Epidemiological Methods

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What is Epidemiology?

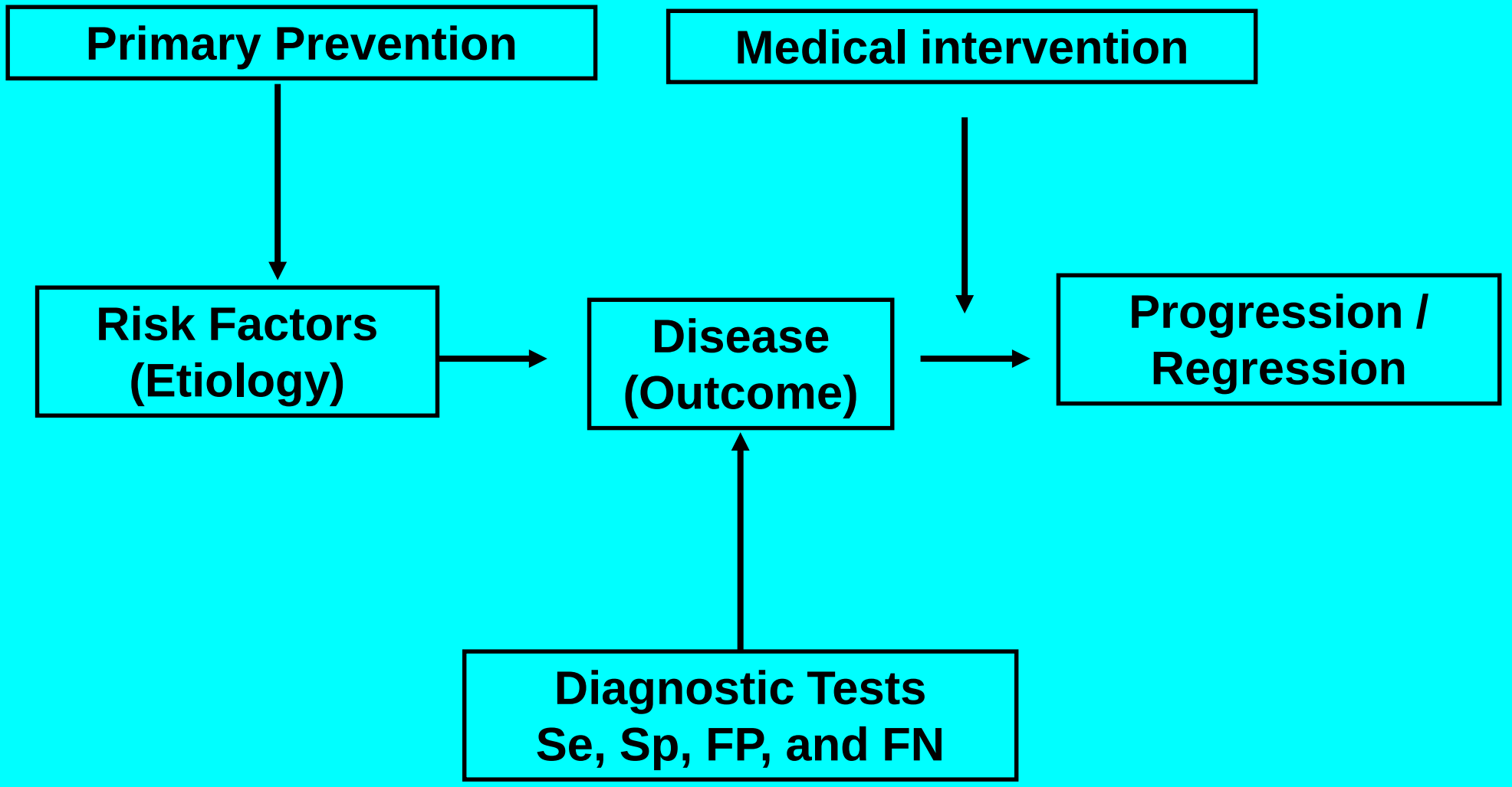
Epidemiology is the study of the distribution and determinants of health-related states or events in specified populations.

