A Population-based Approach to Sudden Unexpected Death Epidemiology

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Background

- Out-of-Hospital Sudden Unexpected Death (OHSUD) is poorly characterized in minority populations and people ≤65
- Case definitions vary widely in published studies, primarily by time of death, cause of death, and attempted resuscitation
- The SUDDEN Study estimates OHSUD incidence using a reproducible, inclusive case definition in the general population

Study Objective

Identify and characterize OHSUD in Wake County, North Carolina over a two-year period

Methods

Study population

- All EMS-reported deaths (N-2,359) in Wake County, North Carolina, from March 2013 through March 2015
- OHSUD cases were defined as sudden, unexpected deaths occurring in Wake County residents 18- to 65 years old
  - Cardiac death survivors and victims dying from end-stage cancer, infectious disease, and trauma were excluded
  - Wake County demographic data was obtained from the American Communities Survey for 2010 through 2013

Case Definition

- Of 2,359 possible OHSUD cases over two years, 408 were adjudicated as OHSUD by at least two board-certified cardiologists
  - Death certificates were obtained from North Carolina Vital Statistics
  - Medical examiner reports (including autopsy and toxicology) were obtained from the Wake County Medical Examiner's Office
  - Medical Records for all potential cases were requested from two health systems treating most patients in Wake County
- Primary causes of death identified from death certificate ICD-10 codes:
  - Diseases of the Heart (I00-I09, I11, I13, I20-I51)
  - Stroke & Cerebrovascular Disease (I60-I69)
  - Other Cardiovascular Disease (all remaining I codes)
  - Chronic Respiratory Disease (J40-J47)
  - Malignant neoplasms (C00-C97)
  - Infectious Disease (A, B, J09-J18)
  - Accidents (unintentional injuries) (V01-X59, Y85-Y86)
  - Intentional Acts (X60-X84 , Y870)

Standardization

- Statewide OHSUD estimates were age- and sex-standardized to 2013 North Carolina mortality tables
  - Wake County and North Carolina mortality data obtained from North Carolina State Center for Health Statistics

Table 1. Distribution of Risk Factors in Wake County OHSUD

Demographic Trait		Cases, N (%)	Wake County 2013, %
Female		127 (31%)	51%
***Obese (BMI >30 kg/m²)**		134 (42%)	26%
Age:	**18-44**	76 (19%)	21%
	45-54	125 (31%)	14%
	55-64	209 (51%)	12%
Race:	**White**	252 (62%)	69%
	African American	145 (36%)	21%
	Other	11 (3%)	19%
***Smoker†**		171 (62%)	16%
***≤ High School Education**		190 (48%)	23%
***Married**		143 (41%)	52%
Medical Records available		322 (79%)	---

*Missing or "unknown" trait values were not included in the denominator for proportions
†Includes self-reported current and former smokers as recorded in medical record

Figure 1. Causes of Death by Age Group in Wake County

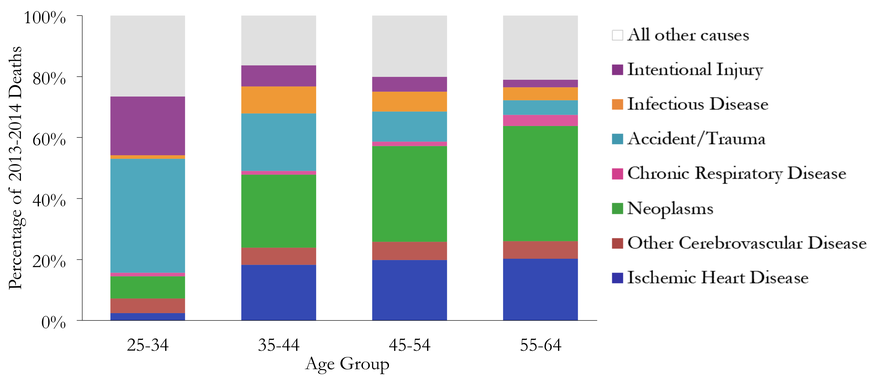
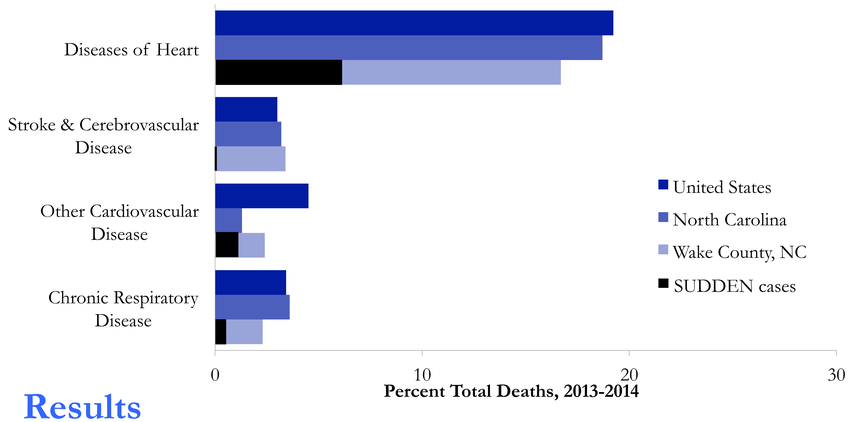


Table 2. Potential Misclassification of OHSUD victims

	Wake County 2013-2014, N (%)	Annual OHSUD Estimate, North Carolina (N)
EMS report dead on scene	2,359 (24% of all deaths)	19,830
Age < 18*	56 (2.4%)	470
Age > 65*	945 (40%)	7,944
Survive > 24h*	723 (31%)	6,078
Total adjudicated SUD	408 (15% of 18-64yo)	3,482†
Unwitnessed	377 (92%)	3,218†
Time of death ≥24h/unknown	216 (53%)	2,645†
No attempted resuscitation	272 (67%)	2,113†
Non-cardiac COD	207 (51%)	1,548†

* Exclusion criteria used by SUDDEN
† Age- and sex-standardized extrapolated annual counts of all OHSUD for NC population aged 20 to 64 using information for presumed sudden deaths in Wake County, North Carolina, in 2013

Figure 2. OHSUD by Death Certificate Cause of Death



Results

- 36% of 2013-2014 OHSUD cases are African Americans; 31% are women (Table 1)
  - As compared to 21% and 51% of Wake County residents, respectively
- OHSUD is a common condition in adults under age 65 in Wake County
  - A substantial number of cases would be misclassified as expected or not sudden based on literary criteria (Table 2)
- OHSUD accounts for over 30% of Wake County deaths with primary causes always included as SUDDEN study cases meeting age inclusion criteria (Figure 2)

Strengths

- Population-based analysis captures cases more completely than other study designs
- Inclusion of young adults and unwitnessed deaths presents a clearer picture of OHSUD

Limitations

- Medical records missing for 21% of cases (possible informative missingness could bias statistical analyses)
- Survivors of sudden cardiac death currently not included
- Sample size currently prevents analysis of smaller age groups

Conclusions

- Case definitions for sudden death excluding unwitnessed deaths, unknown time of death, and noncardiac causes of death prevent researchers from fully characterizing OHSUD
- Population-based analysis is the ideal way to identify opportunities for intervention to reduce OHSUD

Investigator's Study Website:
www.med.unc.edu/medicine/cardiology/sudden

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