oligodendroglioma, IDH-mutant and 1p/19q-codeleted
		Anaplastic oligodendroglioma, IDH-mutant and 1p/19q-codeleted
CPT	61304	Craniectomy or craniotomy, exploratory; supratentorial
CPT	61500	Craniectomy; with excision of tumor or other bone lesion of skull
CPT	61510	Craniectomy, trephination, bone flap craniotomy; for excision of brain tumor, supratentorial, except meningioma
CPT	61516	Craniectomy, trephination, bone flap craniotomy; for excision or fenestration of cyst, supratentorial
CPT	61526	Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor;
CPT	61530	Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor; combined with middle/posterior fossa craniotomy/craniectomy
CPT	61545	Craniotomy with elevation of bone flap; for excision of craniopharyngioma
CPT	61140	Burr hole(s) or trephine; with biopsy of brain or intracranial lesion
CPT	61751	Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion; with computed tomography and/or magnetic resonance guidance
CPT	61750	Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion;

Measure Title	Chemotherapy Education and Informed Consent for Brain Tumor Patients	
Description	Percentage of patients prescribed chemotherapy outside of a clinical trial for a diagnosis of brain tumor who were provided chemotherapy education AND from whom informed consent was obtained prior to prescription of chemotherapy.	
Measurement Period	January 1, 20xx to December 31, 20xx	
Eligible Population	**Eligible Providers**	Medical Doctor (MD), Doctor of Osteopathy (DO), Physician Assistant (PA), Advanced Practice Registered Nurse (APRN)
	Care Setting(s)	Inpatient and Outpatient
	Ages	18 years and older
	Event	Patient was prescribed chemotherapy outside of a clinical trial for a brain tumor.
	Diagnosis	Brain Tumor
Denominator	Patients 18 years and older with a diagnosis of brain tumor who were prescribed chemotherapy outside of a clinical trial. (See comprehensive diagnostic list in code table below)	
Numerator	Patients who were provided chemotherapy education AND for whom informed consent was obtained prior to prescription of chemotherapy. (See education and informed consent requirements below)	
Required Exclusions	Education and active consent obtained for same chemotherapy prescription in the past 12-month period.	
Allowable Exclusions	None	
Exclusion Rationale	Consent would not need to be obtained if already obtained for same chemotherapy prescription due to previous treatment. Giving any additional education and consent would be duplicative. A consent should be obtained from surrogate legal decision makers when a patient is unable to consent to treatment.	
Measure Scoring	Percentage/Proportion	
Interpretation of Score	Higher Score Indicates Better Quality	
Measure Type	Process	
Level of Measurement	Provider and Practice	
Risk Adjustment	Not Applicable	
For Process Measures Relationship to Desired Outcome	This measure is intended to reduce chemotherapy errors and increase patient engagement.	

	
Opportunity to Improve Gap in Care	Guidelines indicate that all patients who are prescribed chemotherapy should be provided education in advance of prescription.(1) Errors can occur in the home administration of oral chemotherapy and the likelihood of harm is great.(2) Education of patients and caregivers to reduce the risk of error is vital, as well as to empower them to speak up if an error occurs.(2) There are additional concerns surrounding the administration of oral chemotherapy. A recent review of practice-level systems indicated opportunities for quality improvement efforts for this safe management of chemotherapy for high risk population.(3)
Education and Informed Consent Requirement's	To meet the numerator, the following American Society of Clinical Oncology (ASCO) standards for education and informed consent are required. These requirements are taken verbatim from ASCO's 2013 Updated American Society of Clinical Oncology/Oncology Nursing Society Chemotherapy Administration Safety Standards Including Standards for the Safe Administration and Management of Oral Chemotherapy: "Before initiation of a chemotherapy regimen, each patient is given written documentation, including, at minimum: A. Information regarding his or her diagnosis B. Goals of therapy C. Planned duration of chemotherapy, drugs, and schedule D. Information on possible short- and long-term adverse effects, including infertility risks E. Regimen- or drug-specific risks or symptoms that require notification and emergency contact information, including: • How to contact the practice or organization • Symptoms that should trigger a call • Who should be called in specific circumstances (oncologist or other provider) F. Plan for monitoring and follow-up, including appointments with practitioners or laboratory testing *Patient education materials should be appropriate for the patient's reading level/literacy and patient-caregiver understanding. Documentation should include patient feedback reflecting understanding and engagement.*" (original emphasis) (1)
Harmonization with Existing Measures	No similar measures known.