Epidemiologists develop and evaluate hypotheses about the effects of genetic, environmental, behavioral, and health care factors on human health/disease.

Epidemiologists also apply epidemiological study results to the prevention and control of health problems.

The field is interdisciplinary and has a methodology distinctive from, but also dependent on, biostatistics.

Clinical Epidemiology and Clinical Research



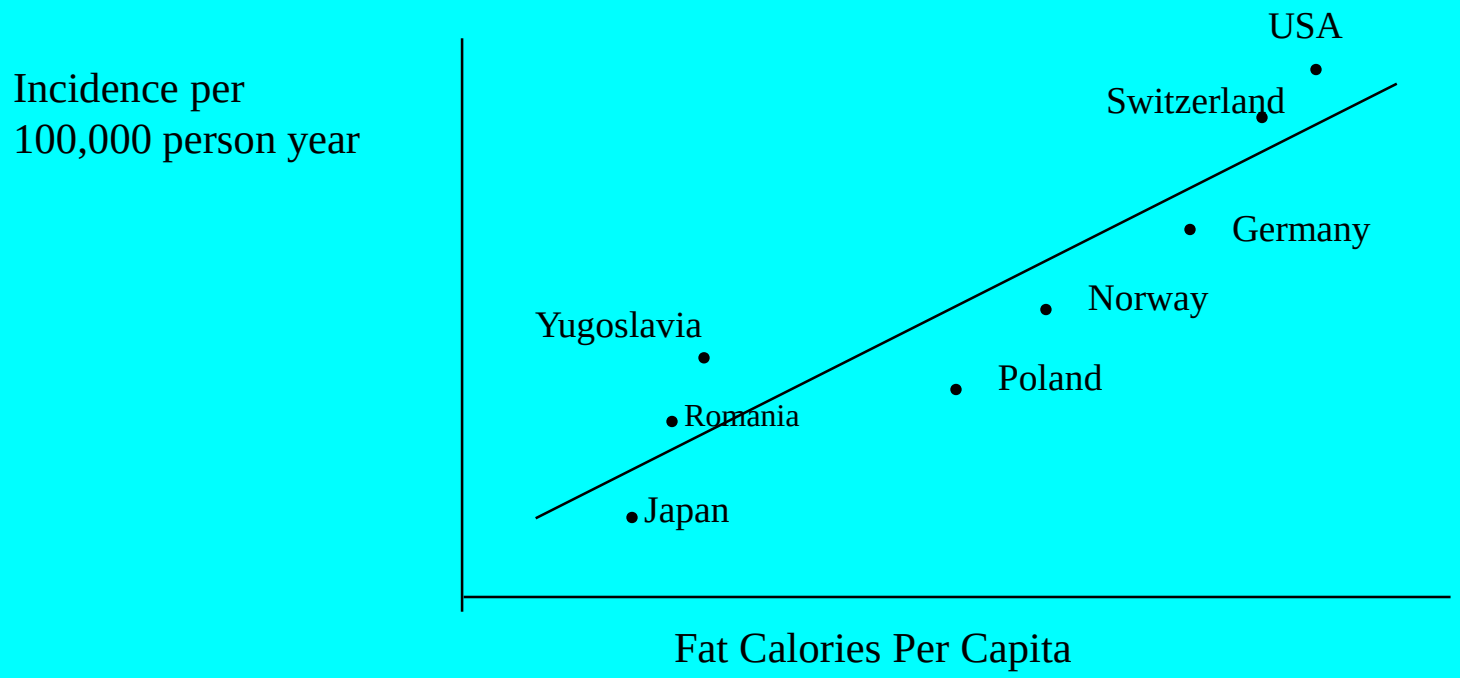
Classical Epidemiological Studies

Categories by Objectives

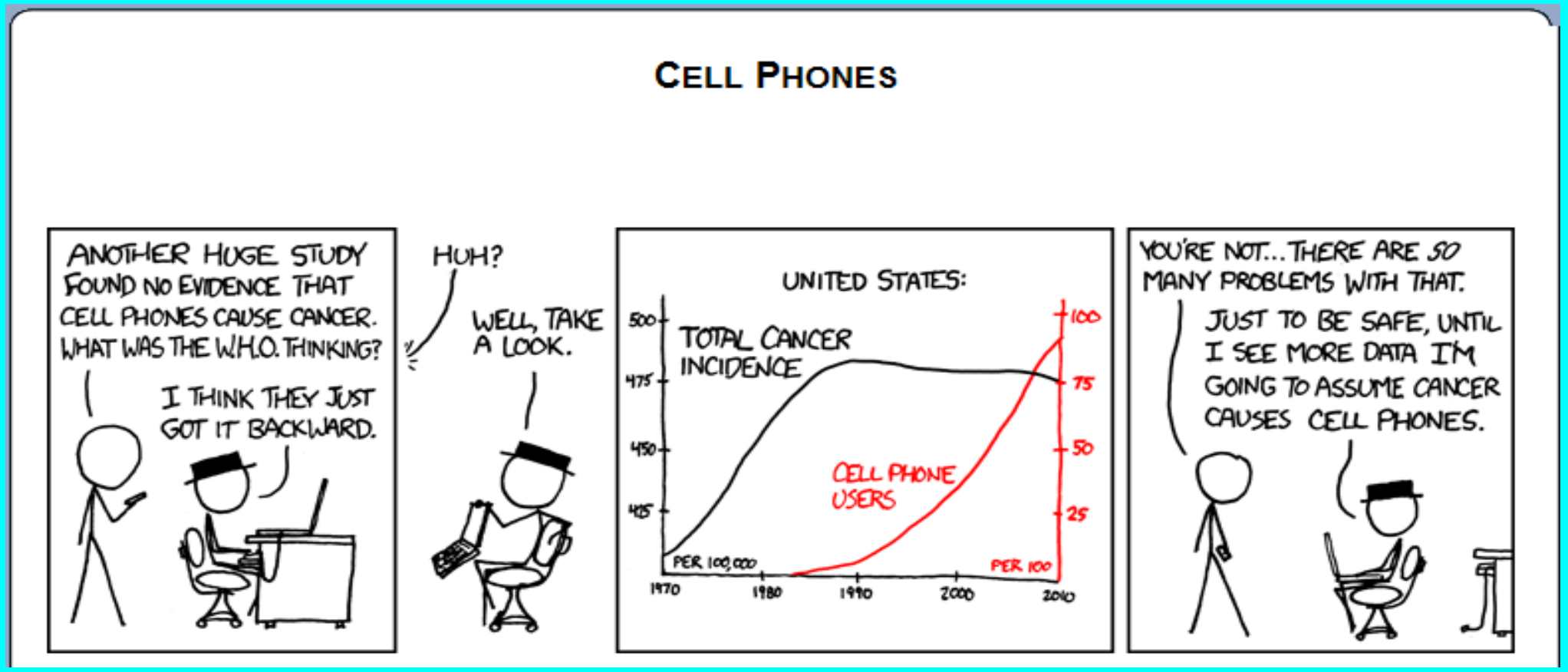
Descriptive Studies	Analytic Studies
1. Correlational (Ecological) Studies	***1. Cohort Study***
2. Case Reports Case Series	***2. Case-Control Study***
3. Cross-sectional Studies	***3. Intervention Study***

DISTRIBUTION OF DISEASE BY PLACE

Breast Cancer Incidence by Dietary Fat Intake by Country



Conclusion: Fat intake may be associated with breast cancer risk.



Ecological fallacy!!

It assumes that individual members of a group have the average characteristics of the group at large. However, statistics that accurately describe group characteristics do not necessarily apply to individuals within that group.

