

INTERNATIONAL **STROKE** CONFERENCE $\frac{20}{18}$

Neurovascular Disease is the Second Leading Cause of Death in the United States (US): A Modern Disease Burden Analysis



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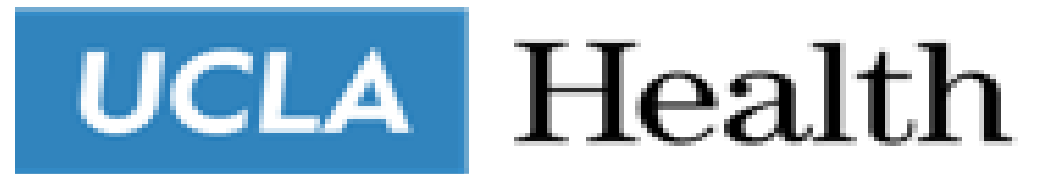
Health

Disclosures:

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 - None



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Objective

- The World Health Organization (WHO) in 2017 voted to return cerebrovascular disease from Circulatory Disorders to its historic home in Neurologic Disorders (forthcoming ICD-11)
 - Due to advances in cerebrovascular disease therapy, and
 - Due to increased recognition of neurovascular contributions to dementia



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Introduction

- ❖ World Health Organization (WHO)
- ❖ WHO Global Burden of Disease
 - ❖ measures burden of disease using disability-adjusted-life-year (DALY)
 - ❖ measures burden of disease using mortality
- ❖ WHO Global of Burden of Disease measures separate disease processes and category of diseases
 - ❖ Cerebrovascular disease is a separate disease process
 - ❖ Cerebrovascular disease is NOT consider a neurovascular disease; instead it is currently under cardiovascular disease



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Methods:

- WHO Global Burden of Disease Project 2015 data
- We calculated the impact on attributable deaths and attributable disability (disability-adjusted life years lost – DALYs) of:
 - 1) return of cerebrovascular diseases to the Neurologic Disorders category
 - 2) use “**neurovascular disease**” state to include both “**cerebrovascular diseases**” and proportion of dementia due to neurovascular insults.



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| WHO 2015 Top 5 Leading Causes of DALY Loss | | DALYS Lost | Rank |
|--|-----------|-----------------------|----------|
| Ischemic Heart Dz | | 164,020,394.11 | 1 |
| Cerebrovascular Disease | | 118,626,743.79 | 2 |
| Lower respiratory infections | | 103,048,564.21 | 3 |
| Low back and neck pain | | 94,941,485.55 | 4 |
| Neonatal preterm birth complications | | 74,833,590.58 | 5 |
| Alz Dz and other Dementias | | 23,779,234.84 | |
| UK vasc contr to dementia | 51.72882+ | | |
| Neurovascular Dz | | 130,927,461.38 | |
| Top 5 with NVD | | | |
| Ischemic Heart Dz | | 164,020,394.11 | 1 |
| Neurovascular Dz | | 130,927,461.38 | 2 |
| Lower respiratory infections | | 103,048,564.21 | 3 |
| Low back and neck pain | | 94,941,485.55 | 4 |
| Neonatal preterm birth complications | | 74,833,590.58 | 5 |
| Total of Top 5 with CVD | | 555,470,778.24 | |
| Proportion of Top 5 due to CVD | | 21.3560728 | |
| Total of Top 5 with NVD | | 567,771,495.83 | |
| Proportion of Top 5 due to NVD | | 23.0598863 | |



10 % increase



+ Ref: Dodge HH, Zhu J, Woltjer R., et al. Alzheimers Dement. 2017 Jun;13 (6):613-623. doi: 10.1016/j.jalz.2016.11.003. SMART data consortium.

Categories of Disease as defined by WHO

| | DALYs lost | |
|--|-----------------------|-----------|
| Cardiovascular | 347,528,912.75 | 1 |
| Diarrhea/Lower respiratory/Other infectious diseases | 242,875,768.38 | 2 |
| Neoplasm | 209,359,204.81 | 3 |
| Neonatal disorders | 197,924,839.34 | 4 |
| Other non-communicable | 192,712,901.98 | 5 |
| Neurologic Disorders w/o Cerebrovascular | 87,082,099.23 | 12 |
| Top 5 with CVD Moved to Neurologic Dz | | |
| Cardiovascular - Cerebrovascular | 228,902,168.96 | 2 |
| Diarrhea/LRI/Other | 242,875,768.38 | 1 |
| Neoplasm | 209,359,204.81 | 3 |
| Neonatal disorders | 197,924,839.34 | 5 |
| Other non-communicable | 192,712,901.98 | 6 |
| Neurologic Disorders with Cerebrovascular | 205,708,843.02 | 4 |
| Total of Top 5 with Neuro - CVD | 1,190,401,627.26 | |
| Proportion of Top 5 due to Neuro - CVD | 0% | |
| Total of Top 5 with Neuro + CVD | 1,084,770,824.51 | |
| Proportion of Top 5 due to Neuro + CVD | 18.96334584 | |