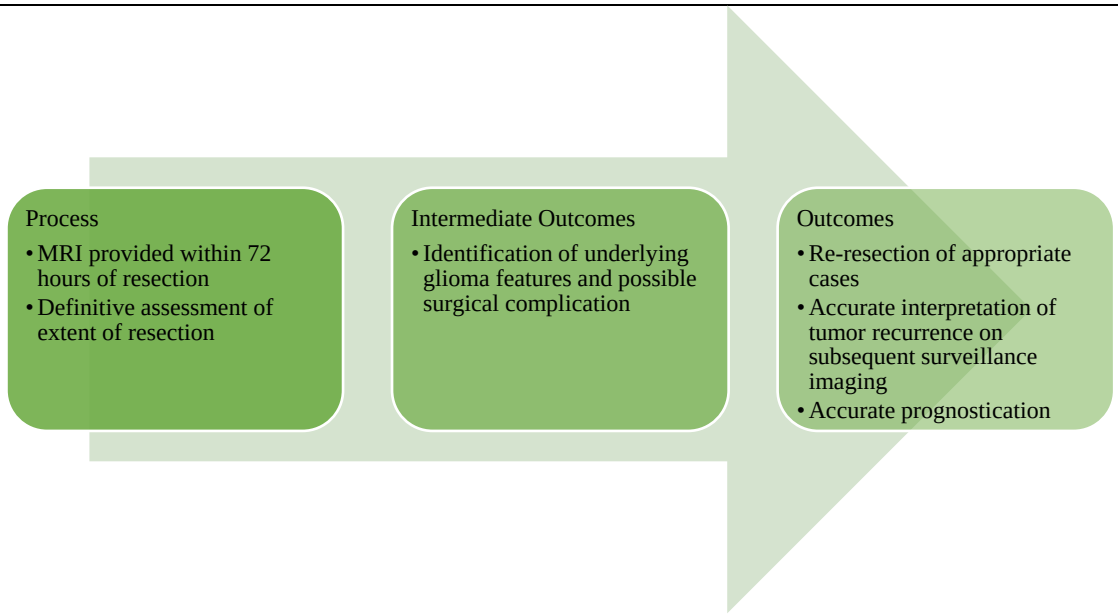
References	1. Neuss MN, Polovich M, McNiff K, et al. 2013 Updated American Society of Clinical Oncology/Oncology Nursing Society Chemotherapy Administration Safety Standards Including Standards for the Safe Administration and Management of Oral Chemotherapy. 2. Schwappach DLB and Wernli M. Medication errors in chemotherapy: incidence, types and involvement of patients in prevention. A review of the literature. European Journal of Cancer Care 2010;19:285-292. 3. Zerillo JA, Pham TH, Kadlubek P, et al. Administration of Oral Chemotherapy: Results From Three rounds of Quality Oncology Practice Initiative. J Oncol Pract. 2015;11(2):2255-2262.

