National Trends in Hospitalizations for Stroke Associated with Infective Endocarditis and Opioid Use Between 1993-2015

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Opioid Epidemic

• The opioid epidemic in the United States has led to increasing number of hospitalizations, cardiovascular complications, and deaths.

• Number of deaths from heroin has tripled since 2010.
Infective Endocarditis is a major cardiovascular complication of intravenous opioid use

- Incidence of opioid-related infective endocarditis (IE) is increasing.

Njoroge et al, JAMA Cardiology, 2018 Aug 1;3(8)779-780
Infective Endocarditis leads to stroke in 20% of cases

• Limited knowledge on trends in stroke as a complication of opioid-related infective endocarditis.

We assessed whether increasing opioid use has led to higher rates of stroke associated with IE and opioid use.
Methods – Patient Population

Used National Inpatient Sample to identify stroke hospitalizations associated with IE and opioid use from 1993-2015.

- Used validated *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes to identify patients with stroke, IE and opioid use.
- **All three diagnoses** must be present during index hospitalization.
- Stroke = hemorrhagic and ischemic events.
Methods - Measurement

• We obtained demographic information (age, sex, race) and hospital geographic location of all hospitalizations.

• Pre-specified subgroup analyses:
  - Age (<45 vs. ≥45 years of age)
  - Sex (Male vs. Female)
  - Race/ethnicity (non-Hispanic white vs. not)
  - U.S. Census region (Northeast, Midwest, West, and South)
Methods – Statistical Analysis

• Used population estimates from the U.S. census to calculate hospitalization rates per 10 million person-years.

• Statistical Analysis: STATA and Joinpoint Regression Software

• Joinpoint regression: use log-linear regression models and Monte Carlo permutation to identify \( \leq 3 \) linear segments that describe the trend. Lines connected at the “joinpoints.”
  
  - Identify the annual percentage change (APC) for each segment
  - Determine if each APC is significantly different from zero
Results

• From 1993-2015: 5,283 hospitalizations for stroke associated with IE and opioid use.

• Mean age, 41.2 years; female, 34.2%; non-Hispanic white, 57.6%

• Ischemic stroke=71.5%  Hemorrhagic stroke=28.5%
Stroke hospitalizations increased in both age groups and sexes.
• No significant trend for non-white patients.
• Non-Hispanic white patients had greatest increase in hospitalization rate.
All regions experienced significant increases in hospitalizations – greatest absolute increase in South and Northeast.
Possible Limitations

• Misclassification from administrative claims data usage.

• Double counting of patients with multiple hospitalizations in a given year.

• Underreporting of opioid use by patients.
Conclusion

• U.S. hospitalization rates for stroke associated with IE and opioid use were stable for nearly two decades before rising in 2008.

• Increased hospitalizations since 2008 may be a consequence of increased heroin use over past decade.
Conclusion

• Increasing opioid use may be adding to the population burden of permanent functional disability.

• Our findings add to the urgency of addressing the underlying opioid epidemic in the U.S., suggest need for improved awareness of cerebrovascular complications of opioid use.
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