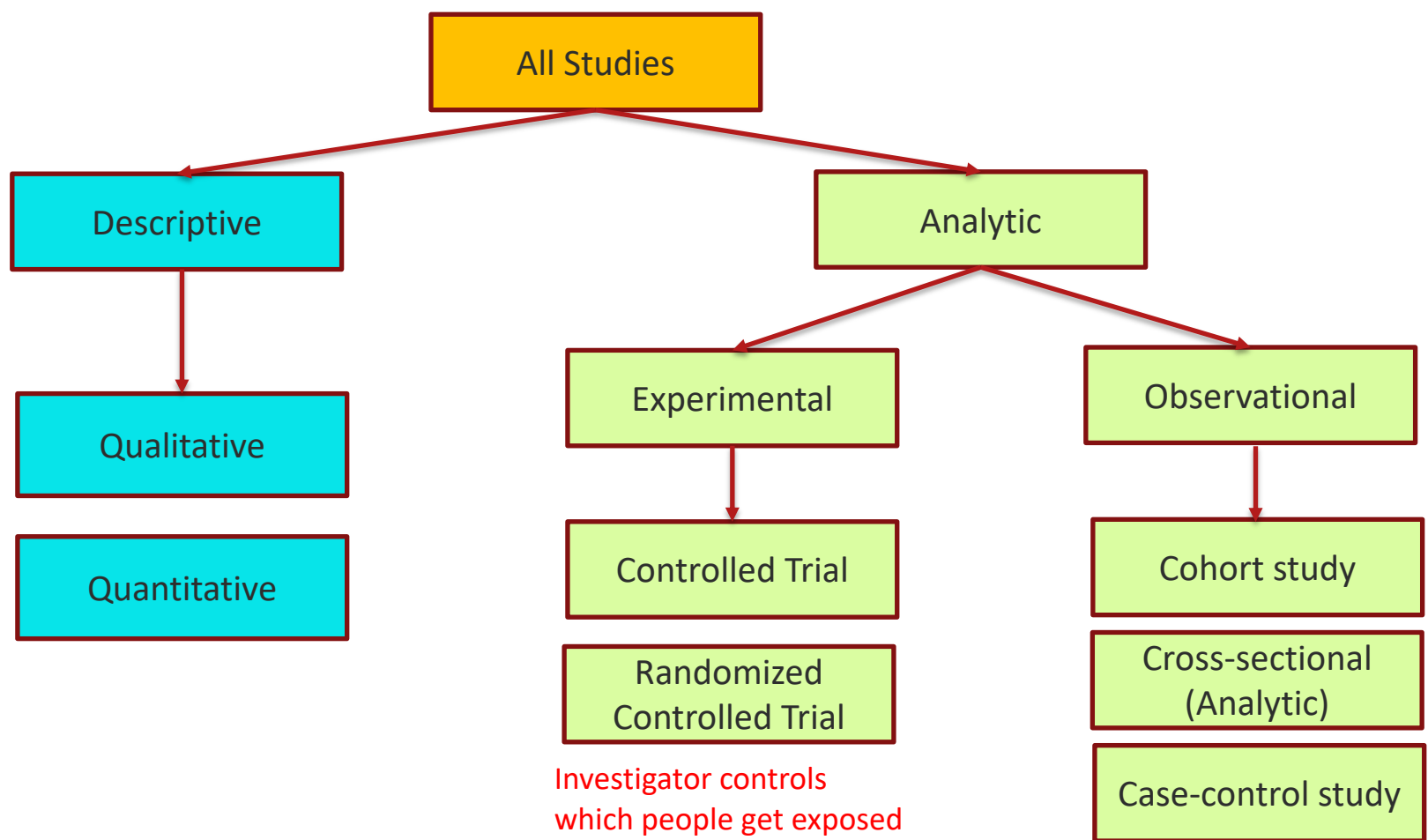


Evidence-Based Decision Making in Healthcare

Observational Studies

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Investigator controls
which people get exposed

Investigator has no control over which
people get exposed

Hierarchy of Evidence



<https://www.nature.com/articles/s43016-021-00388-5/figures/1>

Cross-Sectional: Design

- Interview, examine, and/or test large group of people
- Classify
 - Patient characteristics
 - Exposures
 - Outcomes