Flow Chart Diagram

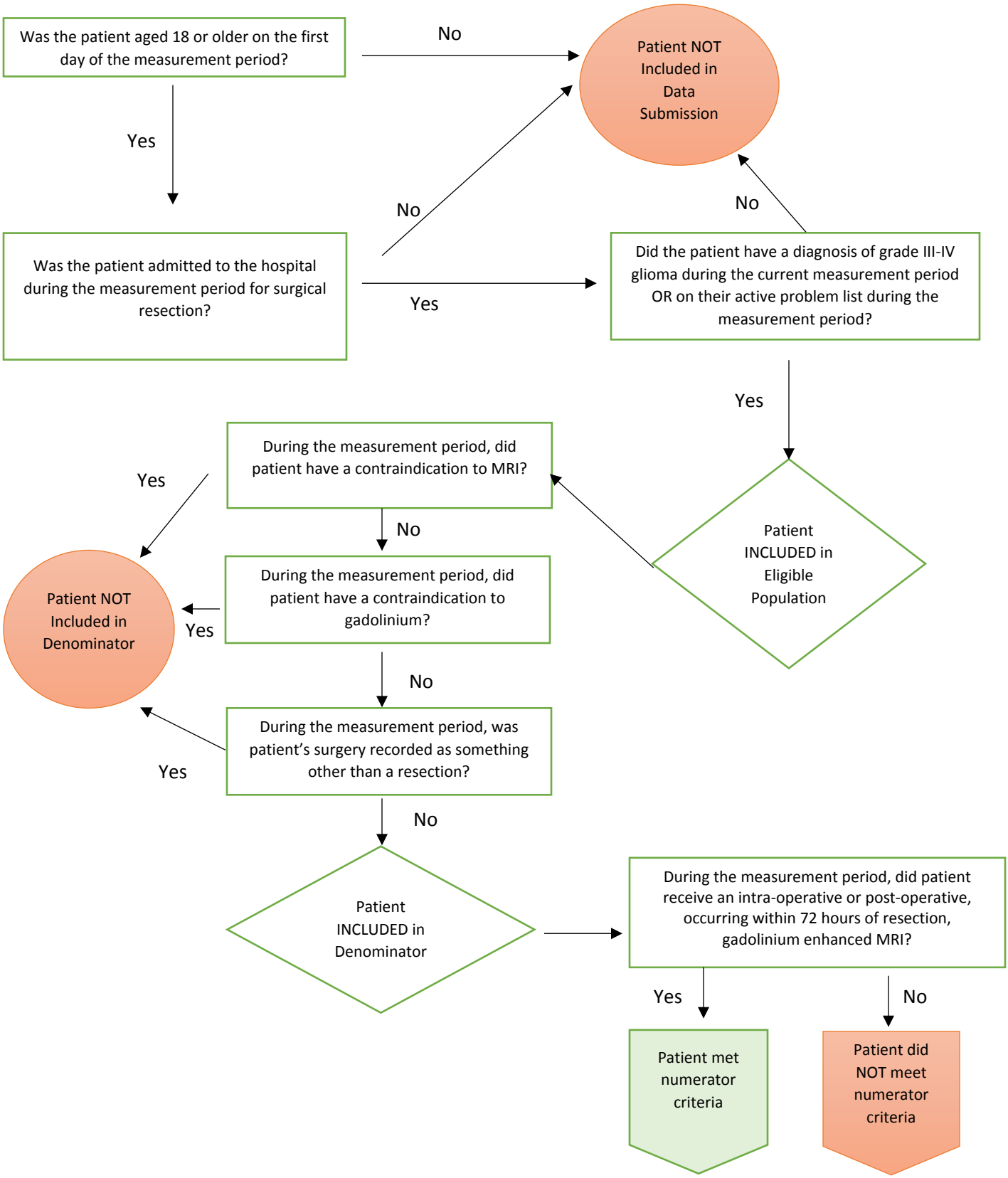


Code System	Code	Code Description
ICD-10-CM	C70	Malignant neoplasm of meninges
ICD-10-CM	C70.0	Malignant neoplasm of cerebral meninges
ICD-10-CM	C70.1	Malignant neoplasm of spinal meninges
ICD-10-CM	C70.9	Malignant neoplasm of meninges, unspecified
ICD-10-CM	C71.0	Malignant neoplasm of cerebrum, except lobes and ventricles
ICD-10-CM	C71.1	Malignant neoplasm of frontal lobe
ICD-10-CM	C71.2	Malignant neoplasm of temporal lobe
ICD-10-CM	C71.3	Malignant neoplasm of parietal lobe
ICD-10-CM	C71.4	Malignant neoplasm of occipital lobe
ICD-10-CM	C71.5	Malignant neoplasm of cerebral ventricle
ICD-10-CM	C71.6	Malignant neoplasm of cerebellum
ICD-10-CM	C71.7	Malignant neoplasm of brain stem
ICD-10-CM	C71.8	Malignant neoplasm of overlapping sites of brain
ICD-10-CM	C71.9	Malignant neoplasm of brain, unspecified
CPT	96400	Chemotherapy administration services
CPT	96408 to 96425	Chemotherapy administration services
CPT	96520	Chemotherapy administration services
CPT	96530	Chemotherapy administration services

