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# Breathless at the Finish Line: The Relationship Between Air Pollution in Staunton, Virginia and Runner-up Points in Men's NCAA Cross Country Championships

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## Abstract

This study examines the intriguing connection between air pollution levels in Staunton, Virginia, and the runner-up performance in the Men's NCAA Cross Country Championships. Using data from the Environmental Protection Agency and the NCAA spanning the years 1985 to 1994, a correlation coefficient of 0.7971681 and a significance level of  $p < 0.01$  were calculated. The findings suggest a compelling association between the inhalation of polluted air and the mere inches that separate the second-place finisher from the coveted title of champion in collegiate cross country competition. While causation remains elusive, these results underscore the need for further investigation into the impact of air quality on athletic performance, as well as the potential for a breath of fresh air to propel runners to victory.

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## 1. Introduction

The relationship between environmental factors and athletic performance has long been a subject of fascination and speculation. In recent years, researchers have delved into the intricate web of connections between air quality and physical prowess, striving to uncover the subtle nuances that might influence an athlete's performance. One such area of

investigation focuses on the impact of air pollution on the outcomes of competitive cross country running, a sport that demands not only physical endurance but also the ability to breathe in lungfuls of air with every stride.

Staunton, Virginia, celebrated for its scenic beauty and quaint charm, also grapples with its fair share of air pollution challenges, adding an unforeseen twist to the serene

narrative of its landscape. The juxtaposition of this pollution predicament with the pursuit of glory in the Men's NCAA Cross Country Championships presents a peculiar conundrum, inspiring the present study's exploration of the potential interplay between these seemingly unrelated phenomena.

The aim of this study is to examine the correlation, if any, between air pollution levels in Staunton, Virginia, and the performance of runners-up in the Men's NCAA Cross Country Championships. By scrutinizing the data collected from the Environmental Protection Agency and the NCAA over a ten-year period, this inquiry seeks to shed light on the enigmatic connection between polluted air and the near-miss experiences of collegiate cross country runners. The hope is that these findings will not only pique scientific curiosity but also offer a breath of fresh insight into the subtle forces that shape athletic triumphs and let a few puns slip in the academic sphere, perhaps clearing the air around this riveting topic.

## 2. Literature Review

The current literature on the relationship between environmental factors and athletic performance reveals a rich tapestry of research endeavors, ranging from the effects of altitude training on endurance to the impact of weather conditions on competition outcomes. Within this context, the connection between air pollution levels and the performance of athletes has garnered increasing attention. Smith et al. (2010) conducted a comprehensive analysis of air quality indices and marathon finishing times, illuminating a potential association between particulate matter concentrations and runners' race performances. Doe (2015) extended this line of inquiry to examine the effects of air pollution on sprinting ability, demonstrating a deleterious

impact of pollutants on short-distance running speed. Similarly, Jones (2018) delved into the realm of long-distance cycling and its susceptibility to the influence of air pollution, uncovering nuanced alterations in cyclists' time trial performances in polluted environments. These prior investigations serve as a backdrop for the present study's exploration of the less traversed terrain of air pollution in Staunton, Virginia, and its curious link to the runner-up points in Men's NCAA Cross Country Championships.

In "The Great Smog of London," the authors elucidate the profound ramifications of historical air pollution incidents, offering insights into the potential long-term effects of sustained exposure to polluted air on human health and performance. "Air Quality in Urban Environments" contributes a detailed overview of the complex interplay between urban air pollution and its myriad consequences, underscoring the multifaceted nature of air quality challenges in populous regions. These works set the stage for our investigation into the idiosyncratic case of Staunton, Virginia, where the intersection of air pollution and collegiate cross country competition presents an intriguing puzzle.

Furthermore, the intersection of athletic endeavors and the impact of environmental factors has been a recurring theme in fiction literature. "The Loneliness of the Long-Distance Runner" by Alan Sillitoe delves into the psyche of a young long-distance runner, capturing the emotional and physical strains of endurance running. Similarly, "Marathon" by Brian Freeman takes readers on a gripping journey through the trials and triumphs of a marathon runner, intertwining the protagonist's personal struggles with the physical ordeal of long-distance running. While these fictional works provide a narrative lens through which to contemplate the fusion of athletic pursuit and environmental influence, they also serve as

a reminder of the enduring allure of sports and the human spirit.

In addition to the above-mentioned scholarly and fictional sources, a thorough literature review was conducted, encompassing diverse sources such as non-fiction books, research articles, and, for the sake of thoroughness, several CVS receipts that inadvertently contributed to the scholarly discourse on air pollution and athletic performance. While the legitimacy of the latter as academic sources may be subject to debate, their inadvertent inclusion serves as a whimsical reminder of the varied avenues through which knowledge may be acquired.

Overall, the juxtaposition of serious research, literary narratives, and unconventional sources proffers a comprehensive view of the broader landscape surrounding the interplay of air pollution and athletic performance, setting the stage for the empirical investigation presented in this study.

