

## A Systematic Literature Review for the Global Incidence of Central Nervous System Vascular Lesions and Meta-Analysis of Hemorrhagic Aneurysms, Arteriovenous Malformations, and Dural Arteriovenous Fistulas

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Introduction: Surgery is increasingly important in global health initiatives.

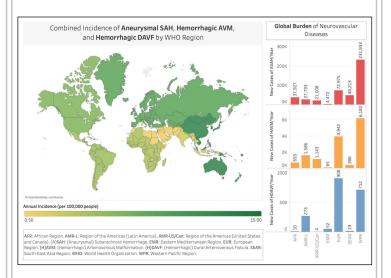
Neurosurgical care is as limited as 1-to-10 million people in parts of the world. We examined the worldwide incidence of hemorrhagic aneurysms(ASAH), AVM(HAVM), and dural arteriovenous fistulas(HDAVF) to define disease burden and inform neurosurgical global health efforts.

**Methods:** A systematic literature review was done according to the PRISMA guidelines for epidemiologic data for ASAH, HAVM, and HDAVF. Our primary objective was to estimate the global epidemiology of these lesions. Manuscripts were graded on a 6-point scale and included both hospital and populationbased studies with data for incidence calculation. Results were organized by WHO regions [USA/Canada(AMR-US/Can);Latin America(AMR-L);South-East Asia(SEAR); European(EUR); Eastern Mediterranean(EMR); and Western Pacific(WPR)] and country income level(high and middle/low). After literature review, there was a lack of data from AMR-L, SEAR, EMR, and AFR. Using the remaining studies and a series of assumptions from 12 high-quality stroke studies, we estimated the crude incidence of ASAH, HAVM, and HDAVF. Estimates were generated using random effects model, and displayed in disease-specific Forest plots; study quality was examined by region and income group with univariate metaregression.

**Results:** From an initial yield of 1,492 studies, 58 studies were found and combined with the 12 stroke studies. By WHO region, EMR had the lowest ASAH rates(0.69/100,000), while WPR had the highest(12.38/100,000). HAVM rates

-US/CAN(0.05/100,000) and highest in Europe(0.1/100,000). We estimate the global crude incidence for ASAH, HAVM, and HDAVF are 6.69, 0.23, and 0.01 per 100,000 persons respectively and calculate that 491,625(95%CI 332,159–680,390); 16,833(95%CI 7,319–30,007); and 1,964(95%CI 527–13,837) suffer these lesions each year.

**Conclusion:** To our knowledge, this is the first systematic literature review on the global incidence of ASAH, HAVM, and DAVF. Worldwide, we estimate just over 500,000 individuals will suffer yearly from lesions.



## **Forest Plot of Included Studies**