Air Pollution and Respiratory Health:
A study of self-reported air pollution effect and respiratory well-being

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Introduction

In this research project, we sought to analyze the impact that air pollution has on individual respiratory health, specifically in the urban area of Siddhartanagar. Air pollution in Nepal is among the worst in the world, and has been shown to have a significant negative impact on health and well-being in other locations. Knowing the extent of this impact on the citizens of Siddhartanagar is the first step towards improving conditions.

Literature Review

Increased industrialization in emerging economies across the globe has presented a host of problems for people in these areas. Singh and Grover explore the increased amount of air pollution in Delhi and the ramifications that come with it. This study highlights the global burden of air pollution and how it has grown as a problem with the rapid rise of industrialization. With over 4.2 million deaths resulting from exposure to outdoor pollution and 90% of Air Pollution deaths occurring in low or middle income countries there's no question that air pollution is an issue that needs to be addressed in Siddharthanagar.

Research Question/Hypothesis

Is there a relationship between Respiratory Health Index and Air Pollution Effect in the Siddharthanagar municipality? Is this relationship significant?

Based on existing research, we predict that there is a significant positive correlation between Air Pollution Effect and Respiratory Health Index score (a higher score indicates poorer respiratory well-being).

Variables / Research

Independent variable

- AirPollutionEffect
  - How strongly do you feel you are affected by air pollution in your residential area?
  - 1 = Not at all affected
  - 2 = Slightly affected
  - 3 = Moderately affected
  - 4 = Strongly affected
  - 5 = Very strongly affected

Dependent variable (and contributing variables)

- RespiratoryHealth
  - Generated as an index of respiratory health based on the sum of respiratory based variable responses (shown below)
- Asthma
  - During the last 30 days, did you and/or your family members get sick with Asthma? 0 = No; 1 = Yes
- Breathing Problem
  - During the last 30 days, did you and/or your family members get sick with Breathing Problem? 0 = No; 1 = Yes
- Respiratory Infection
  - During the last 30 days, did you and/or your family members get sick with Respiratory Infection? 0 = No; 1 = Yes

Methods and Modeling

Due to the fact that many dependent variables contribute to the single characteristic we wished to observe, respiratory health, we created a respiratory health variable for use in this simple linear regression. Individuals were assigned a number 0-3 based on their responses, with a lower score indicating better health. The regression here is the result of regressing RespiraroryHealth on AirPollutionEffect.

Self-Reported Air Pollution Effect and Respiratory Health Impact

VARIABLES	(1)
AirPollutionEffect	0.022*
	(0.012)
Constant	0.062*
	(0.033)
Observations	748
R-squared	0.004
R-Squared2	0.00425
Adjusted-R2	0.00291
F-Sat	3.181
n	748

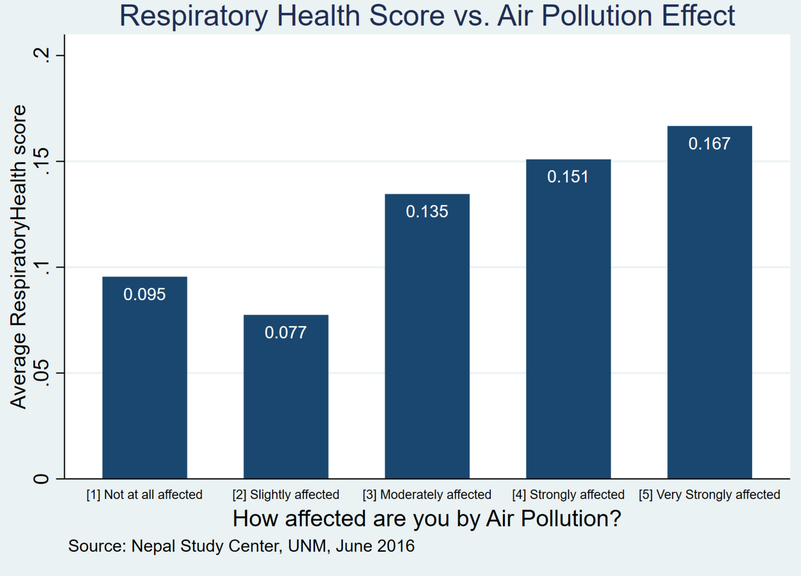
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 1

Overall respiratory health in the last 30 days	How strongly were you affected by air pollution in the last 30 days? Small eff	Large eff	Total
Perfect	329	346	675
Good	19	41	60
Poor	6	7	13
Total	354	394	748

Pearson chi2(2) = 6.4511 Pr = 0.040

Table 2



Results

- Our initial linear regression model (Table 1) output a coefficient of **0.022** which was significant at the 10% level. This indicates that for this model, as an individual moves to one higher level of pollution effect (e.g. from "slightly affected" to "moderately affected"), their respiratory health score will increase (health will worsen) by **0.022** points.
- While the coefficient is significant, the model has a very poor fit with an R-squared coefficient of correlation of **0.004**, a finding that does not corroborate what existing literature predicts.
- The chi-square test for independence between AirPollutionEffect and RespiratoryHealth (shown in Table 2) gave a calculated chi-squared value of **6.4511**. This is large enough to surpass the critical value at 2 degrees of freedom of **5.99** for a significance level of .05. This indicates that there is a statistically significant relation between self reported effect of air pollution and respiratory health.
- Despite the weak correlation displayed by the regression output, the bar graph of Repiratory Health Score vs. Air Pollution Effect shows the obvious **upward trend**, again demonstrating that higher air pollution effect indicates worse respiratory well-being.

Conclusion

Although we were able to find a statistically significant relationship between respiratory health and air pollution, the correlation is unexpectedly weak. As indicated in the bar graph, an upward trend is obvious, but the fit of the corresponding regression model is poor. We believe this suggests that respondents may not be aware ofor accurately reporting their level of respiratory health. This may have weakened the correlation of our variables of interest. We recommend the implementation of medical testing equipment such as spirometry and accurate pollution measurement devices to achieve more accurate assessment of the actual impacts of air pollution in Siddharthanagar on respiratory health. The use of dust masks to filter out some particulates on abnormally high pollution days is a potential short-term solution, but we believe education of the public (via poster, flyer, Q and A session) would be an effective way of growing awareness and increasing locals investment in improving air quality, or at least avoiding potentially harmless areas and situations.

Works Cited

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