

# Alcohol Consumption and Ischemic Stroke Risk: The Atherosclerosis Risk in Communities Study

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# Introduction

- Stroke is the 3rd leading cause of death and a leading cause of long-term disability in U.S.
- In 1999 the National Stroke Association published recommendations for prevention strategies for a first stroke
  - identified 6 risk factors & 4 lifestyle factors, including alcohol consumption

# Background

- Previous studies reported
  - increased ischemic stroke risk among heavy drinkers
  - either no association or a “J” shaped relationship (protective effect) for ischemic stroke risk among those consuming light to moderate amounts of alcohol
- Mechanisms supporting the role of alcohol in reducing ischemic stroke risk include
  - increasing HDL cholesterol levels
  - decreasing platelet aggregation and fibrinogen levels

# Objective

- Examine the relationship between alcohol consumption and ischemic stroke risk

# Study design and population

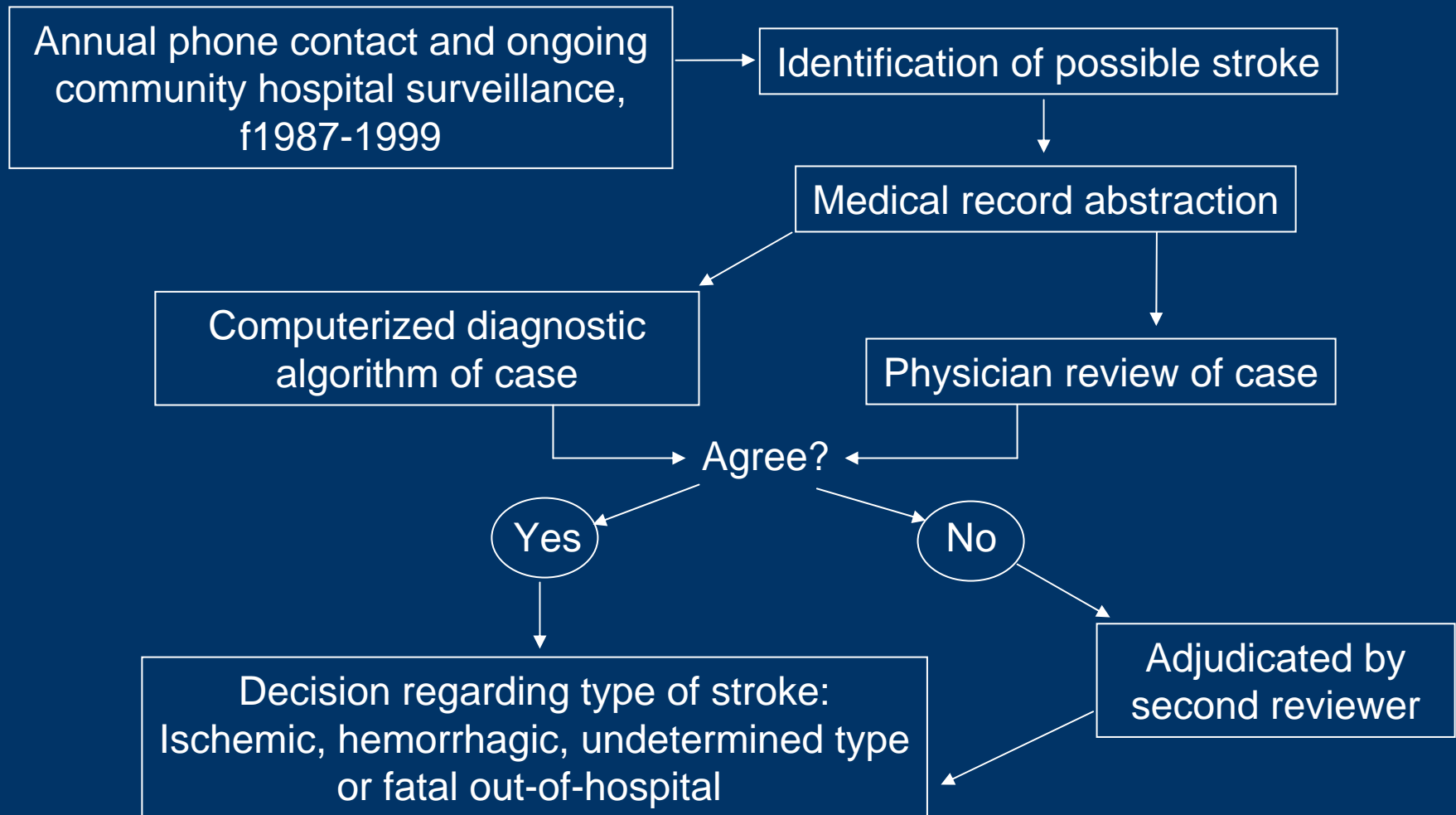
- Prospective data analysis of ARIC cohort data
  - ARIC designed to examine the etiology and natural history of atherosclerosis among men & women aged 45-64 yrs in 4 U.S. communities
- Excluded:
  - non-blacks & non-whites (n=48)
  - those with CHD at baseline (n=766)
  - those with unknown or history of stroke at baseline (n=329)
  - those with missing data on alcohol consumption (n=425)
- 14,336 study participants

# Alcohol Consumption

- Measured at visit 1 by an interviewer administered dietary questionnaire
- Weekly alcohol consumption was derived based on responses & categorized:

	Males	Females
Never	0	0
Former/rare	0	0
Light/moderate	$\leq 2$ drinks/day	$\leq 1$ drink/day
Heavy	$> 2$ drinks/day	$> 1$ drink/day

