Statistical Epidemiology Assignment - A study on neck, back and joints' health

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1 Background of Study

1.1 Motivation for Study

Back Pain, Neck Pain and pain in the joints are the most frequent ailments that the majority of the world deals with everyday. They can range from being minor aches to causing immobilization and thus are ailments that we should be aware about constantly. Posture and daily activity are one of the major factors behind these ailments (besides orthopedic diseases). To see how these factors affect these common ailments, we conduct this study.

1.2 Objectives of the Study

The study aims at understanding the following things:

1. Understand how activity of lifestyle relates to joint pain.
2. Understand whether poor posture increases risk of developing neck and back pain

1.3 Survey

A survey with 8 questions was floated. The link to the survey is: `https://forms.gle/nRPffjt7SV1KyYEr9`. 68 responses were received to this survey as of making of this report and these 68 responses will be taken forward for the study.

The responses can be found by clicking on this link: `https://docs.google.com/spreadsheets/d/1RZknOaZOh3WykScNZjDKxnEYsJcK8-YApxGTPxCsMus/edit?usp=sharing`

1.4 Methodology

We first see the prevalence (per 100) of the three ailments in the surveyed population.

Then we proceed to conduct a case-control study of joint pain where the exposure is inactive lifestyle.

Finally we will conduct a cohort study for incidence of back and neck pain when exposed to bad posture. Conducting a cohort study here makes sense since bad posture is said to slowly induce neck and back pain.

2 Fundamental/Basic Analysis

We begin our analysis with first seeing the age-wise distribution of all the three ailments, posture status, and activity level for the surveyed population and then computing their age-wise prevalence per 100. Here, persons who answered sometimes were also included in the numerator for prevalence computation.

Age Group	No. of people	No. of people experiencing neck pain	No. of people experiencing back pain	No. of people experiencing joint pain
18-21 years old	25	3 (Yes), 9 (Sometimes)	4 (Yes), 7 (Sometimes)	1 (Yes), 6 (Sometimes)
22-25 years old	19	2 (Yes), 6 (Sometimes)	5 (Yes), 4 (Sometimes)	2 (Yes), 5 (Sometimes)
26-29 years old	9	2 (Yes), 4 (Sometimes)	4 (Yes), 3 (Sometimes)	1 (Yes), 3 (Sometimes)
30-45 years old	6	0 (Yes), 3 (Sometimes)	1 (Yes), 2 (Sometimes)	1 (Yes), 2 (Sometimes)
45-60 years old	6	0 (Yes), 2 (Sometimes)	1 (Yes), 4 (Sometimes)	0 (Yes), 3 (Sometimes)
60+ years old	3	0 (Yes), 0 (Sometimes)	1 (Yes), 1 (Sometimes)	1 (Yes), 2 (Sometimes)
Total	68	7 (Yes), 24 (Sometimes)	16 (Yes), 21 (Sometimes)	6 (Yes), 21 (Sometimes)

Table 1: Age-wise population experiencing neck, back, or joint pain

As an additional age-wise information, the following table is prepared.

Age Group	No. of people	Population with good posture	Activity Level of Population				
			Very Active	Acitve	Neutral	Inacitve	Very Inactive
18-21 years old	25	11	4	6	9	4	2
22-25 years old	19	8	1	4	10	3	1
26-29 years old	9	6	1	2	3	3	0
30-45 years old	6	4	0	0	4	2	0
45-60 years old	6	4	0	2	3	1	0
60+ years old	3	3	0	1	2	0	0
Total	68	36	6	7	16	7	3

Table 2: Age-wise posture status and activity level of population

Finally we compute the prevalence (per 100) age-wise for the surveyed population.

Age Group	No. of people	Prevalence of neck pain (per 100)	Prevalence of back pain (per 100)	Prevalence of joint pain (per 100)
18-21 years old	25	$\frac{12}{25} \times 100 = 48$	$\frac{11}{25} \times 100 = 44$	$\frac{7}{25} \times 100 = 28$
22-25 years old	19	$\frac{8}{19} \times 100 = 42.1$	$\frac{9}{19} \times 100 = 47.36$	$\frac{7}{19} \times 100 = 36.84$
26-29 years old	9	$\frac{6}{9} \times 100 = 66.67$	$\frac{7}{9} \times 100 = 77.78$	$\frac{4}{9} \times 100 = 44.44$
30-45 years old	6	$\frac{3}{6} \times 100 = 50$	$\frac{3}{6} \times 100 = 50$	$\frac{3}{6} \times 100 = 50$
45-60 years old	6	$\frac{2}{6} \times 100 = 33.33$	$\frac{5}{6} \times 100 = 83.33$	$\frac{3}{6} \times 100 = 50$
60+ years old	3	$\frac{0}{3} \times 100 = 0$	$\frac{2}{3} \times 100 = 66.67$	$\frac{3}{3} \times 100 = 100$
Total	68	$\frac{31}{68} \times 100 = 45.58$	$\frac{37}{68} \times 100 = 54.41$	$\frac{27}{68} \times 100 = 39.71$

Table 3: Age-wise prevalence per 100 for the three ailments

3 Case-Control Study - Lifestyle Activity and Joint Pain

We will consider the activity levels of very active, active, and neutral as active, where as activity levels of inactive and very inactive as inactive.