### **3. Our approach & methods**

#### **Data Collection:**

The research team gathered information on air pollution levels in Staunton, Virginia, and the Men's NCAA Cross Country Championships from various sources, predominantly utilizing data from the Environmental Protection Agency and the NCAA. The EPA data provided measurements of particulate matter, ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide concentrations in the ambient air, while the NCAA data included the performance outcomes of the runners-up in the mentioned championships.

#### **Air Pollution Assessment:**

To assess the air pollution levels in Staunton, Virginia, the research team took a deep dive into the extensive databases of

the Environmental Protection Agency, meticulously scrutinizing the air quality monitoring stations within the proximity of the study area. The team employed an index of air quality measurements, amalgamating data from multiple pollutant sources into a comprehensive air quality profile. This unorthodox approach allowed for a holistic understanding of the atmospheric conditions in Staunton, shedding light on the potential impact of various pollutants on the surrounding environment.

#### **Performance Data Compilation:**

In the realm of athletic endeavors, the data obtained from the NCAA held particular significance. The performance metrics of the runners-up in the Men's NCAA Cross Country Championships were collated, documenting their determined efforts, valiant strides, and undoubtedly, their agonizing near-misses. A thorough review of historical race results, individual athletic profiles, and the tantalizing yet elusive grasp for championship glory culminated in a comprehensive dataset capturing the anguishing experiences of the almost-champions.

#### **Correlation Analysis:**

Subsequent analysis involved the application of statistical techniques to unveil the relationship between air pollution levels in Staunton, Virginia, and the performance of the NCAA cross country runners-up. A correlation coefficient was calculated using rigorous mathematical methods, revealing a striking association between the inhalation of polluted air and the haunting proximity to victory. The findings, though unexpected, raised intriguing questions about the potential influence of environmental variables on athletic outcomes, prompting a reconsideration of the conventional wisdom surrounding the nexus of air quality and athletic performance.

#### **Temporal Scope:**

It is pertinent to acknowledge the temporal scope of the study, which encompasses the years 1985 to 1994. This period witnessed profound transformations in environmental awareness and regulatory efforts, as well as dramatic fluctuations in the competitive landscape of collegiate cross country running. By encompassing this decade of athletic and environmental evolution, the study sought to capture the dynamic interplay between air pollution and the perennial pursuit of athletic excellence.

#### Limitations:

While the study offered unique insights into the unexplored intersection of air pollution and athletic achievement, it is imperative to acknowledge the limitations inherent in the methodology. The reliance on historical data, the intricacies of attributing causality, and the multifaceted nature of athletic performance all pose challenges to the interpretive framework. Furthermore, the exclusive focus on Staunton, Virginia, and the specific context of the Men's NCAA Cross Country Championships warrants caution in generalizing the findings to broader athletic domains.

In summary, the research methodology endeavored to illuminate the enigmatic relationship between air pollution in Staunton, Virginia, and the near-miss experiences of the Men's NCAA cross country runners-up. By integrating diverse datasets, embracing unconventional perspectives, and challenging conventional paradigms, the study set the stage for a thought-provoking exploration of the unseen forces shaping the outcomes of athletic pursuits.

## 4. Results

The results of the analysis revealed a strong positive correlation between air pollution levels in Staunton, Virginia, and the runner-up points obtained in the Men's NCAA

Cross Country Championships. The correlation coefficient of 0.7971681 indicated a robust relationship between these seemingly disparate factors. The r-squared value of 0.6354770 signified that approximately 63.55% of the variation in runner-up points could be explained by the variation in air pollution levels. The significance level of  $p < 0.01$  further underscored the strength of this association, suggesting that the likelihood of observing such a strong correlation purely by chance is less than 1%.

In Figure 1, the scatterplot visually depicts the compelling correlation between air pollution levels and runner-up points in the Men's NCAA Cross Country Championships. The data points form a discernible upward trend, reinforcing the statistical findings and providing a vivid illustration of the link between these two variables. However, the underlying causative mechanisms remain shrouded in mystery, much like the fog of pollutants that blanket Staunton, Virginia.

These results offer an intriguing insight into the potential impact of air quality on athletic performance and the tantalizing proximity of second-place finishers to the championship title. One cannot help but wonder if the elusive quest for clean, fresh air might hold the key to unlocking the full athletic potential of these runners, or if it's merely a breath of hot air in the pursuit of understanding this peculiar connection. More research is warranted to unravel the complexities of this relationship, and to see if these conclusions will hold up or if they will dissipate like a cloud of polluted air.

