**PUBH 7150/8150**

**Homework 2**

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Homework should only be submitted to Canvas as a single document. Please make sure to use the file title format:

PUBH7150\_Online\_Vishnu\_Choundur\_HW2. Should you use excel, please attach that as a separate document with a similar name, i.e. HW2excel. Please round to two decimal points.

1. We have a cohort of 100 cancer patients receiving various forms of treatment. Treatment can be stand alone or combinations, the unique types of treatment are: surgery only, radiation only, chemotherapy only, chemotherapy and radiation, surgery and chemotherapy, surgery and chemotherapy and radiation, and no treatment. Our sample has the follow distribution of treatments:

* 38 patients receiving surgery only
* 10 patients receiving radiation only
* 18 patients receiving chemotherapy only
* 17 patients receiving surgery and chemotherapy
* 6 patients receiving surgery, chemotherapy, and radiation
* 11 patients with no treatment (this does not count as a type of treatment)

If we randomly select one person from this sample, find the following probabilities:

Diagram

Description automatically generated

P(chemotherapy) =

P(radiation) =

P(surgery) =

1. P(any treatment)

**Answer :**

P(any treatment) = 1 – P(no treatment) = 1 - =

P(any treatment) = 0.89

1. P(any chemotherapy - regardless of additional treatment))

**Answer :**

P(any chemotherapy – regardless of additional treatment) = P(Chemotherapy) + P(surgery and Chemotherapy) + P(Chemotherapy, radiation, surgery)

=

= 0.41

1. P(radiation and surgery)

**Answer :**

There are no people who are taking the radiation and surgery

P(radiation and surgery) = P(radiation and surgery)

= =

**= 0**

1. P(any chemotherapy or radiation)

**Answer :**

P(any chemotherapy or radiation) = P(Chemotherapy) + P(Radiation) + P(radiation and chemotherapy) + P(surgery, chemotherapy, and radiation)

=

= 0.51

1. P(no chemotherapy)

**Answer :**

P(no chemotherapy) = 1 – P(Chemotherapy)

= =

= 0.59

1. \*P(surgery only and radiation only and chemotherapy only)

**Answer :**

Surgery only, radiation only and Chemotherapy only are three independent events. So, we write P(AUB) = P(A)P(B)

P(surgery only and radiation only and chemotherapy only) =

= 0

1. P(any radiation)

**Answer :**

P(any radiation) = P(radiation only) + P(surgery, chemotherapy and radiation)

= P(radiation)

= =

= 0.16

1. P(no treatment)

**Answer :**

P(no treatment) =

= 0.11

1. P(radiation and no treatment)

**Answer :**

Radiation and no treatment are independent.

P(radiation and no treatment) = 0

1. P(chemotherapy only or surgery only)

**Answer :**

P(chemotherapy only or surgery only) = P(chemotherapy only) + P(Surgery only)

= =

= 0.56

1. Suppose we sample 2 patients, what is P(patient 1 had surgery only and patient 2 had chemotherapy only). The order of patients 1 and 2 does not matter and each patient is independent.

**Answer :**

P(patient 1 had surgery only and patient 2 had chemotherapy only) = P(Patient 1 received surgery only) \* P(Patient 2 received chemotherapy only)

= =

= 0.0684

= approximately 0.06

1. Suppose we sample 2 patients, what is P(patient 1 had radiation only and patient 2 had no treatment). The order of patients 1 and 2 does not matter and each patient is independent.

**Answer :**

P(patient 1 had radiation only and patient 2 had no treatment) = P(Patient 1 received radiation only) \* P(Patient 2 received no treatment)

= =

= 0.011

= approximately 0.01

1. Suppose we sample 2 patients, what is P(patient 1 had surgery and chemotherapy and patient 2 had chemotherapy only). The order of patients 1 and 2 does not matter and each patient is independent.

**Answer :**

P(patient 1 had surgery and chemotherapy and patient 2 had chemotherapy only) = P(Patient 1 received surgery and chemotherapy ) \* P(Patient 2 received chemotherapy only)

= =

= 0.0306

= approximately 0.03

2. If we use the patient population from question 1, calculate the following:

a) How many ways can we sample 4 people without replacement if order is important?

**Answer :**

The number of ways to sample 4 people without replacement and order is important = 100P4

= = 94109400

Therefore, The number of ways to sample 4 people without replacement and order is important is 94109400.

b) How many ways can sample 6 people without replacement if order is not important?

**Answer :**

The number of ways to sample 6 people without replacement and order is not important = 100C6

= = 1192052400

Therefore, The number of ways to sample 4 people without replacement and order is important is 1192052400.

3. With micro-technologies improving, the capabilities of wrist-based sleep tracking, such as technology in Fitbit or Apple watches, have vastly improved. To determine exactly how accurate they are, we asked 500 people to try out the watches to check if the watches could determine if that person got more less than 5 hours of sleep. Essentially, we want to assess if the watches could be a type of screening testing for insomnia, where we are defining insomnia as getting less than 5 hours of sleep a night. The 500 people also underwent a polysomnography exam (PSG) that same night as a “true” sleep reading. PSGs are considered the gold standard for sleep studies as they can precisely measure a range of biometric values. The outcomes for this study are below:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | PSG Results | |
|  |  | Insomnia | No Insomnia |
| Watch results | Insomnia | 223 | 33 |
| No Insomnia | 69 | 175 |

1. Calculate the sensitivity.

**Answer :**

Sensitivity = Se = P(+|D) = ≈ 0.76

Sensitivity = 0.76

1. Calculate the specificity.

**Answer :**

Specificity = Sp = P(-|) = ≈ 0.84

Specificity = 0.84

1. Calculate the negative predictive value assuming the prevalence is 0.15.

**Answer :**

Negative Predictive Value = NPV= P( =

≈ 0.95

Negative Predictive Value = 0.95

1. Calculate the positive predictive value assuming the same prevalence as c).

**Answer :**

Positive Predictive Value = PPV= P(D|+) =

= ≈ 0.45

Positive Predictive Value = 0.45

1. Is this a good screening test and why or why not?

**Answer :**

No, It is not a good screening test. Further evaluation and validation is necessary to improve accuracy