Measure Title	Intra-Operative or Post-Operative MRI for Gliomas	
Description	Percentage of patients undergoing a surgical resection for grade III-IV glioma who had an intra-operative or post-operative gadolinium enhanced MRI.	
Measurement Period	January 1, 20xx to December 31, 20xx	
Eligible Population	**Eligible Providers**	Medical Doctor (MD), Doctor of Osteopathy (DO), Physician Assistant (PA), Advanced Practice Registered Nurse (APRN)
	Care Setting(s)	Inpatient
	Ages	18 years and older
	Event	Patient hospitalized for a surgical resection of glioma Grade III-IV
	Diagnosis	Grade III-IV glioma
Denominator	Patients 18 years and older with a diagnosis of grade III-IV glioma who undergo a surgical resection. (See comprehensive diagnostic list in code table below)	
Numerator	Patients who had a post-operative^ gadolinium enhanced MRI of the brain or an intraoperative* MRI of the brain with or without gadolinium. ^Post-operative MRI must be obtained within 72 hours of the surgical resection.(1) *Intraoperative MRI is often of poorer quality than post-operative MRI for true extent-of-resection visualization and for radiation planning, based both on limited sequences performed and brain landmark shifting during craniotomy. As such, while intraoperative MRI will count toward this measure numerator as a minimum amount of perioperative imaging, it is suggested that post-operative MRI (within 72 hours of surgical resection) remain the standard imaging timing where possible.(2)	
Required Exclusions	Patients with a contraindication for MRI. (i.e., presence of pacemaker, intracranial metal clip, metallic body in the eye, or neurostimulator). Patients with a contraindication for receiving gadolinium. Patients who undergo surgery for purposes other than cytoreduction (i.e. diagnostic biopsy only).	
Allowable Exclusions	None	
Exclusion Rationale	Exclusions required to prevent harm from patients. If patient has a contraindication to either MRI or gadolinium they are excluded from the denominator to avoid potential harm. However, such patients should have a post-operative head CT in order to provide similar (albeit lower resolution) data. Measure should not apply to individuals undergoing surgery for purposes other than cytoreduction to prevent unnecessary testing.	
Measure Scoring	Percentage/Proportion	
Interpretation of Score	Higher Score Indicates Better Quality	
Measure Type	Process	
Level of Measurement	Provider, Practice and Hospital	
Risk Adjustment	Not Applicable	

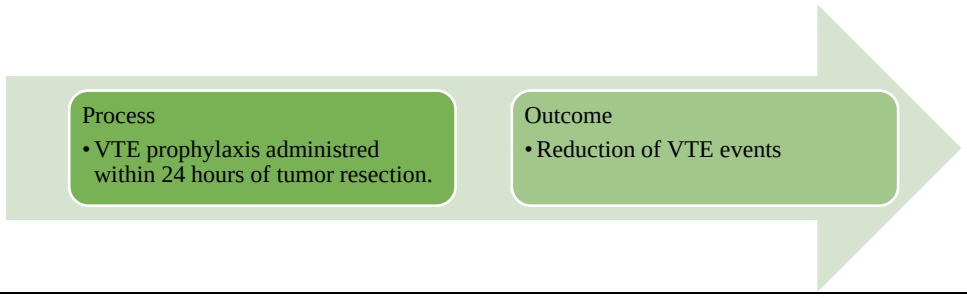
For Process Measures Relationship to Desired Outcome	 This measure is intended to assist in development of appropriate treatment planning and identification of possible surgical complications through appropriate MRI use. MRI imaging can help determine extent of resection and identify baseline residual tumor both of which can be important for prognostication.(3,4) It is anticipated that additional information gained through the MRI will be beneficial to development of a treatment plan that may include clinical trials.
Opportunity to Improve Gap in Care	Current statistics on performance of intra-operative or post-operative gadolinium enhanced MRI for glioma are not available. It is anticipated that by measuring performance a treatment gap will be confirmed and further opportunities for improvement will be identified. During public comment, there was concern of potential unintended consequences of increased care costs. The measure provides a 72-hour window for completion, reducing the need to use STAT orders for the MRI. The work group will reevaluate the measure during the next update to determine if these consequences materialized.
Harmonization with Existing Measures	No similar measures known.
References	1. Stupp R, Roila F and On behalf of the ESMO Guidelines Working Group. Malignant glioma: ESMO Clinical Recommendations for diagnosis, treatment and follow-up. Ann Oncol 2009; 20(suppl 4);iv126-iv128. 2. Lau D, Hervey-Jumper SL, Han SJ, et al. Intraoperative Perception and Estimates on Extent of Resection During Awake Glioma Surgery: Overcoming the Learning Curve. Neurosurg 2017 July 21:1-9. Epub ahead of print. 3. Albert FK, Forsting M, Sartor K, et al. Early postoperative magnetic resonance imaging after resection of malignant glioma: objective evaluation of residual tumor and its influence on regrowth and prognosis. Neurosurgery. 1994; 34(1):45-60. 4. Kao HW, Chiang SW, Chung HW, et al. Advanced MR Imaging of Gliomas: An Update. BioMed Research International 2013; Article 970586. p 14.