The 2×2 contingency tables for this is as follows:

	Develops joint pain	Doesn't develop joint pain
Inactive Lifestyle	6	10
Active Lifestyle	21	31

$$\text{Odds ratio for Joint Pain} = \frac{6 \times 31}{21 \times 10} = 0.885$$

4 Cohort Study - Bad posture and back/neck pain

For this, we will exclude those participants who have answered the questions of back and neck pain with "Sometimes" as back pain and neck pain (which we hypothesize to be caused by bad posture) is usually chronic and takes much longer to heal compared to short streaks of pain which can be caused by exercising or activity related injury.

The 2×2 contigeny tables for this cohort study is as follows:

	Develops back pain	Doesn't develop back pain
Bad Posture	9	15
Good Posture	7	16

$$\text{Relative Risk for Back Pain} = \frac{\frac{9}{9+15}}{\frac{7}{7+16}} = \frac{9 \times 23}{7 \times 24} = 1.23$$

$$\text{Odds ratio for Back Pain} = \frac{16 \times 9}{7 \times 15} = 1.371$$

	Develops neck pain	Doesn't develop neck pain
Bad Posture	6	14
Good Posture	1	23

$$\text{Relative Risk for Neck Pain} = \frac{\frac{6}{14+6}}{\frac{1}{23+1}} = \frac{6 \times 24}{1 \times 20} = 7.2$$

$$\text{Odds ratio for Neck Pain} = \frac{6 \times 23}{1 \times 14} = 9.86$$

5 Results

Thus we see that back pain is the most prevalent from our basic age-wise analysis, whereas joint paint is the least prevalent among the three, that too across majority of the age groups. The line-chart of the prevalence data clearly shows this:

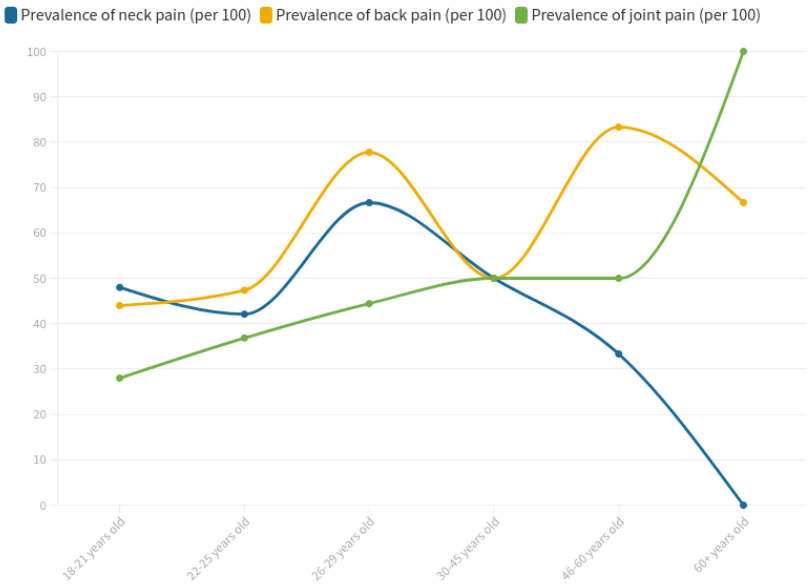

Figure 1: Age-wise prevalence of the three ailments

Coming to the case-control study for joint pain, we observe that having an active lifestyle leads to increased chances of having joint pain. This comes from the fact the odds ratio calculated for this is less than 1, and in the calculation, the denominator were the odds of developing joint pain given an active person develops joint pain. This does make sense because having an active lifestyle involves more use of joints which can lead to either injury or joints getting overworked leading to strain.

Coming to the cohort study for back and neck pain, we observe that relative risk for developing both neck and back pains due to bad posture is above 1, indicating there is positive association between bad posture and these two ailments. For this study we observe that risk of neck pain is higher than risk of back pain due to bad posture, which is because of slightly skewed data for neck pain, but suppose we increase the number of people developing neck pain with good posture to be equal to be that with bad posture, the relative risk will become $\frac{23}{14} = 1.64$ which is still more than that of back pain. This may be attributed to the increased use of phones while standing which leads to people bending their necks to see their phone screens.

The odds ratio shares a similar story as relative risk, but in case of back pain, they are quite close, whereas odds ratio and relative risk for neck pain are further apart. We can say that back pain is more infrequent than neck pain based on this.