Cross-Sectional: Measurement

- Prevalence: X% of people have Y condition
- Correlation: X% of people with Y condition are old, have arthritis, and live in the Northeast
- Everything depends on:
 - How representative your sample population is
 - How you defined exposures & outcomes
 - How you measured exposures & outcomes

Evaluation of Sleep Habits and Disturbances Among US Adults, 2017-2020

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Abstract

IMPORTANCE Unhealthy sleep behaviors and sleep disturbances are associated with higher risk of multiple diseases and mortality. The current profiles of sleep habits and disturbances, particularly the differences between workdays and free days, are unknown in the contemporary US.

OBJECTIVE To comprehensively evaluate sleep habits on workdays and free days and the prevalence of sleep disturbances among US adults.

DESIGN, SETTING, AND PARTICIPANTS This study is a cross-sectional analysis of US nationally representative data from the National Health and Nutrition Examination Survey (2017-2020) among adults aged 20 years or older. Data analysis was performed from February to May 2022.

MAIN OUTCOMES AND MEASURES The main outcomes were means and/or distributions of sleep habits, including sleep duration and sleep-wake timing on workdays and free days, sleep debt (ie, the difference between sleep duration on free days and mean weekly sleep duration), and social jet lag (ie, the difference between the midpoint between sleep and wake time on workdays and free days). Prevalence of trouble sleeping (ie, participants told a doctor or other health professional that they have trouble sleeping) and daytime sleepiness (ie, self-reported feeling of being overly sleepy during the day ≥ 5 times per month) were also determined.

RESULTS A total of 9004 individuals (mean [SE] age, 48.3 [0.53] years; 4635 women [51.9%]; 3158 non-Hispanic White [62.8%]) were included in the current study. The mean sleep duration was 7.59 hours (95% CI, 7.54 to 7.64 hours) on workdays and 8.24 hours (95% CI, 8.17 to 8.31 hours) on free days (difference, 0.65 hour). The mean sleep and wake times were at 11:02 PM (95% CI, 10:57 PM to 11:17 PM) and 6:41 AM (95% CI, 6:36 AM to 6:45 AM), respectively, on workdays and 11:25 PM (95% CI, 11:21 PM to 11:35 PM) and 7:41 AM (95% CI, 7:37 AM to 7:46 AM), respectively, on free days (differences, 0.23 hour for sleep time and 1.00 hour for wake time). On workdays, 23.1% (95% CI, 21.3% to 24.9%) of adults slept less than 7 hours and 25.4% (95% CI, 24.1% to 26.6%) went to sleep at midnight or later; the corresponding percentages changed to 12.9% (95% CI, 11.6% to 14.3%) and 40.9% (95% CI, 38.4% to 43.5%), respectively, on free days. Furthermore, the mean sleep debt was 0.73 hours (95% CI, 0.68 to 0.77 hours), and mean social jet lag was 1.10 hours (95% CI, 1.05 to 1.15 hours); 30.5% (95% CI, 26.8% to 33.3%) of adults experienced 1 hour or more of sleep debt, and 46.5% (95% CI, 42.6% to 50.3%) experienced 1 hour or more of social jet lag. The prevalence of trouble sleeping was 29.8% (95% CI, 28.2% to 31.5%), and that of daytime sleepiness was 27.2% (95% CI, 25.0% to 29.5%).

CONCLUSIONS AND RELEVANCE In 2017 to 2020, US adults showed variability in sleep habits between workdays and free days, with longer sleep duration and later sleep-wake phases on free days, and high percentages of US adults experienced long-term sleep deprivation, chronic social jet lag, and frequent sleep disturbances. These findings provide evidence to further investigate potential approaches to optimize overall US sleep health.

JAMA Network Open. 2022;5(10):e2240788. doi:10.1001/jamanetworkopen.2022.40788

Key Points

Question What were the profiles of sleep habits and the prevalence of sleep disturbances among US adults in 2017 to 2020?