Flow Chart Diagram

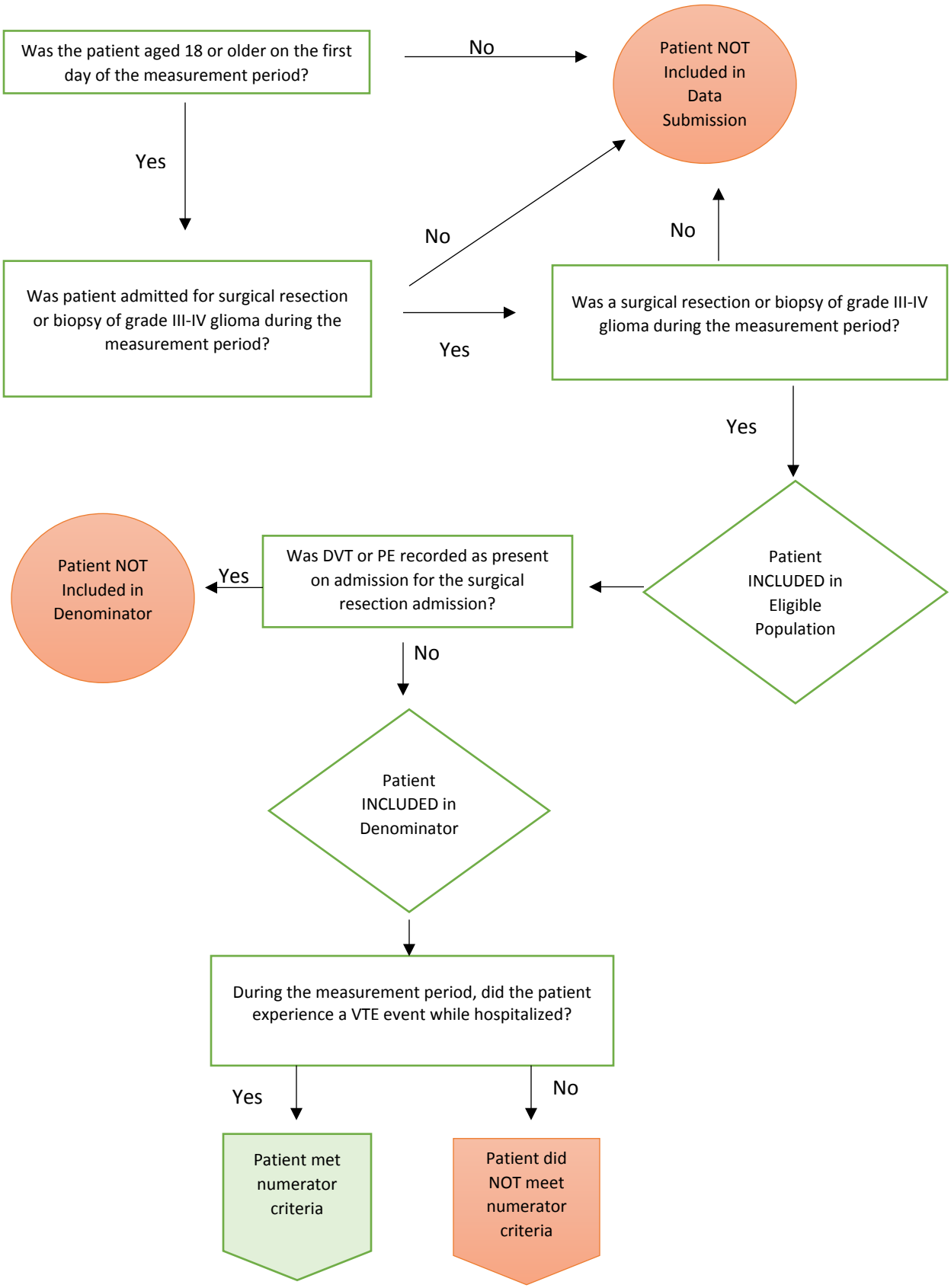


Code System	Code	Code Description
		Anaplastic astrocytoma, IDH-mutant
		Anaplastic astrocytoma, IDH-wildtype
		Anaplastic astrocytoma, NOS
		Glioblastoma, IDH-wildtype
		Giant cell glioblastoma
		Gliosarcoma
		Epithelioid glioblastoma
		Glioblastoma, IDH-mutant
		Glioblastoma, NOS
		Diffuse midline glioma, H3 K27M-mutant
		Anaplastic oligodendroglioma, all types
CPT	61304	Craniectomy or craniotomy, exploratory; supratentorial
CPT	61500	Craniectomy; with excision of tumor or other bone lesion of skull
CPT	61510	Craniectomy, trephination, bone flap craniotomy; for excision of brain tumor, supratentorial, except meningioma
CPT	61516	Craniectomy, trephination, bone flap craniotomy; for excision or fenestration of cyst, supratentorial
CPT	61526	Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor;
CPT	61530	Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor; combined with middle/posterior fossa craniotomy/craniectomy
CPT	61545	Craniotomy with elevation of bone flap; for excision of craniopharyngioma
CPT	99231-99233	Subsequent Hospital Care
CPT	99238-99239	Hospital Discharge
CPT	99251-99255	Initial Inpatient Consultation

Measure Title	Venous Thromboembolism Events (VTE) Following Primary Brain Tumor Surgery	
Description	Percentage of patients who had a surgical resection or biopsy of their grade III-IV glioma and experienced a Deep Vein Thrombosis (DVT) or pulmonary embolism (PE) event during their immediate post-surgical hospitalization.	
Measurement Period	January 1, 20xx to December 31, 20xx	
Eligible Population	**Eligible Providers**	Medical Doctor (MD), Doctor of Osteopathy (DO), Physician Assistant (PA), Advanced Practice Registered Nurse (APRN)