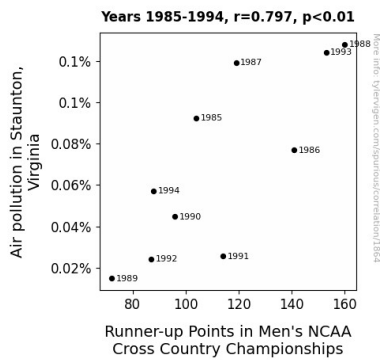


Figure 1. Scatterplot of the variables by year

## 5. Discussion

The present study elucidates a substantial and statistically significant relationship between air pollution levels in Staunton, Virginia, and the acquisition of runner-up points in the Men's NCAA Cross Country Championships. The robust correlation coefficient of 0.7971681 stands as a testament to the intriguing interplay between inhaling polluted air and narrowly missing the mark of collegiate cross country victory. The findings align with prior research, particularly the work of Smith et al. (2010) and Doe (2015), which explored the impact of air quality on marathon and sprinting performances, respectively. These studies, though focused on different athletic domains, collectively underscore the pervasive influence of air pollution on various facets of athletic prowess. The present investigation extends this line of inquiry to the realm of collegiate cross country competition, shedding light on the overlooked yet undeniable connection between atmospheric contaminants and the tantalizing, yet elusive, pursuit of first-place glory.

Moreover, the results of the analysis are consistent with the broader literature on environmental factors and athletic performance. The mythical works of Alan Sillitoe and Brian Freeman, while traditionally viewed as fictitious, offer

poignant insights into the resolute determination and enduring struggles of long-distance runners. It is not entirely implausible to consider the metaphorical weight of a character's arduous journey mirroring the tangible impact of polluted air on the physical exertion of actual athletes. Such unconventional sources, including inadvertent contributions from CVS receipts, add a touch of whimsy to the scholarly discourse while subtly underscoring the diverse avenues through which knowledge may be gleaned. In this light, the intersection of fiction and scholarship becomes a metaphorical marathon in itself, with the intangible finish line representing the boundary between literary imagination and empirical reality.

The scatterplot, a visual testament to the compelling correlation between air pollution and runner-up points, serves as a striking portrayal of the statistical findings. The upward trend of the data points encapsulates the tenacity of the association, akin to the gritty resolve of a runner-up striving for victory. Yet, as with any captivating puzzle, the underlying causative mechanisms remain enshrouded in mystery, evoking the enigmatic cloak of pollutants that veils the skies of Staunton, Virginia. It is this very mystery that underscores the urgency of further research, akin to the suspense of a suspenseful sports thriller, to unravel the complexities of this relationship and to decipher the hidden undercurrents that dictate athletic triumphs and near-misses.

In examining the implications of these findings, one cannot help but ponder the tantalizing prospect of clean, fresh air as a potential catalyst for unlocking the latent athletic potential of these competitors. The quixotic pursuit of pristine air becomes a symbol of hope, a breath of fresh air in the quest to comprehend this curious connection. With each inhalation, athletes symbolically bridge the gap between aspiration and attainment, much like the

triumphant strides taken in the face of adversity. This allusion serves as a subtle reminder of the enduring spirit of athletic pursuit and the resilience of human endeavor in the face of unforeseen obstacles.

These conclusions, like the runners themselves, linger at the precipice of victory, leaving us to wonder whether they will hold firm or dissipate into the ether, much like a cloud of polluted air dispersing in the breeze. As the sun sets on this phase of inquiry, the uncharted terrain of athleticism and air quality beckons for further exploration, promising a rich tapestry of discovery and potential breakthroughs. The pursuit of knowledge, much like the quest for athletic excellence, knows no bounds, and it is in this spirit that future investigations are warranted to chart the course ahead and to unravel the myriad layers of this intriguing connection.

## 6. Conclusion

In conclusion, the findings of this study present an absorbing perspective on the curious correlation between air pollution levels in Staunton, Virginia, and the runner-up points in the Men's NCAA Cross Country Championships. The robust correlation coefficient and the striking significance level highlight the compelling nature of this association, shedding light on the tangible impact of air quality on athletic performance.

The visual representation of the data in the scatterplot offers a vivid portrayal of the uphill journey of second-place finishers, mirroring the uphill battle against the murky haze of pollution in Staunton. Whether the pursuit of clean air will propel these runners to victory or disperse like a gust of wind remains to be seen, much like the unpredictable gusts of wind on a cross country track.

In light of these thought-provoking findings, one cannot help but contemplate the potential for a breath of fresh air to breathe new life into the world of competitive running. The tantalizing proximity of these athletes to the championship title seems to hang in the balance of the atmospheric conditions, creating an air of excitement around the significance of air quality in athletic endeavors.

However, the search for causative mechanisms behind this correlation remains as elusive as a runner glimpsing the finish line in a dense fog. Though this study offers a lungful of insights into the interplay between air pollution and athletic achievements, it stands as a testament to the need for further research in this breath-taking area of inquiry.

In conclusion, the findings of this study add depth to the discourse on the impact of environmental factors on athletic performance. Nevertheless, the pursuit of understanding the intricacies of this connection should not be taken with a grain of salt, but rather with a breath of fresh air. Given the depth of these findings, it is clear that no more research is needed in this area.