136% increase

| WHO 2015 Top 5 Leading Causes of Death | | Deaths | Rank |
|---|----------|---------------------|----------|
| Ischemic Heart Dz | | 8,916,964.20 | 1 |
| Cerebrovascular Disease | | 6,326,135.35 | 2 |
| Chronic obstructive pulmonary disease | | 3,292,534.30 | 3 |
| Lower respiratory infections | | 2,860,842.81 | 4 |
| Alzheimer disease and other dementia | | 2,229,136.71 | 5 |
| Alz Dz and other Dementias | | 2,229,136.71 | |
| UK vasc contr to dementia | 51.72882 | 1153106.116 | |
| Neurovascular Dz | | 7,479,241.47 | |
| Top 5 with NVD | | | |
| Ischemic Heart Dz | | 8,916,964.20 | 1 |
| Neurovascular Disease | | 7,479,241.47 | 2 |
| Chronic obstructive pulmonary disease | | 3,292,534.30 | 3 |
| Lower respiratory infections | | 2,860,842.81 | 4 |
| Alzheimer disease and other dementia | | 2,229,136.71 | 5 |
| Total of Top 5 with CVD | | 23625613.37 | |
| Proportion of Top 5 due to CVD | | 26.77659729 | |
| Total of Top 5 with NVD | | 24778719.49 | |
| Proportion of Top 5 due to NVD | | 30.18413228 | |



18% increase



| Categories of Disease as defined by WHO | | Deaths | |
|---|--|---------------------|----------|
| cardiovascular diseases | | 17,921,046.52 | 1 |
| neoplasms | | 8,764,608.37 | 2 |
| diarrhea, lower respiratory and other common infectious | | 4,959,833.05 | 3 |
| chronic respiratory | | 3,795,462.30 | 4 |
| diabetes, urogenital, blood, and endocrine diseases | | 3,409,347.54 | 5 |
| HIV/AIDs and tuberculosis | | 2,305,173.05 | 6 |
| neurological disorders w/o Cerebrovascular | | 2,258,914.84 | 7 |
| Ranking with cerebrovascular under neuro | | | |
| Cardiovascular - Cerebrovascular | | 11,594,911.17 | 1 |
| neoplasms | | 8,764,608.37 | 2 |
| diarrhea, lower respiratory and other common infectious | | 4,959,833.05 | 4 |
| chronic respiratory | | 3,795,462.30 | 5 |
| diabetes, urogenital, blood, and endocrine diseases | | 3,409,347.54 | 6 |
| Neurologic Disorders with Cerebrovascular | | 8,585,050.19 | 3 |
| Total of Top 5 with Neuro – CVD | | 38,850,297.78 | |
| Proportion of Top 5 due to Neuro – CVD | | 0% | |
| Total of Top 5 with Neuro + CVD | | 37,699,865.08 | |
| Proportion of Top 5 due to Neuro + CVD | | 22.77209792 | |

Results:

1. Reclassification of cerebrovascular disease as a Neurologic Disorder (vs. cardiovascular disease)
 - ❖ In the US:
 - ❖ Increased the number of deaths attributable to Neurologic Disorders by 50.5%, from 326,000 to 490,000 per year, and increased DALYs lost by 37.3% (6.0 to 8.3 million).



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Results:

2. Reclassification of cerebrovascular disease as a Neurologic Disorder (vs. cardiovascular disease)

❖ Worldwide:

- ❖ this reclassification increased the number of deaths attributable to Neurologic Disorders by 280% (2.3 to 8.6 million), and increased DALYs lost by 136%, (87.1 to 205.7 million).



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Results:

3. Systematic literature review shows vascular brain lesions contribute to 51% of clinically diagnosed Alzheimer's disease and 65% of clinically diagnosed vascular dementia.
 - ❖ Adding these cases to focal strokes, in the US, the number of deaths attributable to neurovascular disease increased by 90% (164,000 to 313,000)
 - ❖ DALYs lost increased by 37.3%, (2.3 to 3.7 million).
 - ❖ Worldwide, the number of deaths attributable to neurovascular disease increased by 18% (6.3 to 7.5 million), and DALYs lost increased by 10.4% (119 to 131 million).



Conclusions:

- ❖ When correctly classified according to modern pathophysiology, **neurovascular disease (with inclusion of contribution of vascular dementia)** moves from the 5th to the 2nd leading cause of death in the US; Neurologic Disorders moves from the 12th to the 4th leading cause of disability worldwide.
- ❖ This more accurate delineation of the national and global burden of neurovascular disease, should guide more informed allocation of resources for neurovascular research and clinical care.



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Questions

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