	Care Setting(s)	Inpatient
	Ages	18 years and older
	Event	Patient hospitalized for a surgical resection or biopsy of grade III-IV glioma
	Diagnosis	Grade III-IV glioma
Denominator	All patients who had resection or biopsy of grade III-IV glioma. (See comprehensive diagnostic list in code table below)	
Numerator	Patients who experience a DVT or PE event during their immediate post-surgical hospitalization, identified on diagnostic testing performed.	
Required Exclusions	None	
Allowable Exclusions	DVT or PE present admission	
Exclusion Rationale	Not Applicable	
Measure Scoring	Percentage/Proportion	
Interpretation of Score	Lower Score Indicates Better Quality	
Measure Type	Outcome	
Level of Measurement	Provider and Hospital	
Risk Adjustment	*See Appendix A AAN Statement on Comparing Outcomes of Patients* *This measure is being made available in advance of development of a risk adjustment strategy. Individuals commenting on the measures are encouraged to provide input on potential risk adjustment or stratification methodologies. The work group identified the following potential data elements that may be used in a risk adjustment methodology for this measure:* • Type of tumor (main volume GBM will have higher risk) • Comorbidities • Nonambulatory patients (nonambulatory status noted preoperative) higher risk • KPS ≤ 50 or ECOG ≤ 2 will have higher risk • Refusal of chemical or mechanical prophylaxis • Administration of chemical or mechanical prophylaxis • Length of OR time greater than 4 hours • Length of admission • Hemiparesis (tumor-related)	
Desired Outcome	This measure is intended to monitor adverse thromboembolic events following a brain tumor resection.	