# Stroke Event Ascertainment



# Covariates

- age
- race
- gender
- smoking status
- diabetes
- hypertension
- left ventricular hypertrophy
- body mass index
- physical activity
- education
- study center
- lipids

# Statistical Analyses

- Calculated age-adjusted stroke incidence rates by levels of alcohol consumption
- Used multivariate Cox proportional hazards models to determine the association of differing levels of alcohol consumption with ischemic stroke incidence

# Baseline risk factors by drinking status

	Never	Former/ Rare	Light/ Moderate	Heavy
Mean age (y)	54.5	54.0	53.6	53.7
Male, %	12.9	34.2	42.8	10.2
Female, %	35.1	36.3	23.0	5.6
Whites, %	18.2	38.1	35.2	8.4
Blacks, %	45.7	28.0	21.1	5.2
Forsyth Co., %	26.8	38.1	27.9	7.3
Jackson, %	49.0	25.2	20.8	5.0
Minneapolis, %	4.4	37.7	47.7	10.2
Washington Co., %	24.2	39.8	28.5	7.6
Current smoker, %	14.5	36.7	35.1	13.8

# Baseline risk factors by drinking status

	Never	Former/ Rare	Light/ Moderate	Heavy
< High school, %	35.4	39.1	20.0	5.9
High school grad, %	25.3	36.8	30.2	7.7
> High school, %	19.6	31.6	40.4	8.5
Diabetes, %	38.0	38.4	20.2	3.4
Hypertension, %	31.8	33.5	26.4	8.2
Mean BMI (kg/m <sup>2</sup> )	28.9	27.8	26.8	26.3
Total cholesterol (mg/dL)	216.9	213.3	213.1	218.1
LDL cholesterol (mg/dL)	136.3	135.1	133.0	129.8
HDL cholesterol (mg/dL)	54.7	51.1	54.2	60.8

# Alcohol consumption by gender & race

Drinking status	BM # (%)	BF # (%)	WM # (%)	WF # (%)
Never	315 (22)	1426 (59)	483 (10)	1436 (25)
Former/ Rare	453 (32)	612 (25)	1661 (35)	2349 (41)
Light/ Moderate	499 (36)	306 (13)	2144 (45)	1565 (27)
Heavy	137 (10)	61 (3)	491 (10)	398 (7)

BM=black male, BF=black female, WM=white male, WF=white female

# Ischemic Stroke Events

- Mean follow-up = 10.8 yrs
- Number incident ischemic strokes = 346

	# ischemic strokes	Person-time (yrs)	Crude incidence rate (per 1000 P-Y)	Age-adjusted incidence rate (per 1000 P-Y)
Black Males	68	14381.6	4.7	4.72
Black Females	88	25425.8	3.5	3.48
White Males	114	51741.4	2.2	1.90
White Females	76	63437.8	1.2	1.11

## Age-adjusted incidence rates per 1000 P-Y for black males

	# ischemic strokes	Person-time (yrs)	Age-adjusted incidence rate (per 1000 P-Y)
Never	15	3299	4.87
Former/ Rare	22	4561	4.59
Light/ Moderate	28	5154	5.62
Heavy	3	1337	3.02

# Age-adjusted incidence rates per 1000 P-Y for black females

	# ischemic strokes	Person-time (yrs)	Age-adjusted incidence rate (per 1000 P-Y)
Never	52	15178	3.34
Former/ Rare	19	6347	2.98
Light/ Moderate	15	3280	5.10
Heavy	2	638	3.59

## Age-adjusted incidence rates per 1000 P-Y for white males

	# ischemic strokes	Person-time (yrs)	Age-adjusted incidence rate (per 1000 P-Y)
Never	13	5327	1.80
Former/ Rare	41	17744	2.00
Light/ Moderate	45	23287	1.76
Heavy	15	5277	2.31

## Age-adjusted incidence rates per 1000 P-Y for white females

	# ischemic strokes	Person-time (yrs)	Age-adjusted incidence rate (per 1000 P-Y)
Never	21	15925	1.16
Former	29	25671	1.08
Light/ Moderate	20	17321	1.12
Heavy	6	4391	1.38

# Multivariable\* hazard rate ratios of incident ischemic stroke with 95% CIs

	Never	Former/ Rare	Light/ Moderate	Heavy
Black Males	1.0	0.92 (0.45, 1.80)	1.32 (0.66, 2.64)	0.20 (0.05, 0.81)
Black Females	1.0	0.78 (0.44, 1.38)	1.66 (0.89, 3.14)	1.13 (0.27, 4.84)
White Males	1.0	0.86 (0.45, 1.62)	0.97 (0.51, 1.84)	0.93 (0.41, 2.13)
White Females	1.0	0.95 (0.53, 1.69)	1.00 (0.51, 1.97)	0.78 (0.28, 2.21)
All**	1.0	0.89 (0.66, 1.19)	1.26 (0.90, 1.77)	0.85 (0.51, 1.43)

\* Adjusted for age, diabetes, hypertension, smoking, and education; \*\* Also adjusted for race & sex.  
Referent group = never drinkers, CI = confidence interval

# Conclusions

- Alcohol consumption not associated with ischemic stroke risk
  - no protective effect found for those consuming light/moderate amounts
  - no increased risk found for those consuming heavy amounts

# Strengths and Limitations

- Strengths
  - prospective follow-up study design
  - geographically and racially diverse population
  - detailed alcohol consumption data
- Limitations
  - change in alcohol consumption over time
  - small number of participants consuming heavy amounts of alcohol

# Public Health Impact

- Findings related to alcohol consumption guidelines for the prevention of stroke
- Future directions
  - examine type of alcohol consumed