Findings In this nationally representative cross-sectional analysis with 9004 adults, differences in sleep patterns between workdays and free days were observed (0.65 hour for sleep duration, 0.23 hour for sleep time, and 1.00 hour for wake time). With regard to sleep disturbances, 30.5% of adults experienced 1 hour or more of sleep debt, 46.5% experienced 1 hour or more of social jet lag, 29.8% had trouble sleeping, and 27.2% experienced daytime sleepiness.

Meaning These findings elaborate on sleep habits and disturbances among US adults and provide evidence to further investigate potential approaches to optimize overall US sleep health.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

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Case-Control: Design

- Define a case using strict criteria
- Define a control using similar criteria
 - Should have had equal opportunity to be exposed to the factor you are concerned about
- These are (almost always) *retrospective* studies
 - The outcome has already happened
 - You are now trying to figure out factors that led to that outcome

Case-Control: Design

- Some students report they started vomiting after attending class on March 25th
- All of them said they ate lunch that day
- Can we figure out what the cause might be?

Case-Control: Design

Cases:

Students who attended EMBA class on March 25th
and

Developed vomiting on March 25, 26, 27, or 28

Who are the controls?

Case-Control Studies: Design

Cases:

Adults who attended EMBA class on March 25th

and

developed vomiting on March 25, 26, 27, or 28

Controls

Adults who attended EMBA class on March 25th

and

Did not have vomiting on March 25, 26, 27, or 28

Case-Control: Design

- Interview, examine, test cases and controls using the same identical methods
 - If asking, “did you eat any food from the salad bar on March 25th,” make sure you phrase question exactly the same for cases and control
- Ideally interviewers and examiners are “blinded” to who is a case and who is a control

Case-Control: Measurement

- Analyze exposures for cases and control
- Calculate an “odds ratio”
 - A number > 1 = risk factor
 - A number < 1 = protective factor

Case-Control: Measurement

	Cases	Controls	Total
Ate salad	10	5	20
Did not eat salad	20	50	120
Total	30	55	85

- 50% of cases vs. 10% of controls ate salad on March 25th
- Odds ratio = $(10/20) / (5/50) = 5.0$
- The odds of eating salad were five times greater in those that developed vomiting than those that did not
- Eating salad is a risk factor for vomiting

Case-Control: Pros and Cons

Pros	Cons
Excellent for diseases that are rare or with long lag between exposure & disease	Difficult if exposure is not common
Cheap and quick	Selection bias, especially with controls
No loss to follow-up	Observation bias when collecting information about exposures

Cohort: Design

- Define a large group
- Interview members of the group for exposures that you are interested in
- Follow them over time: interview, examine, and test at regular intervals
- Can also enroll more than one group and compare the outcomes in the different groups