	
Opportunity to Improve Gap in Care	Venous thromboembolism (VTE) is a common complication for patients who have a malignant glioma and occur at a higher percentage (25-39%)(1-3) than in the general population (1-2%).(4) The Work Group discussed development of a process measure evaluating the performance rates on administration of chemical or mechanical prophylaxis following surgery. It was noted that adherence rates to potential process measures would leave little room for improvement given current prophylaxis practices. The Work Group felt the measure was ripe to move to direct measurement of an outcome as a result. Known VTE risks extend beyond hospitalization, as some individuals will develop a clot after they are discharged. The work group evaluated development of a measure with a time component but current EHR practices prevent feasibility of such a measure. Providers are unable to capture data on VTE events without outreaching to patients directly or receiving notification from treatment facilities if admitted to an alternate hospital for treatment of their VTE event. This issue will be revisited during planned, periodic updates of the measure. The intent of the measure is to reduce VTE events, not increase unnecessary screening ultrasounds or reduce evaluation of PE or DVT symptoms while hospitalized. With proper risk adjustment there is low likelihood providers would 'game' the measure with these practices. Additionally, providers must be aware that 0% performance rate is not possible, but a low performance rate is desirable.
Harmonization with Existing Measures	No similar measures known.
References	1. Silvani A, Gaviani P, Lamperti E, et al. Metabolic, electrolytes disorders and thromboembolic risk in malignant glioma patients. Neurol Sci 2011;32 Suppl 2:S229-231. 2. Mandel JJ, Yust-Katz S, Wu J, et al. Venous thromboembolism (VTE) and glioblastoma. J Clin Oncol 2014; 32:5s. 3. Edwin NC, Elson P, Ahluwalia MS, Khorana AA. Venous thromboembolism in patients with glioblastoma: risk factors and prognostic importance. J Clin Oncol 2015; 33s. 4. Fowkes FJ, Price JF, Fowkes FG. Incidence of diagnoses deep vein thrombosis in the general population: systematic review. Eur J Vasc Endovasc Surg 2003; 25(1):1-5.

Flow Chart Diagram



Code System	Code	Code Description
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		Gliosarcoma
		Epithelioid glioblastoma
		Glioblastoma, IDH-mutant
		Glioblastoma, NOS
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CPT	61530	Craniectomy, bone flap craniotomy, transtemporal (mastoid) for excision of cerebellopontine angle tumor; combined with middle/posterior fossa craniotomy/craniectomy
CPT	61545	Craniotomy with elevation of bone flap; for excision of craniopharyngioma
CPT	61140	Burr hole(s) or trephine; with biopsy of brain or intracranial lesion
CPT	61751	Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion; with computed tomography and/or magnetic resonance guidance
CPT	61750	Stereotactic biopsy, aspiration, or excision, including burr hole(s), for intracranial lesion;
CPT	99231-99233	Subsequent Hospital Care
CPT	99238-99239	Hospital Discharge
CPT	99251-99255	Initial Inpatient Consultation

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Appendix A AAN Statement on Comparing Outcomes of Patients

Why this statement: Characteristics of patients can vary across practices and differences in those characteristics may impact the differences in health outcomes among those patients. Some examples of these characteristics are: demographics, co-morbidities, socioeconomic status, and disease severity. Because these variables are typically not under the control of a clinician, it would be inappropriate to compare outcomes of patients managed by different clinicians and practices without accounting for those differences in characteristics among patients. There are many approaches and models to improve comparability, but this statement will focus on risk adjustment. This area continues to evolve (1), and the AAN will revisit this statement regularly to ensure accuracy, as well as address other comparability methods (2) should they become more common.

AAN quality measures are used primarily to demonstrate compliance with evidence-based and consensus-based best practices within a given practice as a component of a robust quality improvement program. The AAN includes this statement to caution against using certain measures, particularly outcome measures, for comparison to other individuals/practices/hospitals without the necessary and appropriate risk adjustment.