CROSS-SECTIONAL STUDY

(Prevalence study)

An epidemiological study in which exposure and/or outcome are assessed simultaneously among individuals in a well-defined population.

CDC: 1 in 13 pregnant women say they drink alcohol (AP, July 19, 2012):

ATLANTA (AP) — A government survey shows 1 in 13 pregnant women drink alcohol and some even go on binges.

The Centers for Disease Control and Prevention says drinking — especially binge drinking — can damage fetal brain development.

CROSS-SECTIONAL STUDY

(Prevalence study)

Prevalence: The total number of cases of a disease/condition in a given population at a specific time.

CDC: 1 in 13 pregnant women say they drink alcohol (AP, July 19, 2012):

The CDC numbers are from national telephone surveys that included 14,000 pregnant women. They were asked whether they drank alcohol the previous month and how much. Of those who said they drank, nearly 1 in 5 said they went on at least one binge — downing four or more drinks. Pregnant women ages 35 to 44 were the biggest drinkers.

The good news: Binge drinking among pregnant women is down slightly since a similar study was done in the early 2000s.

The survey results from 2006 through 2010 were released Thursday.

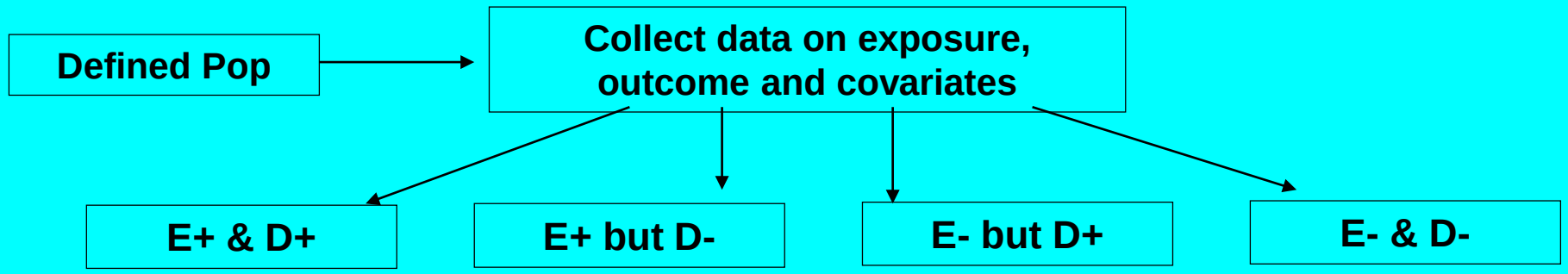
Prevalence_drinking: N of Yes / total number of women surveyed = n / 14000 = 1 / 13
n of drinker = 1077, or the prevalence of 7.7%.

Prevalence_binge = n of women drink 4 or more drinks / total number of drinkers
= n / 1077 = 1 / 5, thus, n= 215, or prevalence of 20%

CROSS-SECTIONAL STUDY

(Prevalence study)

Use cross-sectional study to generate hypothesis of the etiological relationship between a risk factor and a disease.



	D +	D -
E +	a	b
E -	c	d

Data Structure 2 x 2 Table

	D +	D -
E +	a	b
E -	c	d

P_1 (D|E+)= a / (a+b) vs.