Cohort: Measurement

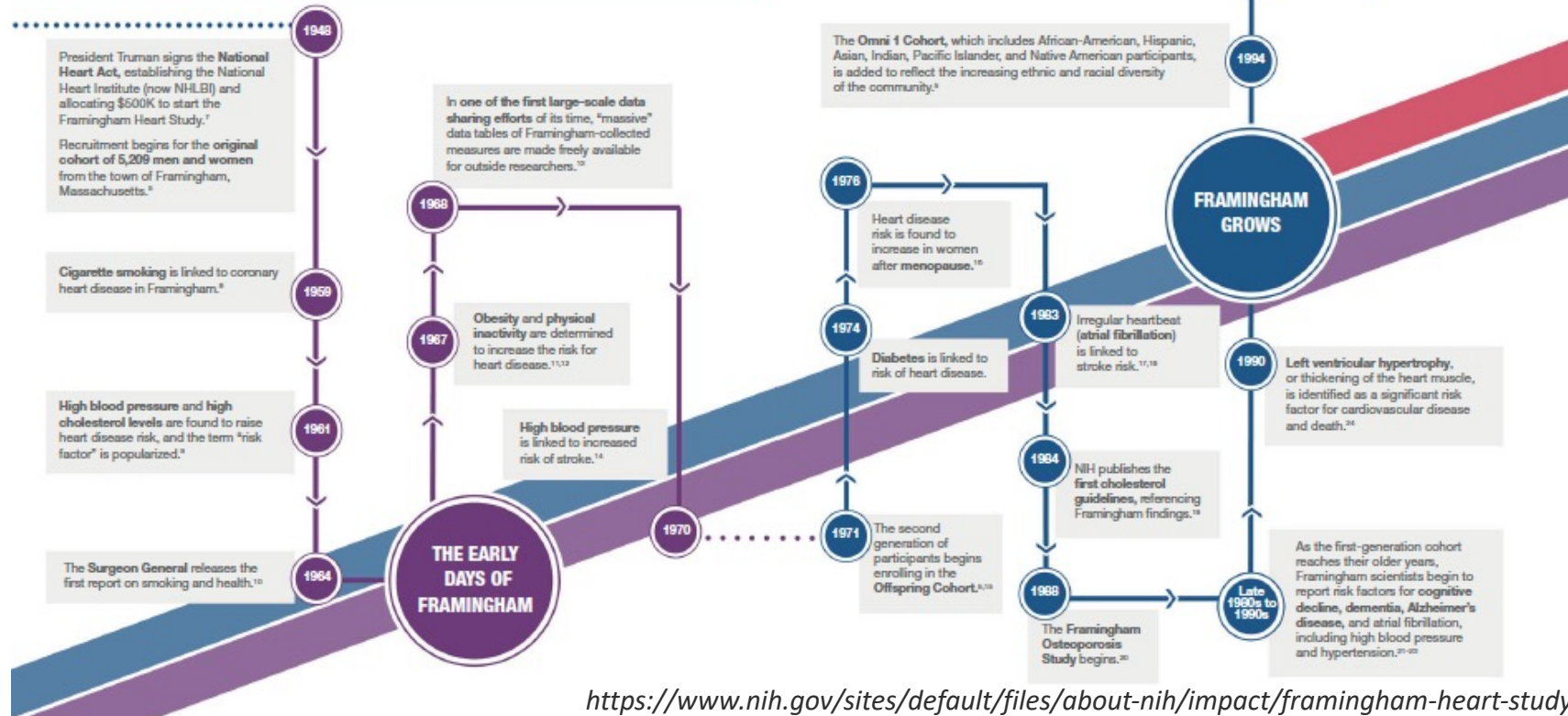
- Compare % of people with an outcome who had an exposure vs. % of people with an outcome who did not have that exposure
- If disease rate is higher in a group exposed to X compared to a group not exposed to X, then exposure to X is a risk factor for the disease

Cohort: Framingham Heart Study

- Started in 1948
- 5,209 people from Framingham, Massachusetts
- Interviews, physical examinations, blood tests
- Followed over time for heart disease and strokes

SELECTED RESEARCH-TO-PRACTICE MILESTONES FOR THE FRAMINGHAM HEART STUDY⁶

All of the milestones in this timeline were made possible with NIH funding.



<https://www.nih.gov/sites/default/files/about-nih/impact/framingham-heart-study.pdf>

Cohort: Measurement

	Heart Attack	No Heart Attack	<i>Total</i>
Eat apples	200	3800	4000
Don't eat apples	100	900	1000
<i>Total</i>	300	4700	5000

- 200/4000 (5%) of those that eat apples regularly got a heart attack after five years vs. 10/1000 (10%) that do not
- Relative risk of heart attack is $5/10$ for eating apples = 0.5 = the risk of developing a heart attack is 50% less in those that eat apples compared with those that do not eat apples

Cohort: Pros and Cons

Pros	Cons
Higher quality data than other observational studies regarding exposure	Expensive and time-consuming
Less prone to bias because exposure assessed before outcome occurs	Hard to do if long lag between exposure and disease onset
	Loss to follow-up can make it hard to interpret findings

What Type of Study Is This?

- Persons diagnosed with new-onset Lyme disease were asked how often they walk through woods, use insect repellent, wear short sleeves and pants, etc. Twice as many patients without Lyme disease from the same physician's practice were asked the same questions, and the responses in the two groups were compared.

What Type of Study Is This?

- Occurrence of cancer was identified between April 1991 and July 2002 for 50,000 troops who served in the first Gulf War (ended April 1991).

What Type of Study Is This?

- Representative sample of residents were telephoned and asked how much they exercise each week and whether they currently have or have ever been diagnosed with heart disease.