What is Risk Adjustment: Risk adjustment is a statistical approach that can make populations more comparable by controlling for patient characteristics (most commonly adjusted variable is a patient's age) that are associated with outcomes but are beyond the control of the clinician. By doing so, the processes of care delivered and the outcomes of care can be more strongly linked.

Comparing measure results from practice to practice: For process measures, the characteristics of the population are generally not a large factor in comparing one practice to another. Outcome measures, however, may be influenced by characteristics of a patient that are beyond the control of a clinician.(3) For example, demographic characteristics, socioeconomic status, or presence of comorbid conditions, and disease severity may impact quality of life measurements. Unfortunately, for a particular outcome, there may not be sufficient scientific literature to specify the variables that should be included in a model of risk adjustment. When efforts to risk adjust are made, for example by adjusting socioeconomic status and disease severity, values may not be documented in the medical record, leading to incomplete risk adjustment.

When using outcome measures to compare one practice to another, a methodologist, such as a health researcher, statistician, actuary or health economist, ought to ensure that the populations are comparable, apply the appropriate methodology to account for differences or state that no methodology exists or is needed.

Use of measures by other agencies for the purpose of pay-for-performance and public reporting programs: AAN measures, as they are rigorously developed, may be endorsed by the National Quality Forum or incorporated into Centers for Medicare & Medicaid Services (CMS) and private payer programs. 14

It is important when implementing outcomes measures in quality measurement programs that a method be employed to account for differences in patients beyond a clinicians' control such as risk adjustment.

References and Additional Reading for AAN Statement on Comparing Outcomes of Patients

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Appendix B Disclosures

Work Group Member	Disclosures
Terri Armstrong, PhD, ANP-BC, FAAN, FAANP	Dr. Armstrong reports no current conflicts; prior to October 30, 2016, served as consultant for ABBvie Pharmaceuticals, Tocagen, Pfizer, and Immunocellular Therapeutics, and received funding from Genentech and Merck.
Tony Asher, MD	Dr. Asher reports no disclosures related to this project.
Erin Dunbar, MD	Dr. Dunbar reports no disclosures related to this project.
Justin Jordan, MD, MPH	Dr. Jordan reports no disclosures related to this project.
Nimish Mohile, MD	Dr. Mohile reports he has received consulting fees from Novocure in the past 2 years.
Douglas Ney, MD	Dr. Ney reports no disclosures related to this project.
Phioanh Leia Nghiemphu, MD	Dr. Nghiemphu reports no disclosures related to this project.
Amy E. Sanders	Dr. Sanders reports serving as a member of the NQF Palliative and End-of-Life Standing Committee.
Timothy Smith, MD, PhD, MPH	Dr. Smith reports no disclosures related to this project.

[i] American Brain Tumor Association. Brain Tumor Information: Glioblastoma (GBM). Available online at: http://www.abta.org/brain-tumor-information/types-of-tumors/glioblastoma.html Accessed on October 6, 2016.

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[iv] Ostrom QT, Gittleman H, Fulop J, et al. CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors diagnosed in the United States in 2008-2012. Neuro-Oncology 2015;17:iv1-iv62.

[v] Deorah S, Lynch CF, Sibenaller ZA, et al. Trends in brain cancer incidence and survival in the United States: surveillance, epidemiology, and end results program, 1973 to 2001. Neurosurg Focus 2016;20(4):E1.

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[vii] Ostrom QT, Gittleman H, Fulop J, et al. CBTRUS Statistical Report: Primary Brain and Central Nervous System Tumors diagnosed in the United States in 2008-2012. Neuro-Oncology 2015;17:iv1-iv62.

[viii] American Brain Tumor Association. Brain Tumor Information: Glioblastoma (GBM). Available online at: http://www.abta.org/brain-tumor-information/types-of-tumors/glioblastoma.html Accessed on October 6, 2016.

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[xii] Porter AB, Lachance DH, Johnson DR. Socioeconomic status and glioblastoma risk: a population-based analysis. Cancer Causes Control 2015;26:179-185.

[xiii] Curry WT and Barker FG. Racial, ethnic and socioeconomic disparities in the treatment of brain tumors. J Neurooncol 2009;93:25-39.