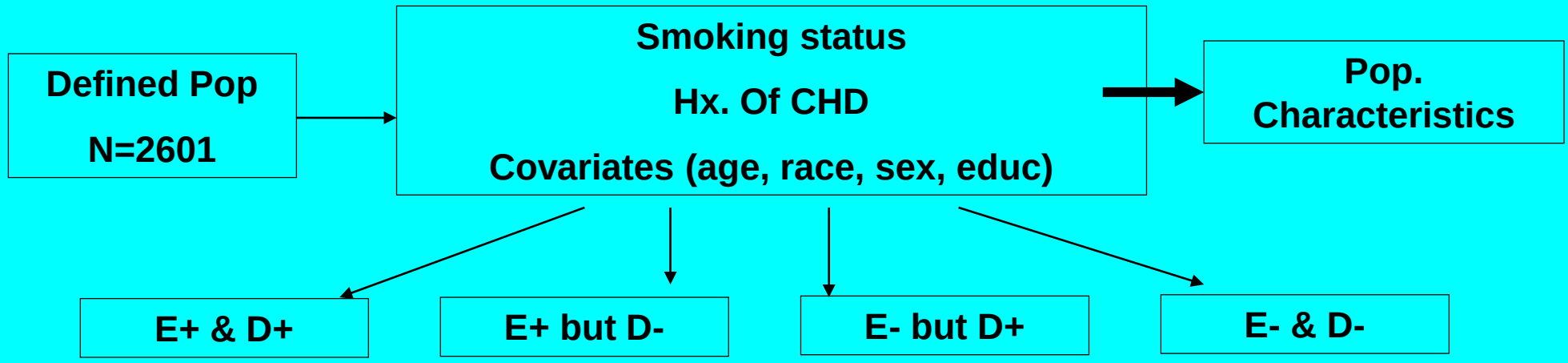
P_0 (D|E-)=c / (c+d)

	D +	D -
E +	a	b
E -	c	d

P_1 (E+|D+)= a / (a+c) vs.

P_0 (E+|D-)= b / (b+d)

Example: Smoking and prevalent CHD in the baseline examination of a sub-sample of the ARIC Study.



	D +	D -
E +	89	1453
E -	28	986

	D +	D -
E +	a	b
E -	c	d

	D +	D -
E +	a	b
E -	c	d

Prevalence of CHD in this population-based sample=

Data structure

P_1 (D|E+)= 89 / (89+1453) = 5.8%

P_0 (D|E-)=28 / (28+986)=2.8%

P_1 (E+|D+)= 89 / (89+28) = 76%

P_0 (E+|D-)= 1453 / (1453+986)=24%

Table 2. The Exposure x Disease (2 x 2)

	CHD +	Non-CHD
Smoker	89 - a	1453 - b
Non-Smoker	28 - c	986 - d

CHD prevalence:

Among Smokers: 89 / (89+1453)=5.7%

Among non-Smokers: 28 / (28 + 986) =2.8%

Smoking prevalence:

Among CHD +: 89 / (89+28)= 76%

Among CHD -: 1453 / (1453 + 986) = 24%

From X^2 test:

$X^2 = 12.69$, $p = 0.001$

Prevalent Odds Ratio:

OR= (a x d) / (b x c)

= 2.16

Cross-Sectional Association between Sleep and Hypertension (Sleep 2009, 32: 491-497)

Population of 1741: Sleep Variables and Hypertension Diagnosis → **Pop. Characteristics**

	Hyp +	Hyp -
Insomnia +	121	78
Insomnia -	837	705

Prevalence of Hypertension: 958 / 1741=55%, weighted 35%
Prevalence of Insomnia: 199/1741=11%, weighted 8%

P_1 (D|E+)=121 / (121 + 78) = 61%

P_0 (D|E-)=837 / (837+705) = 54%

Prevalence ratio = 61 / 54 = 1.13

Odds Ratio = (a * d) / (b * c) = (121 * 705) / (78 * 837) = 1.31

After accounting for sampling weight:

Prevalence of Hypertension: 35%
Prevalence of Insomnia: 8%

P_1 (Prevalence of Hyp among insomnia)= 55%

P_0 (Prevalence of Hyp among non-insomnia) = 34%

$X^2 = 25$, $p < 0.01$

The prevalence of hypertension is significantly higher among persons with chronic insomnia than among persons without.

Prevalence ratio = 55 / 34 = 1.62

Odds Ratio = 2.45, 95% CI 1.71, 3.51, $p < 0.01$

The odds of hypertension is significantly higher among chronic insomnia patients than among non-insomnia patients.